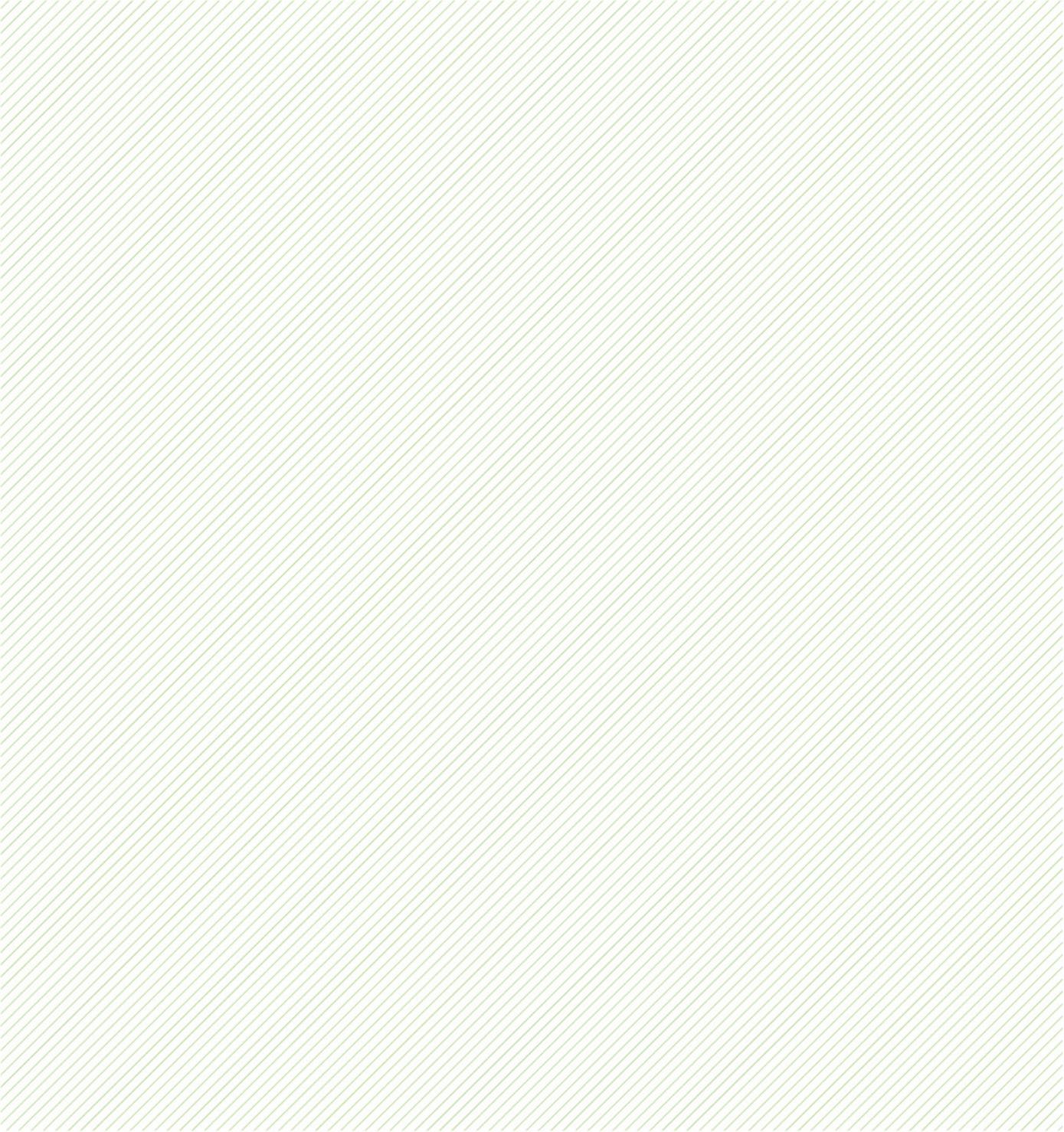




Appendix A
Erosion and Sediment Control Plan





GLNG

Gas Transmission Pipeline

Erosion and Sediment Control Plan

Document Number: 3380-GLNG-4-1.3-0010

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DATE	REV	REASON FOR ISSUE	AUTHOR	ENDORSED	APPROVED
25.02.11	2	DRAFT PROGRESS REPORT	AW		
07.03.11	3	DRAFT	AW		
07.03.11	4	80% DRAFT FOR RPS REVIEW AND INTERNAL REVIEW/VERIFICATIONS	AW		
05.04.11	7	95% DRAFT FOR GLNG COMMENT	AW		
15.04.11	8	FINAL DRAFT FOR LEGAL REVIEW	CM		
30.06.11	9	LEGAL COMMENTS ADDRESSED	CC		
15.07.11	10	FOR AGENCY REVIEW	CC		
07.09.11	11	FOR AGENCY REVIEW	CC		

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Abbreviations

ARI	Average recurrence interval
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soil
BoM	Bureau of Meteorology
CIC	Callide Infrastructure Corridor
CSG	Coal Seam Gas
DERM	Department of Environment and Resource Management
dS/m	deci-Siemens per meter
EC	Electrical Conductivity
EIS	Environmental Impact Statement
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
GLNG	Gladstone Liquefied Natural Gas
GTP	Gas Transmission Pipeline
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
KP	Kilometre Point
LNG	Liquefied Natural Gas
LRMP	Landscape Rehabilitation Management Plan
km	Kilometer
QGP	Queensland Gas Pipeline
~	Approximately
m	Metres
Mm	Millimeters
RoW	Right of Way



1. INTRODUCTION

1.1 Overview

Erosion and sediment control is a key factor for consideration prior to, and execution during, the construction of the GTP.

1.2 Purpose and Objective of this Document

This Erosion and Sediment Control Plan (ESCP) is part of the Development Approval documentation required for the project to assist the regulator to assess the key issues. It may assist the contractor to prepare the site-specific ESCP that is required under the contract with GLNG Operations Pty Ltd.

The report outlines the minimum standards that will be utilised to minimise erosion through the life of the pipeline project. This involves consideration of the environments through which the pipeline will be constructed, operated, and decommissioned, including topography, climate, soils, and receiving waters.

It is intended that this document will highlight areas and circumstances of elevated erosion risk and provide mitigation options for designers, constructors, estimators, and decision-makers to consider.

The information used to develop this document is based on a desktop review of previous studies, in particular the Environmental Impact Statement (EIS) (URS, 2009), and other soils databases. It also considers relevant guidelines for erosion and sediment control in Queensland and Australia.

1.3 Relevant Guidelines

Guidelines relevant to soil management for this Project are:

- AS 4970-2009 Protection of Trees on Development Sites
- APIA, 2009. Code of Environmental Practice – Onshore Guidelines. The Australian Pipeline Industry Association Pty Ltd. March 2009
- IECA, 2008. Best Practice Erosion and Sediment Control. International Erosion Control Association (Australasia) (IECA)
- Landcom, 2004. Managing Urban Stormwater: Soils and Construction. NSW Government
- DECC, 2008a. Managing Urban Stormwater: Soils and Construction. Volume 2A. Installation of Services. Department of Environment and Climate Change (DECC) NSW
- DECC, 2008b. Managing Urban Stormwater: Soils and Construction. Volume 2C. Unsealed Roads. Department of Environment and Climate Change (DECC) NSW
- DMR 2002. Road Drainage Design Manual. Department of Main Roads (DMR) QLD

1.4 Relevant Legislation

A person or persons conducting land-disturbing development must conduct such development in accordance with the requirements of relevant legislation.

The State Planning Policy (SPP) for Healthy Waters provides the planning to ensure new development delivers its requirements of the EPP (Water). The SPP refers to a companion document that outlines design objectives for:

- a) Erosion and sediment control
- b) Stormwater quality
- c) Waterway stability

d) Frequent flows

1.4.1 Environmental Protection Act 1994

All persons have a legal duty under the Environmental Protection Act 1994 (s319) to take all reasonable and practicable measures to minimise or prevent environmental harm.

Under s443 of the Environmental Protection Act 1994 a person must not cause or allow a contaminant to be placed in a position where it could reasonably be expected to cause serious or material environmental harm or environmental nuisance (e.g. placing a stockpile adjacent to a waterway).

In addition, people who are concerned with management in a corporation have an additional duty under the Environmental Protection Act 1994 to ensure their corporation complies with the Act. This means supervisors need to take reasonable and practicable steps to ensure that the people under their control do not breach environmental laws.

People who become aware of environmental harm in association with their work (e.g. loss of sediment from their site into a watercourse) have a legal duty under the Environmental Protection Act 1994 to notify their employer. The employer must then rectify the problem, and if significant, to notify the Department of Environment and Resource Management (DERM).

1.4.2 Environmental Protection (Water) Policy 2009

This policy sits under the Environmental Protection Act 1994. The Environmental Protection (Water) Policy 2009 provides environmental values and water quality objectives for Queensland waters. These are utilised when determining environmental harm and to inform other statutory and non-statutory decisions. The water quality objectives assist in identifying whether the environmental values are protected. These values and objectives should be utilised when determining risk of environmental harm from water releases or run off, and the appropriate erosion and sediment controls to be implemented.



2. PROJECT DESCRIPTION

The gas transmission pipeline (GTP) has been divided into three sections based on major geographic boundaries. There are:

- Mainland GTP EM Plan: Fairview Gas Fields to the west of the Kangaroo Island Wetlands (KP0 to KP406)
- Marine Crossing GTP EM Plan: West of Kangaroo Island Wetlands to Curtis Island (KP406 to KP414.5)
- Curtis Island GTP EM Plan: Curtis Island to gate of LNG Facility

Separate environmental management plans have been prepared for each section described above; however, this erosion and sediment control plan addresses concerns for the entire length of the alignment.

2.1 Route

The Mainland GTP will extend from the gas fields at Fairview to Point A on Port Curtis, and span a distance of approximately 406km. Figure 2.1 illustrates the route alignment and shows the extent of the three GTP EM Plans.

The proposed Mainland GTP corridor is closely aligned with the existing Queensland Gas Pipeline (QGP) for much of its length with the exception of the section north of Injune where the corridor will run up the western side of the Arcadia Valley. The Mainland GTP will approach Gladstone from the southwest and will pass through the Gladstone State Development Area (GSDA) before crossing Port Curtis to Curtis Island.

By locating the Mainland GTP adjacent to the existing QGP RoW for approximately 300 km of the corridor from south of Rolleston to Gladstone, the area of land disturbed and the impact on existing land use and infrastructure will be reduced. However there are sections along the Mainland GTP corridor where due to land use, environmental or topographical constraints the proposed Mainland GTP will by necessity deviate from the QGP RoW.

From the gas fields at Fairview, the Mainland GTP will traverse mostly rural land and numerous ranges. The route departs Fairview in a northerly direction continuing north through the Arcadia Valley. It then turns easterly and crosses the Expedition Range, the Dawson Range, and then a wide section of the Dawson River. The pipeline continues easterly, crossing the Callide and Calliope Ranges. After crossing the Calliope Range, the pipeline crosses the Bruce Highway and terminates at the Queensland Energy Resources (QER) land-bridge at Point A on Port Curtis, where from here the Marine Crossing section of the GTP commences (referred to as the Marine Crossing GTP; see Figure 2.2). From this point, the Marine Crossing GTP crosses the Kangaroo Island Wetlands (south of Kangaroo Island) to Friend Point at which point it crosses the Narrows waterway and lands on Curtis Island at Laird Point. From Laird Point, the Marine GTP tracks inland to Point H. From here the Curtis Island GTP commences, continuing in an easterly direction, before turning south and finishing at the GLNG LNG Facility gate.

2.2 Pipeline Details

The GTP will be a buried, high-pressure steel pipeline. It will be designed in accordance with the requirements of Australian Standard 2885 (AS 2885) Pipelines - Gas and Liquid Petroleum and constructed in accordance with the Australian Pipeline Industry Association's Code of Environmental Practice (APIA, 2009).

In accordance with AS 2885 the design considerations include:

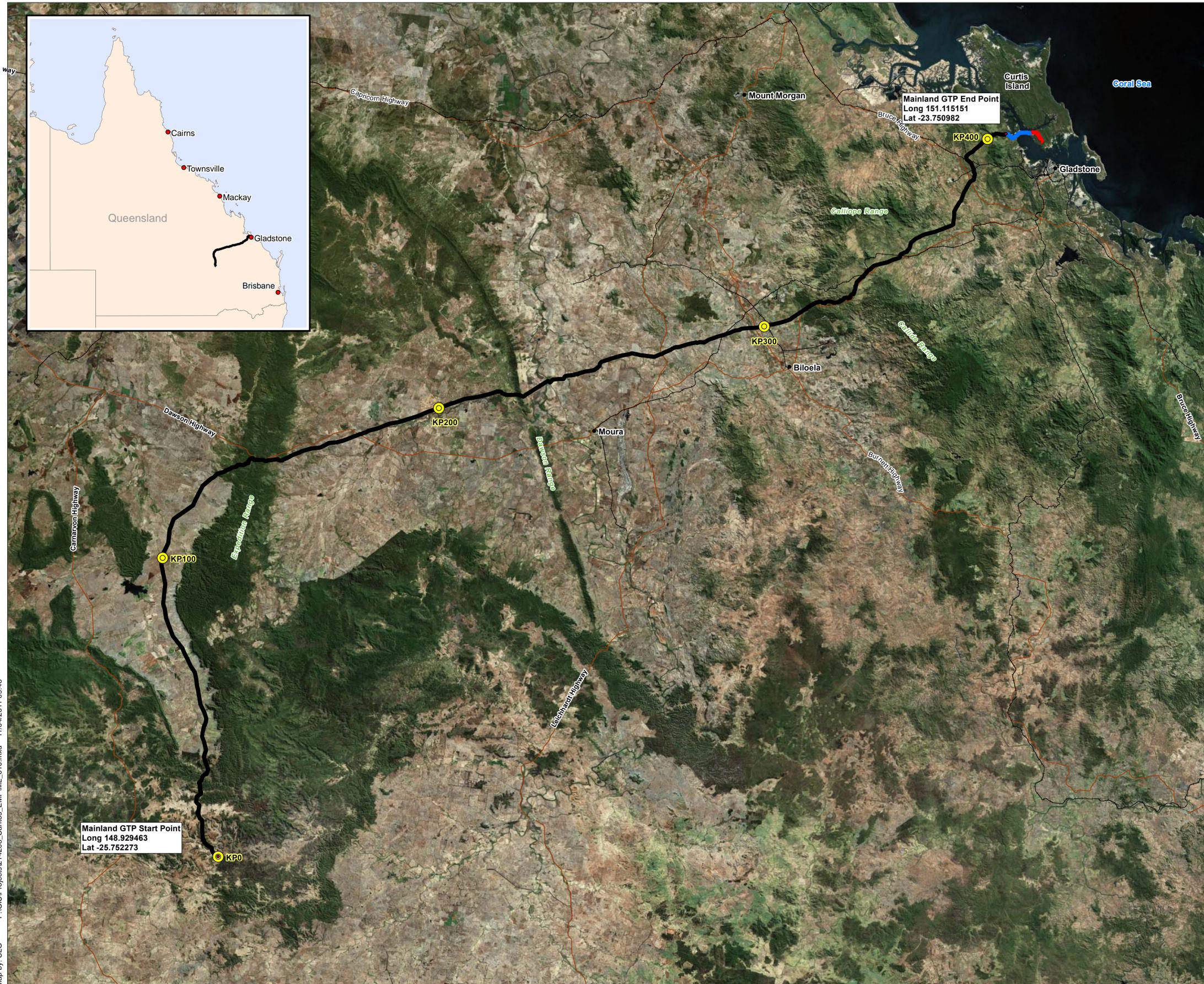


- Risk assessment – route selection, land use conflict, future development, land stability, and flooding
- Pipeline design – material selection, wall thickness, coating requirements, corrosion protection, burial depth, and remote monitoring



Mainland GTP EM Plan

- Gas Transmission Pipeline (GTP)
 - Mainland GTP EM Plan
 - Marine Crossing GTP EM Plan
 - Curtis Island GTP EM Plan
- Kilometre Post Distance Marker (km)
- Rail
- Major Road



Mainland GTP Start Point
 Long 148.929463
 Lat -25.752273

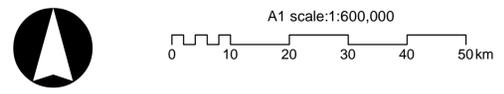
Mainland GTP End Point
 Long 151.115151
 Lat -23.750982

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Aerial: BING, Feb 2011.

Note:
 Lat/Long given in GDA94

Locality Plan Figure 2.1

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Map by: SLG



GLNG No: 3381-40-0400
 Coordinate system: GCS_GDA_1994



Marine Crossing GTP EM Plan

- Gas Transmission Pipeline (GTP)
- Mainland GTP EM Plan
 - Marine Crossing GTP EM Plan
 - Curtis Island GTP EM Plan
 - GTP Marine Crossing Reference Point
 - Proposed Infrastructure and Footprint
 - Stringing Location
 - Land Area Required
 - Other Proponents Pipeline RoW

Reference Point	KP (km)
A	406
B	406.5
B1	408.5
C	408.9
D	410.7
E	411.2
F	411.6
G	413.5
G1	413.8
H	414.5

Reference Points and Associated KPs



Source:
 Gas Transmission Pipeline (GTP): Santos, Aug 2011.
 Aerial: Santos, Feb 2011.
 Indicative Project Footprint: Aurecon, GLNG Aug, 2011.
 Other Proponents Pipeline RoW: GLNG, March 2011.

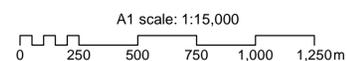
Marine Crossing Section Figure 2.2

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Version: e

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Map by: RB



GLNG No: 3381-40-0433
 Coordinate system: GCS_GDA_1994

3. CONSTRUCTION METHODOLOGY

Construction methodologies to be utilised during the construction of the GTP consist of open trenching and Horizontal Directional Drilling (HDD). Construction of all terrestrial GTP sections, including the entire Mainland GTP and the Curtis Island GTP will be by open trenching. HDD will be utilised in the Marine Crossing GTP in the area of the Kangaroo Island Wetlands and the Narrows from Points C to G (see Figure 2.2). Construction activities relevant to erosion and sediment control are described below.

3.1 Terrestrial GTP construction (Mainland and Curtis Island GTP)

3.1.1 Clear and grade

Clear and grade will be carried out along the GTP alignment to allow for the development of a construction Right-Of-Way (RoW) for plant, equipment and vehicular movement. The RoW for the terrestrial GTP section will generally be 40 m wide, and narrowed to 30 m wide for areas defined as an Environmental Sensitive Area (ESA). A typical 30 m and 40 m RoW layout is presented in Figures 3.1 and 3.2.

Clearing of the RoW shall include the removal as required of trees, brush, stumps and other obstacles, and the grubbing, or removal otherwise, of stumps in the way of the trench line and in trafficked areas. All cut timber and other vegetation shall be stockpiled along the right-hand edge of the RoW.

The seed bank – typically the top 50mm – will be stripped from both sides of the proposed trench line, and stockpiled along the edge of the RoW. Then the topsoil will be stripped to a depth not more than 200 mm, and stockpiled as windrows along the edge of the RoW.

Openings in trench spoil banks will be provided to allow normal drainage of the area and to prevent surface water from ponding.

Subsoil from the levelling of the RoW will be stockpiled separately from vegetation and topsoil. It will be placed to assist with restoring original contours. In rock areas surplus excavated rock material and surface boulders within the RoW will be stockpiled separately for re-use.

3.1.2 Stringing and bending

Pipe stringing involves laying the pipe out in lengths in preparation for welding. Pipe will be transported to the Mainland GTP RoW to temporary pipe storage areas adjacent to the RoW on trucks.

The pipes will be placed on wooden skids in order to elevate the pipe from the ground surface, standing water and mud.

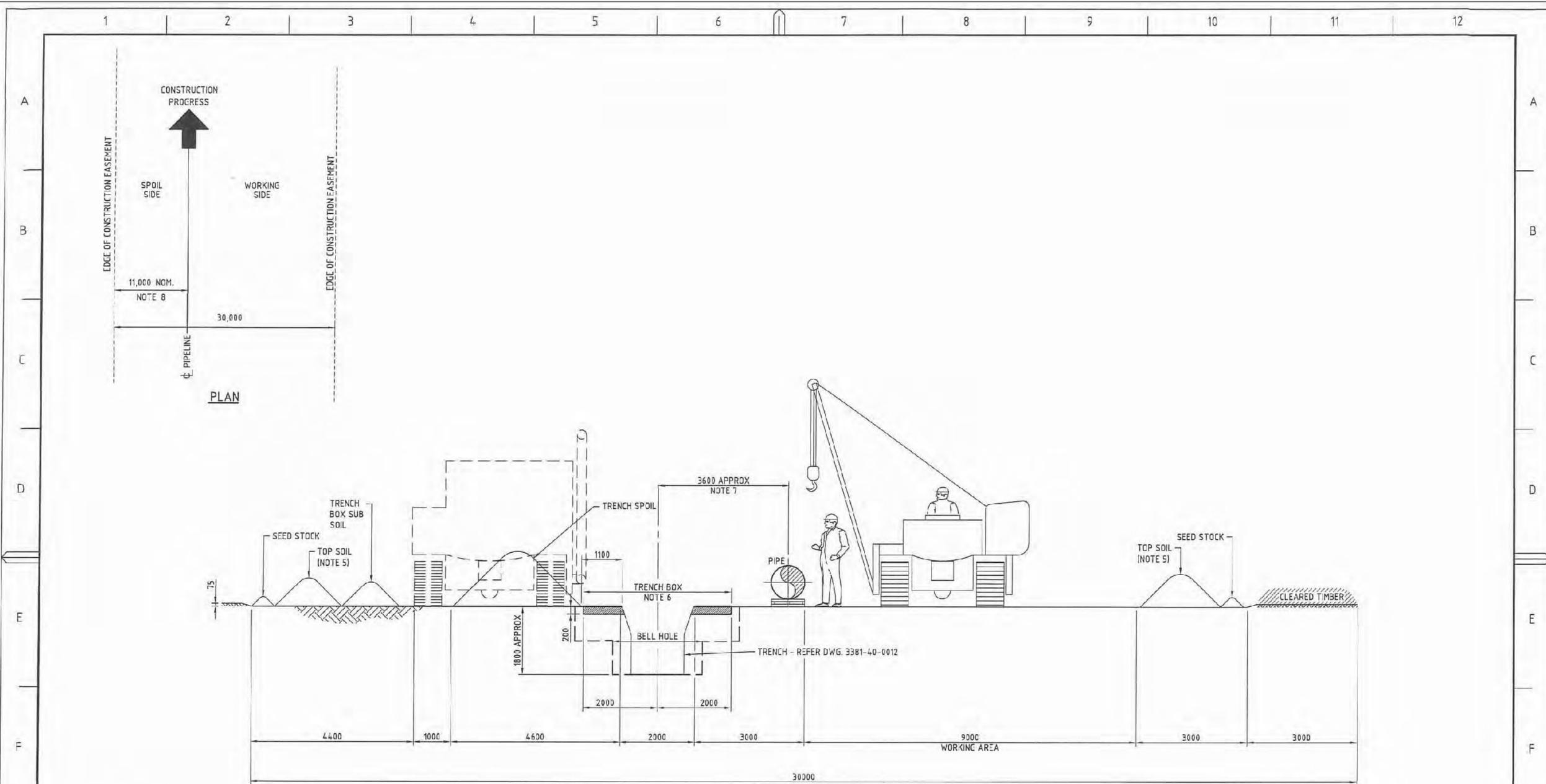
3.1.3 Trenching

Trenching will be undertaken either prior to, during or after pipe stringing, and will depend upon the project schedules, terrain and other logistical factors. Plant and equipment used to undertake trenching is listed below.

The trench will typically be 2.0 m deep and 1.5 m wide and may vary dependent on soil and topography. It is proposed that the Mainland GTP trench be opened in sections to minimise the risk of surface water entering the trench.

Trench spoil will be windrowed beside the trench allowing gaps at regular intervals for access tracks and for surface drainage.

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Map by: SLG



30m RIGHT-OF-WAY CROSS SECTION
LOOKING IN DIRECTION OF CONSTRUCTION PROGRESS

- NOTES:**
1. DELETED
 2. DELETED
 3. MINIMUM SPACING OF 1m BETWEEN BOX TOPSOIL AND TRENCH SPOIL MUST BE MAINTAINED.
 4. BENCHING FOR TRENCH BOX TO BE DONE TO 200mm MAXIMUM DEPTH. REFER TO ALIGNMENT SHEETS FOR ROW WIDTH.
 5. TOP SOIL FROM ENTIRE ROW IF REQUIRED TO BE REMOVED. REFER TO CONSTRUCTION SPECIFICATION.
 6. TRENCH AND BOX DIMENSIONS MAY BE VARIED WITH GLNG APPROVAL IF EXCAVATORS/BLASTING IS USED.
 7. DIMENSION ON HOLD PENDING ADVICE ON GLNG REQUIREMENT TO WELD BEFORE TRENCHING.
 8. MAY VARY IN ORDER TO FIT PIPE INTO EASEMENT AT BEND LOCATION.
 9. DELETED
 10. FLAG BOUNDARIES PRIOR TO GRADING AND CLEARING. ADDITIONAL FLAGGING MAY BE REQUIRED AT ENVIRONMENTALLY SENSITIVE AREAS eg. WETLANDS.
 11. RIGHT OF WAY DETAIL TO BE HEAVILY REVISED FOR WATERWAY / WETLAND CROSSINGS AND OTHER SENSITIVE AREAS.

PRELIMINARY

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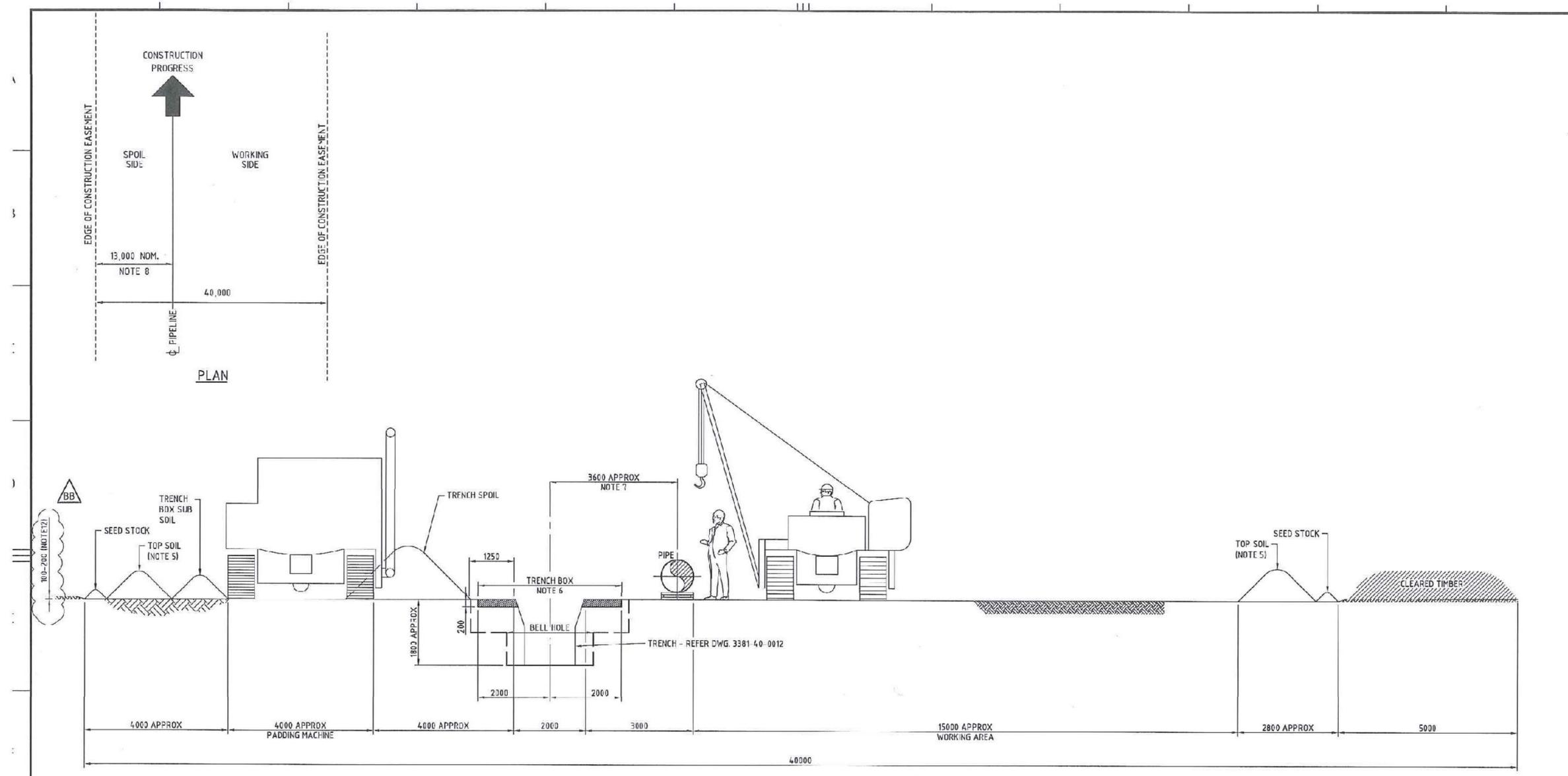
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AA	19/11/09	GHD						ISSUED FOR APPROVAL - 42 INCH			
A1	29/10/09	GHD	CEJ			TM		ISSUED FOR INTERNAL REVIEW			

DRN:	GHD
DATE:	23/10/09
SCALE:	NTS
CHKD:	
ENG:	
D.A.:	
PROJ:	
ACC:	
A.B.N.	80 007 550 923

GLNG GAS PIPELINE
30m RIGHT-OF-WAY LAYOUT
PIPELINE STANDARD

DRAWING No:	3381-40-0151	REV	AA
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4.0m RIGHT-OF-WAY CROSS SECTION
LOOKING IN DIRECTION OF CONSTRUCTION PROGRESS

NOTES:

1. DELETED
2. REFER TO 3381-GHD-3-3.3-0185 FOR TOPSOIL REMOVAL.
3. MINIMUM SPACING 90mm BETWEEN BOX TOPS AND TRENCH SPOIL MUST BE MAINTAINED.
4. BENCHING FOR TRENCH BOX TO BE DONE TO 700mm MAXIMUM DEPTH. REFER TO ALIGNMENT SHEETS FOR ROW WIDTH.
5. TOP SOIL FROM ENTIRE ROW IF REQUIRED TO BE REMOVED. REFER TO CONSTRUCTION SPECIFICATION.
6. TRENCH AND BOX DIMENSIONS MAY BE VARIED WITH GLNG APPROVAL IF EXCAVATORS/BLASTING IS USED.
7. DIMENSION ON HOLD PENDING ADVICE ON GLNG REQUIREMENT TO WELD BEFORE TRENCHING.
8. MAY VARY IN ORDER TO FIT PIPE INTO EASEMENT AT BEND LOCATION.
9. DELETED
10. FLAG BOUNDARIES PRIOR TO GRADING AND CLEARING. ADDITIONAL FLAGGING MAY BE REQUIRED AT ENVIRONMENTALLY SENSITIVE AREAS eg. WETLANDS.
11. RIGHT OF WAY DETAIL TO BE HEAVILY REVISED FOR WATERWAY / WETLAND CROSSINGS AND OTHER SENSITIVE AREAS.



No	DATE	DRN	CHKD	ENG	Q.A.	PROJ	ACC	DESCRIPTION	DRG No.	SUBJECT	REFERENCE DRAWINGS
BB	30/09/10							GLNG ISSUED FOR DETAILED DESIGN			
AA	19/11/09	GHD	CEJ	TM				ISSUED FOR APPROVAL - 42 INCH			
C	29/10/09	GHD	CEJ	TM				PADDER ADDED			
B	27.08.09	GHD						ISSUED FOR GLNG REVIEW			
A1	24.05.09	GHD						ISSUED FOR INTERNAL REVIEW			

DRN:	GHD
DATE:	24/06/09
SCALE:	NTS
CHKD:	
ENG:	
Q.A.:	
PROJ:	
ACC:	
A.B.N.	63 607 559 923

PRELIMINARY
GLNG GAS PIPELINE
40m RIGHT-OF-WAY LAYOUT
PIPELINE STANDARD

DRAWING No.	3381-40-0050	REV	BB
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3.1.4 Lowering and backfilling

Typically, the pipe shall be placed directly on the trench bottom without bedding beneath it.

The pipe will be lowered into the trench using side-booms with roli-cradles.

The trench backfilling shall be compacted by rubber-tyred wheel rollers. Backfill soils will be compacted to a level consistent with surrounding soils, with the aim of preventing trench subsidence and water ponding.

Any subsidence that occurs, including any subsidence occurring during the contract maintenance period, shall be rectified. Surplus excavated material will be spread across the RoW subject to its suitability for this purpose.

3.1.5 Hydrostatic testing

During hydrostatic testing (hydro-testing) the pipe will be filled with clean water sourced from nearby dams or town. The location and source of water supplied for testing will be determined prior to commencing construction, but will be of potable water quality standard. The pipeline once capped and filled is then pressurised. A 24-hour leak test then follows. The water will be re-used along the length of the pipe and then discharged to land in a non-erosive manner.

3.1.6 Blasting

Blasting may be required to form the trench in areas of rock which is not excavated by mechanical methods (such as an excavator with rock hammer).

Details of the blast parameters and design required are not available at this stage, however it is assumed drill and blast techniques incorporating confined blasting (ie blasting of hole/trench on open ground) will be employed.

3.1.7 Crossings

Road crossings

Road crossing construction methods will be selected based on the road formation type. Crossing design and construction methods will vary according to road function, road design and the size and quantity of vehicles that use the road. The types of road crossing methods to be considered are summarised below, along with the relevant road types:

- Open cut: unformed and formed tracks, gravel roads and some bitumen roads
- Bored (cased or uncased): some major highways and some bitumen roads
- Directional drill (cased or uncased): some major highways

Bored rail crossings

Bored rail crossings shall be installed and constructed in accordance with the alignment sheets and construction drawings, responsible authority, requirements of the asset owners and approval conditions.

Bored road crossings

Bored road crossings shall be installed and constructed in accordance with the alignment sheets and construction drawings, responsible authority, requirements of the asset owners and approval conditions.

Watercourse crossings

The crossing of approximately 13 rivers or creeks, and 90 minor watercourses are required for the Mainland GTP. These will be constructed in accordance with the alignment sheets and construction drawings, responsible authority, requirements of the asset owners, and approval conditions.

Three alternative methods may be used for watercourse crossings. These are:

- Open trench. The majority of watercourse crossings are expected to be constructed using standard open trenching construction. This technique is most suited to the dry or low flow conditions which will be preferred for the construction phase
- Open trench with flow diversion. Flow diversion is a modification to the standard open trench method employed where higher water volumes and flows are present (typically up to 1,000 L/s). In this way the risk of erosion and interference with construction activities is reduced
- HDD is generally used to cross major watercourses where standard open cut methods are not feasible or to avoid environmentally sensitive features. The feasibility of using HDD is limited by site conditions such as soil stability, slope, access, available workspace and the nature of subsurface strata

It is anticipated that the majority of the watercourse crossings will be constructed using standard open trench methods, and where possible, construction activities will be scheduled for dry or low flow periods to enable open trench methods to be used.

Clear and grade operations at waterways will be restricted to the minimum necessary for construction purposes and shall be performed in a manner which will minimise the reinstatement requirements.

On completion of works the beds of the stream and watercourse will be restored, and obstructions resulting from construction of the pipeline will be removed and disposed. The banks of each watercourse crossing shall be restored by grading to the natural contours, or to the natural angle of repose of the stream bank material, whichever is less steep.

3.1.8 Rehabilitation after GTP construction

On completion of Mainland GTP construction, the RoW will where required be re-contoured to match the surrounding ground and existing landform. During this process, erosion and sediment controls will be installed when required to ensure the long-term stability of the previously disturbed areas and to minimise secondary impacts upon areas outside of the project boundaries.

Rehabilitation of the RoW will be undertaken in accordance with the Landscape Rehabilitation Management Plan (LRMP).

3.2 Marine Crossing GTP Construction Methodology

The Marine Crossing section will utilise all of the techniques outlined in the Mainland GTP construction section, and the additional measures described in this section.

The terrestrial pipe construction activities within the marine crossing section extend between Point A (KP 406) and C (KP 409) on the Mainland and between Point G (KP 413.5) and H (KP 414.5) on Curtis Island (see Figure 2.2). In particular:

Terrestrial Section: Point A to Point B (0.6 km) (KP 406) to (KP 406.5)



From the exit of the Queensland Energy Resources (QER) land-bridge, the route runs southeast within the boundaries of the Northern Infrastructure Corridor (NIC). For this portion of the route, the GTP Marine Crossing will run parallel to the other LNG Pipelines as it does for the remainder of the NIC. This section of pipeline will be installed using conventional onshore trenching construction techniques.

Terrestrial Section: Point B to Point C (1.8 km) (KP 406.5) to (KP 409))

The route then runs on the eastern side of the QER oil shale mining lease area and above the high water mark (HWM) to the southernmost edge of the intertidal mudflats. This section of pipeline will be installed using conventional onshore construction techniques.

Terrestrial Section: Point G to Point H (1.235 km) (KP 413.5) to (KP 414.5)

The route runs from the winch site to a point where the GTP Marine Crossing alignment rejoins the Curtis Island GTP Marine Crossing section.

3.3 HDD construction within the marine crossing

3.3.1 Location

The Marine Crossing GTP will be constructed using HDD beneath the Kangaroo Island Wetlands and The Narrows crossing (see Figure 2.2).

3.3.2 Description of the overall HDD construction process

HDD will be undertaken in four stages. HDD pads at Points F and G will occur outside of the GBR Coast MP but within the 200m buffer zone. The following describes the sequence of construction activities that will be implemented to HDD from Point G to Point C.

1. A drill pad will be established at Point G. Drill from location Point G to Point F. Pull 1st pipe string 900 m from Point F to Point G. Tie-in 2nd string 900 m from end pull 2nd string from Point F to Point G. Pipe storage and stringing will extend in a south eastern direction from Point F to Point D.
2. The drill pad will be moved from Point G to Point F. Drill from Point F to Point E. Pull 450 m string from Point E to Point F. The pipe stringing will be constructed on the working area between Points E and D and pulled eastward into the excavated hole at Point E and tied in to the pipe once in position at Point F.
3. Move the drill pad from Point F to Point D and drill from Point D to Point E. Pull 450 m string from Point E to Point D. The pipe storage and stringing will extend from Point E in a north eastern direction. The pipe stringing will be constructed on the working area between Points E and F and pulled through the drilled hole from Point E to Point D.
4. Turn the drill pad at Point D and drill from Point D to Point C. Pull 930 m string from Point C to Point D. The pipe storage and stringing area will extend in a south western direction from Point C for a distance of 1,800 m. A pipe stringing area will be constructed on the terrestrial side of Point B1 as indicated in Figure 2.2.

The HDD pads will contain a HDD rig; drilling pipe storage; tanks for fuels, oils and drilling muds (typically bentonitic clay). The HDD process involves a small diameter pilot hole being drilled along the designed directional path. Next, this pilot hole is progressively enlarged to a diameter that will accommodate the pipeline (a process referred to as reaming) (see Figure 3.3).

The material generated during drilling (pilot holes and reaming) will be removed from the site and disposed of at the Western Basin reclamation facility operated and managed by the Gladstone Ports Corporation (GPC) or an approved dump site.

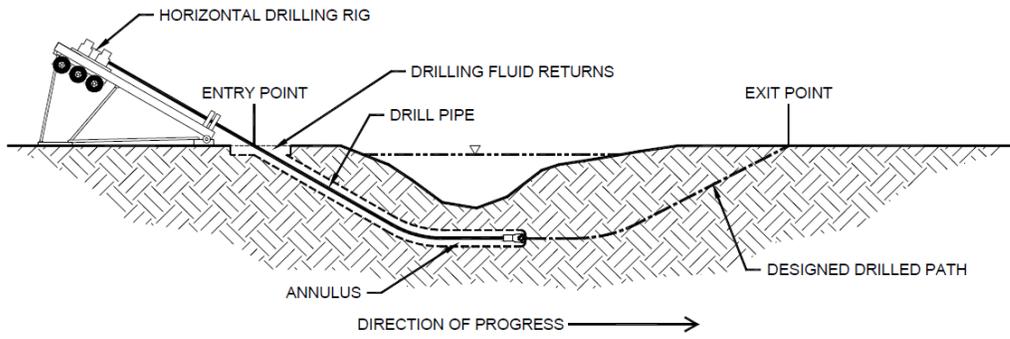


Once the hole is completed, the pipe string will be pulled through the hole in the direction of the rig.

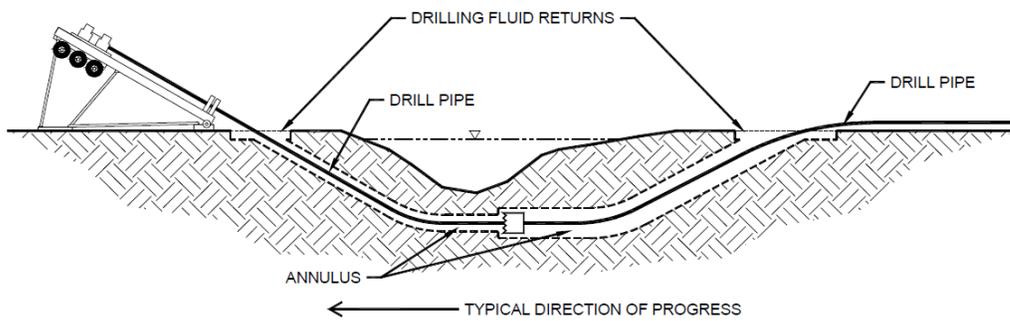
The pipe stringing will be prepared on working areas. The working areas will be delineated using bog mats or a similar product. These are typically high density polyethylene mats which interlock to provide an even weight distribution for vehicles, or construction activities on surfaces such as mudflats. The bog mats do not require additional material (such as road base) to be placed on them, however base material will be utilised under the mats. Once pipeline construction is completed, the bog mats will be removed and reused or recycled.

HDD pads will be removed once all pipeline construction is completed during the restoration phase.

PILOT HOLE



PREREAMING



PULLBACK

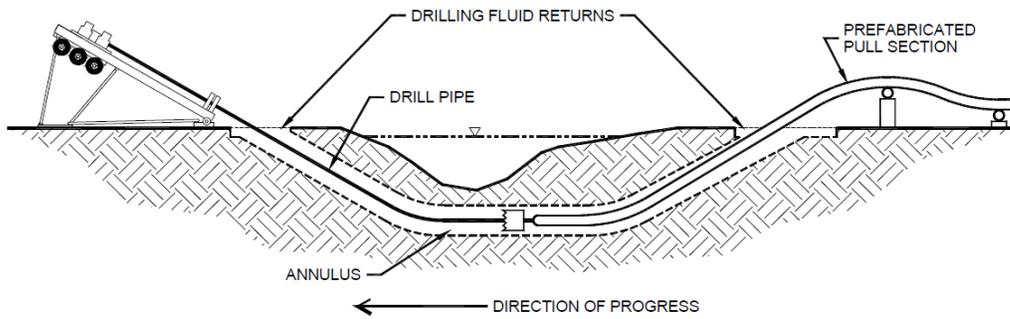


Figure 3.3 Typical stages of the HDD process

3.3.3 Access and pad construction for HDD

Access between HDD pad sites on intertidal or wetland areas will be via Dura Base matting or equivalent material. Matting will be utilised to facilitate vehicular access to the HDD drill pads over soft soils, mud and environmentally sensitive areas. Each mat weighs approximately 477 kg and is made out of recycled plastic, measuring approximately 2.5 m x 4 m and approximately 100 mm thick. Mats will be pegged to the ground to ensure the mats do not float away during extreme high tide or storm surge events. Mats will be removed once the HDD process is complete and managed in accordance with the Waste MP.

There will be approximately 10,000 m³ of HDD fluid (mud) requiring disposal. The HDD mud will be disposed of within the Western Basin reclamation area which is operated and managed by GPC or another approved disposal site.

HDD mud will be tested for ASS and will be managed in accordance with the ASSMP. It is expected that HDD mud will only contain ASS in the upper section of the HDD hole (first 3 – 5 m AHD).

HDD mud that contains ASS will be transported to a treatment pad located adjacent to the RoW trenching area between Point B and Point B1 (Figure 1.2). Once this material has been treated it will then be transported to the Western Basin Reclamation Area and disposed of.

HDD mud not containing ASS will be transported directly to the Western Basin Reclamation Area for disposal.

3.3.4 Rehabilitation after HDD construction

Once the HDD process is completed, the associated infrastructure will be relocated to the next pad, the HDD pads will be removed, and the HDD contractor will reinstate and rehabilitate areas disturbed by HDD works in accordance with the LRMP.

3.4 Ancillary Project Infrastructure

3.4.1 Construction camps

General

Construction camps are required to house and accommodate the construction personnel for the Mainland GTP. These construction camps will be sized to accommodate approximately 450 persons at main camps and 200 persons at behind and advanced camps. An area of approximately 8 ha will be required for each camp.

Construction camp locations

Construction camp sites have been positioned to minimise travel distance for work crews and have been located near a water source.

Four camp sites have been defined and have been located to minimise the travel distance to the work sites. The construction camps will be located at the following locations:

- Camp 1 – Bundaleer – KP 75
- Camp 2 – Bauhinia – KP 180
- Camp 3 – Banana – KP 275
- Camp 4 – Calliope KP – 355

Construction camp installation

The mobilisation schedule of construction camps is based on the logistic and construction priorities as required for the project implementation.

In preparation of camp installation, the proposed site will be filled, compacted, and graded to an adequate elevation above the existing ground level to allow for the proper slope for drainage.

3.4.2 Transportation and storage of pipe

The pipe for the Project will be shipped from overseas in 12 m lengths. It will be received by the Contractor at the Port of Gladstone and Port Alma, from December 2011 to September 2012.

The pipes western and eastern sections of the Mainland GTP will be transported via road to one of eleven temporary pipe storage sites. The size of each temporary pipe storage site will typically be 8 ha (200 m X 400 m) and will be able to accommodate a maximum of 60,000 pipes, and will be located adjacent to the RoW.

Construction of the temporary pipe storage sites will typically be on land which is flat and stable and provided with drainage features/sediment controls. An access road will be constructed around and in-between stacks to facilitate loading/offloading activities.

These sites will be reinstated in accordance with the LRMP once the entire pipe has been delivered to the RoW for stringing and there is no longer a need to retain the temporary pipe storage site.

3.4.3 Transport along the Mainland GTP RoW and access tracks

Access tracks will be prepared in a similar fashion to the RoW. Topsoil will be stripped and stockpiled for reinstatement.

Access tracks will be maintained during construction and rehabilitated to the pre-existing state following completion of construction activities (where on-going operational access is not required) and in accordance with landholder requirements.

It is estimated that up to 700 vehicles will move along the RoW per day with consequent impacts upon soil structure including soil breakdown, compaction, and wind erosion.

3.4.4 Plant wash-down facilities

All access to and from the RoW, which will include the access tracks and hauls roads, will be via dedicated wash down facilities. These have been located throughout the project area. These dedicated wash down facilities are primarily to control pest and weeds, however will also minimise tracking of dirt onto public roads.

4. EROSION CONSIDERATIONS

4.1 Soil Characteristics

Soil Groups occurring along the length of the GTP have been identified in the relevant Land Management chapters of each of the three EM Plans (ie Mainland, Marine Crossing and Curtis Island). The EIS assessment undertaken by URS (2009) indicated soils across the length of the GTP RoW can be separated into nine broad groups.

Group 1: Skeletal, rocky or gravelly soils (>60% coarse fragments) with sandy, silty, loamy or clayey soil matrix

Group 2: Sand soils, includes stratified alluvial soils, residual sand soils, earthy sands

Group 3: Coarse to medium-textured soils

Group 4: Medium-textured sandy, sandy loam or silt to clay

Group 5: Sand, loamy sand, sandy loam or loamy surface duplex soils

Group 6: Fine sandy, silty or clay loamy surface duplex soils

Group 7: Shallow uniform often gravelly fine-textured soils

Group 8: Shallow to medium to deep uniform fine-textured (cracking) clay soils

Group 9: Deep to very deep, very soft, uniform gradational or weak duplex soil

Detail of the properties of these soils and their typical constraints are provided in chapter 7 of the relevant EM Plans.

Characteristics which will influence the erosion and sedimentation are described below.

4.1.1 Soil Erodibility

Soil erodibility for water erosion reflects the susceptibility to detachment and transport by water. It is influenced by soil texture and the stability of soil aggregates i.e. the strength of bonds between soil particles. Soils with low infiltration rates have higher run off rates and are therefore more erodible. Soil with weak bonding between soil particles will be very susceptible to erosion i.e. loamy soils and dispersive sodic soils. (Hazelton and Murphy, 2007).

Highly erodible soils are those with weak bonds between soil particles and an abundance of soil particles that are easily disturbed by water. If these soil properties are combined with low infiltration then soil erodibility is very high. Typical qualities of erodible soils include:

- Dispersible clay soils (usually sodic)
- Soils high in silt and fine sand that have low organic matter levels (loams to silty clay loams)
- Clay soils with shrink-swell properties

These include Soil Groups 4 to 8 as described in the EM Plans.

4.1.2 Dispersible Clay Soils

A soil is considered sodic when sodium reaches a concentration where it starts to affect soil structure, which in Australian soils is commonly at exchangeable sodium percentage (ESP) of > 6 % (Isbell, et al 1983). When sodic soils are wetted the sodium weakens the bonds between soil particles resulting in clay swelling causing slaking or dispersion. (Rengasamy and Walters, 1994). Such dispersion may occur in sodic soils without any disturbance at all. The dispersed clay particles can be easily moved by water or wind and can migrate through the soil clogging soil pores thereby reducing infiltration and drainage and causing higher run-

off. Dispersed clay particles may also be entrained in water and can contribute to water pollution. This may lead to a range of problems for construction sites including high water run-off and erosion rates, water pollution, tunnel formation, reduced workability, difficulty with vegetation establishment, and reduced vegetation growth due to low water holding capacity and root penetration (Raine and Loch, 2003).

However, it is important to note that not all sodic soils are dispersive and not all dispersive soils are sodic. Other factors such as salinity, texture, clay mineralogy, and organic matter can all influence the dispersibility of a soil. Dispersive soils are problematic for construction and maintenance activities and should be identified so that their constraints can be addressed in project planning.

A review of the Australian Soil Resource Information System (ASRIS) in conjunction with data gathered from the EM Plan preparation, indicates that Sodic duplex soils (Sodosols), mapped as Soil Groups 5 and 6 occur along the pipeline route including areas between Gladstone to Mount Alma, Biloela, Bauhina, Arcadia Valley, Biloela and Injune. Sodosols are characterised as being texture contrast soils (i.e. the topsoil is of a lighter texture than the subsoil) in which the subsoil is sodic and not strongly acidic.

Sodic soils are not limited to Sodosols. Soils with sodic properties were identified along the majority of the pipeline route, with the exception being the soils of the Calliope Range, Callide Range, and Dawson Range. Of the sodic soils, topsoils tend to be marginally sodic to sodic with ESP's mostly between 5 % and 15 % with a few occurrences of strongly sodic soil (ESP's 15 % to 25 %). In the subsoils, sodicity is much greater tending to be strongly sodic with vast areas of soils with ESP's that exceed 25 %.

Key management practices to reduce the impacts of sodic soils include: the management of surface water flows and minimisation of the potential for localised ponding, the use of compaction within the soil profile to reduce infiltration and minimise changes in the soil electrolytes which lead to spontaneous dispersion and tunnelling, and the use of amendments (e.g. gypsum, organic matter, polyacrylamides) to modify either the ESP or directly influence aggregate stability (Rained and Loch, 2003).

4.1.3 Soils High in Silt and Fine Sand

Soil texture is an important property contributing to soil's erodibility. Soils with a high content of silt, very fine sand (0.05 to 0.10 mm in diameter), or expanding clay minerals tend to have high erodibility. Erodibility is low for clay soils with a low shrink-swell capacity because these clay particles mass together into larger aggregates that resist detachment and transport. Sandy soils with large amounts of fine, medium, or coarse sand particles (0.10 to 2.0 mm in diameter) also have low erodibility. Sand particles lack the ability to aggregate together, but because most sandy soils are highly permeable, water runoff is low, hence erosion is often slight. In addition, the large grain size of sandy soils means that it takes more energy to transport its particles than those of finer-textured soils. Medium-textured soils (loamy soils) tend to be most erodible because they have high amounts of silt and very fine sands. These soils tend to have moderate to low permeability and low resistance to particle detachment. If disaggregated, small particles (silts and clays) are easily transported. Rock fragments can also prevent erosion by protecting the soil from raindrop impact (O'Geen, 2006).

Soils that are considered to be highly erosive include the following textures (Landcom, 2004):

- Loam and Fine sandy loam, (~25 % clay)
- Silty loam (~25 % clay and > 25 % silt)
- Sandy Clay loam (20 % to 30 % clay)
- Silty clay loam (30 % to 35 % clay and > 25 % silt)

A review of the ASRIS and soils information gathered in the EM Plan indicates loam, silty loam, or sandy clay loam are uncommon along the alignment, however relatively small areas have been noted in the topsoils in the vicinity of the following locations:

- East of Dungree
- Dawson Range
- Sections along Arcadia Valley Road
- Surrounding Biloela

4.1.4 Clay Soils with Shrink-Swell Properties

Soils with expanding clay minerals tend to have high erodibility. Vertosols (described within Soil Group 8 in the EM Plan) are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth (Isbell, 1996), and often exhibit gilgai micro-relief. These can be structurally unstable to raindrop impact and rapid wetting and frequently produce readily detachable and transportable soil particles resulting in high soil erodibility.

Soil Group 8 was identified west of the Calliope Range at a number of locations (Biloela and Bauhinia in particular) and are indicated as having highly sodic subsoils. These Vertosols are commonly adjoined with highly erosive Sodosols.

4.1.5 Salinity

Soils with elevated electrical conductivities (EC) were identified as occurring in a number of areas. Soil EC is used as a measure of soil salinity and is commonly used because it is simple to measure. The relationship between EC and the salinity effect to plant growth is also strongly influenced by soil texture, in particular clay content. The greater the clay content then the higher EC will need to be before it has saline impacts on plant growth i.e. the EC concentrations that severely inhibit vegetation growth in sandy soils may cause little adverse growth effects on in heavy clay soils.

A brief review of the ASRIS identified that soils with elevated EC's (0.95 dS/m) in the subsoil were present along the alignment between Biloela and Bauhinia, which is rated as having a very high salinity rating for soils of these light to medium clay textures.

4.1.6 Acidity and Alkalinity

The optimal pH_w1:5 range in soil is 5.5 to 8.5. Outside of these ranges plant growth tends to be retarded mostly due to changes in the soil chemistry resulting in nutrients becoming either unavailable or toxic to plants. Areas of extreme acidity (pH < 4.5) and alkalinity (pH > 9.0) were not identified in the alignment. The majority of the soils range between moderately acidic to moderately alkaline with the exception of strongly acidic soils (both topsoil and subsoil) with pH 4.8 to 5.5 being identified in the vicinity of Calliope and Expedition Ranges, as well as areas around Beilba and Injune.

4.1.7 Soil Characteristics Summary

The following key points relate to the erodibility of soils along the alignment.

- The majority of the soils along the alignment are considered to have high erodibilities
- Sodic soils are indicated along the majority of the pipeline route with the exception being the soils of the Calliope Range, Callide Range, and Dawson Range. The topsoil tends to be marginal to sodic, whilst the subsoils are considered highly sodic
- Erodible swelling clay soils (Vertosols) with highly sodic subsoils are present at various locations west of the Calliope Range and are prominent from Biloela and Bauhinia

- Surface soils with high erosion potentials are indicated to be present east of Dungee; Dawson Range; along sections of Arcadia valley Rd; and surrounding Biloela
- It is highly likely that subsoils with very high salinity potential to be present between Biloela and Bauhinia. Acidic soils are indicated to present in the vicinity of Calliope and Expedition Ranges, as well as areas around Beilba and Injune

Inversion of these soils during reinstatement may result in on-going reinstatement maintenance issues and costs. Bringing sodic subsoils to the surface could result in highly erodible surfaces with surface crusting and hard setting issues effecting vegetation establishment and growth. Reinstatement of acidic or saline soils is also likely to be problematic to vegetation establishment and surface stabilisation.

4.1.8 Soil Testing

Further information will be obtained to characterise the soils along the route and the remediation required to treat aggressive soils that are prevalent along the alignment. The Coordinator Generals' Conditions (Schedule E) states:

4. establish baseline soils information for areas to be disturbed including soil depth, pH, electrical conductivity (EC), chloride, cations (calcium, magnesium and sodium), exchangeable sodium percentage (ESP), particle size, and soil fertility (including nitrogen, phosphorous, potassium, sulphur and micronutrients)

The field programme will also make observations of similar works along the alignment and the success or otherwise in remediating those areas.

The sampling programme will identify high-risk soils. Potential for remediation includes the addition of gypsum or lime, or limiting macro-nutrients; or deep burial of soils with highly adverse properties. This work will be undertaken prior to construction, so that detailed information regarding application rates of ameliorants can be obtained prior to site works.

4.2 Topography

The erosion risk is of concern whenever water concentrates, and where there is a combination of long and steep slopes. Consequently, the erosion risk due to these factors is generally low across the site, but will be high through the ranges and possibly near the watercourses.

The Environmental Impact Statement (EIS) completed by URS for GLNG (2009) identifies two key basins in the project area, the Fitzroy basin, and Calliope basin.

The Fitzroy Basin is characterised by large variations in river flows. Most of the region's rainfall occurs during October to April, and the prolonged dry periods in winter mean that many of the waterways are ephemeral.

URS (2009) indicates that there are large seasonal variations in flow with notable high flows between October and April. The watercourses with the highest flows were Dawson River and Calliope River with little flow occurring in Bell Creek. This is consistent with their respective upstream catchment sizes.

4.3 Climate

4.3.1 Overview

The climate across the pipeline route passes is subtropical, and characterised as having moderately dry winters. Rainfall is highest near the coast ranging from 750 mm to 800 mm per year and decreases west of the Calliope Range from 650 mm to 700 mm per year.

Further west, total rainfall decrease slightly with comparable total rainfalls at Rolleston and Injune of 600 mm to 650 mm per year.

Monthly rainfall is similar along the route and is characterised by having summer dominant rainfall. In the cooler months from April to September rainfalls are approximately 20 mm per month. Highest rainfalls occur in late spring and summer from November through to February. From Gladstone to Biloela summer rainfall tends to be between 80 and 100 mm per month, whilst in the western region (Rolleston to Injune) rainfall rarely exceeds 70 mm to 80 mm per month (shown in Figures 4.1 to Figures 4.6).

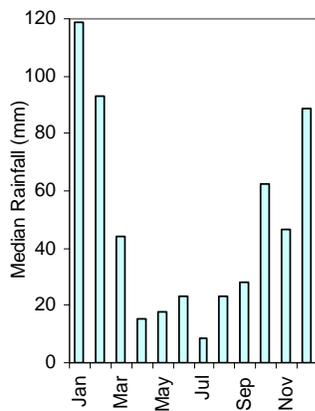


Figure 4.1 Gladstone: monthly median rainfall

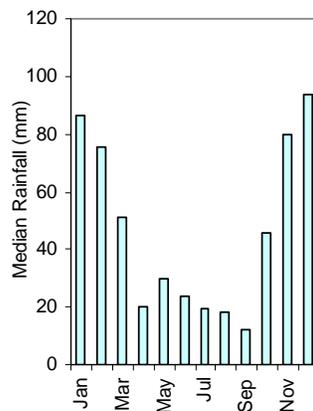


Figure 4.2 Biloela: monthly median rainfall

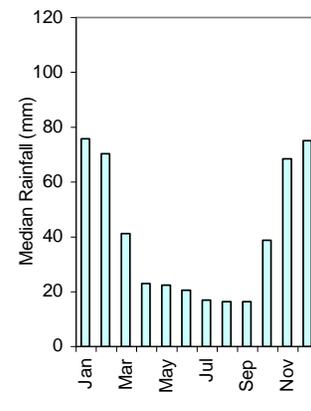


Figure 4.3 Injune: monthly median rainfall

The number of rain days per month can be used as an indicator of how often the potential for erosion may occur. The Bureau of Meteorology (BOM) has readily available climate information, including monthly rainfall data of depths that occur greater than (>) 1 mm, and greater or equal to (\geq) 10 mm and 25 mm days per month. Storms less than 10 mm are considered to have little potential to cause substantial erosion, however the data provides an indication as to how rainfall is distributed throughout the month.

Rainfall between Gladstone and the Calliope Range is common throughout the summer months (6 to 9 days per month), however the majority of these are showers of less than 10 mm. For two to three days per month rainfall of 10 mm to 25 occurs, with half of these being \geq 25 mm.

West of Calliope Range, rainfall occurs slightly less often over summer months, with the main variation being the incidence rainfalls \geq 25 mm, which decreases to once or less per month. In the cooler months between May and September, winter months rainfall is relatively consistent across the route from Gladstone to Injune with most rainfalls being < 10 mm (2 to 3 times per month), with daily rainfalls between 10 mm and 25 mm occurring on average 1 day per month of which approximately one third exceed 25 mm per day.

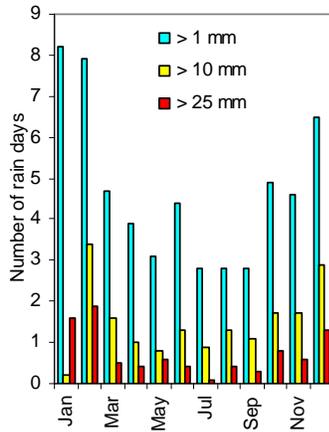


Figure 4.4 Gladstone: number of days with rain ≥ 10 mm and ≥ 25 mm per month.

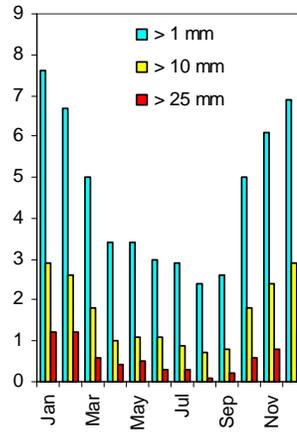


Figure 4.5 Biloela: number of days with rain ≥ 10 mm and ≥ 25 mm per month.

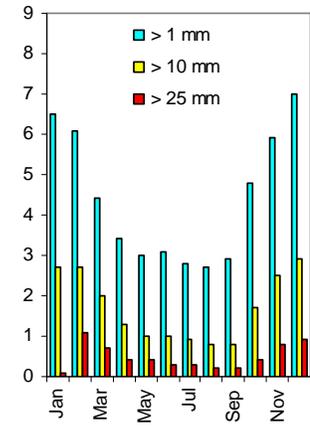


Figure 4.6 Injune: number of days with rain ≥ 10 mm and ≥ 25 mm per month.

Note that this data is presented as averages, and the weather is relatively inconsistent across the project area. In some years there is little rainfall while in others it may rain in particular locations. In recent years, rainfall in parts of the project area has been relative dry for the whole year.

The Gladstone area is subject to cyclones, which bring severe flooding to low laying areas and cause rivers to run. Cyclonic disruptions and the associated effects can last up to one month. The frequency for Gladstone has an average of 0.2 cyclones per year, or one cyclone every five years.

4.3.2 Rainfall Erosivity

Rainfall erosivity is a measure of the ability of rainfall to cause erosion. It is a product of the total energy and the maximum intensity for each storm. When other factors are constant, the potential for soil disturbance from rainfall are directly proportional to the product of the total kinetic energy of the storm, times its maximum 30-minute intensity. Rainfall erosivity is an indication of the two most important characteristics of a storm determining its erosivity being the amount of rainfall; and peak intensity sustained over an extended period.

Climatic erosion risk ratings based on monthly rainfall erosivity intensities are published in IECA, 2008. The closest locations to the pipeline route included in the publication are for Rockhampton, Emerald, and Roma.

The erosion potential from rainfall is dependant upon ground conditions, and if already wet then there will be an accumulative effect. Generally 10 mm of rain in one event will start to cause erosion. There are on average 20 days per year that experience rainfall ≥ 10 mm and 6 to 9 days with ≥ 25 mm.

Table 4.1 Climatic erosion risk ratings based on monthly rainfall

	Rockhampton	Emerald	Roma
Jan	High	High	High
Feb	High	High	Medium
Mar	High	Medium	Medium
Apr	Medium	Low	Low
May	Medium	Low	Low
Jun	Low	Low	Low
Jul	Low	Very Low	Low
Aug	Low	Very Low	Very Low
Sep	Very Low	Very Low	Very Low
Oct	Medium	Low	Medium
Nov	Medium	Medium	Medium
Dec	High	High	Medium

4.4 Erosion Risk Ratings

Vegetation clearing and earthworks along the GTP easement will expose the land to varying levels of erosion due to the combined effects of surface slope and form, soil type, surface run-on/run-off potential and wind erosion over time. A qualitative assessment of erosion potential was conducted based on published land resource information as part of the EIS (URS, 2009). This classified the erosion potential of units of land where disturbance and construction will occur as low (L), medium (M) or high (H). A summary of the cumulative distances of land erosion potential as cited in the EIS (URS, 2009) is included in Table 4.2.

Table 4.2. Cumulative distances of land erosion potential

Erosion Potential Rating	Percentage of gas transmission pipeline	Description
Low (L) or low to moderate (L-M)	6 %	Low level of potential environmental impact. Intersected over a total distance of 25 km (6 %) of the total pipeline corridor
Moderate (M)	52 %	Moderate level of potential environmental impact. Intersected over a total distance of 220 km (52 %) of the total pipeline corridor
Moderate to high (M-H) or high (H)	42 %	High level of potential environmental impact. Intersected over a total distance of 181 km (42 %) of the total pipeline corridor

The erosion potential due to construction activities in the project area as a result of clearing and/or surface disturbance is as follows:

- Low (L) – The combination of surface slope, run-on/run-off and soil erodability is such that no appreciable erosion damage is anticipated.
- Moderate (M) – Significant short-term erosion is likely to occur due to the combination of slope, soil erodibility factors and extent of run-on/run-off. Erosion control can be achieved using structural works, topsoiling and re-vegetation techniques and other site-specific

intensive soil conservation works. Some slightly dispersive soil layers may be present in the profile

- High (H) – High to very high erosion/sediment losses are likely, due to the steepness of slopes, surface condition, soil texture, erodibility factors and surface runoff conditions. Intensive soil conservation works will be required to minimise the effects of erosion. Moderately high to highly dispersive soil layers are usually present within the soil profile

N.B. These erosion potential ratings which were developed as part of the EIS (URS, 2009) are based on available desktop information and tend to steer towards the conservative side. It is possible that the areas rated with moderate or moderate to high ratings are much smaller than indicated in the table. Field investigations are required to confirm these desktop findings. Noteworthy locations that have existing erosion problems include:

- Dawson River escarpment (Kp 37.5 in Alignment Rev A or approx. 25°31'55" S 148°53'22"E)
- Dawson River (Kp 38 in Alignment Rev A or approx. 25°31'41" S 148°53'35"E)
- Clematis Creek (Kp 117 in Alignment Rev A or approx. 24°51'2" S 148°47'43"E)

Site-specific erosion plans will be required to ensure that the soil characteristics, handling methods, and construction issues are understood prior to any works being undertaken. This is essential to minimise erosion during the construction process, and to ensure the success of the rehabilitation strategy to minimise erosion in the long-term.

4.5 Summary

Detailed background information on climate, topography, and soil relevant to the project is summarised in Table 4.3.

Table 4.3 Summaries of Climate, Topography and Soil Information

Topic	Background Data
Climate	<ul style="list-style-type: none"> • The project area experiences subtropical climate that is characterised by having predominantly wet summers with moderately dry winters • High-energy rainfall intensities with <i>high</i> erosivities occur in the summer months; but are more prevalent east of the Calliope Range. In the winter months rainfall is infrequent and is considered to have <i>low</i> to <i>very low</i> erosivity ratings • Rainfall is highest near the coast, and commences to continually decline to the west of Calliope Range. Rainfall is lowest between Rolleston and Injune • There are on average 20 days per year that experience rainfall ≥ 10 mm and 6 to 9 days with ≥ 25 mm. As a general guide, rainfall events of less than 10 mm have a low potential to cause erosion. The erosion potential from rainfall is dependant upon ground conditions and if already wet then there will be an accumulative effect
Topography	<ul style="list-style-type: none"> • The GLNG pipeline extends from Fairview in the Carnarvon Range near Injune to a LNG plant on Curtis Island. Key topographic features associated with the overall route are crossing of five mountain ranges, 13 rivers or creeks, 90 minor watercourses and one marine area. A combination of long and steep slopes has the highest potential for erosion

Topic	Background Data
Soil	<ul style="list-style-type: none"> • The majority of the soils along the alignment are considered to have <i>moderate -high</i> erosion potentials. It is generally the subsoils that have higher erosion potential than the topsoil horizons. Refer to Appendix A. • Sodic soils are indicated along the majority of the pipeline route with the main exceptions being the soils of the Calliope, Callide and Dawson Ranges. Of these sodic soils the subsoils are considered <i>highly sodic</i>, whilst the topsoil tends to be <i>marginal to sodic</i> • Erodible swelling clay soils (Vertosols) with highly sodic subsoils are present at various locations west of the Calliope Range and are prominent from Biloela and Bauhinia • Surface soils with <i>high</i> erosion potential are indicated to be present east of Dungree, Dawson Range, along sections of Arcadia Valley Rd, and surrounding Beilba • It is highly likely that subsoils with <i>very high</i> salinity potentials are present between Biloela and Bauhinia. Acidic soils are indicated to be present in the vicinity of Calliope and Expedition Ranges, as well as areas around Beilba and Injune • Acid Sulfate Soils are present within the upper levels of the estuarine sediments along the pipeline corridor. These estuarine sediments occur along the coastal fringe of The Narrows, both on the mainland coast south of Friend Point and along the western coastline of Curtis Island between Graham Creek and Laird Point

5. MANAGEMENT AND MITIGATION MEASURES

5.1 General Measures for Sediment and Erosion Control

5.1.1 Erosion Control

Erosion is the detachment and movement of soil or rock by water, wind, or other factors such as ice and gravitational creep (SSSA, 1984). Whilst erosion is a natural process, man-made disturbances can result in accelerated erosion and cause rapid detrimental effects to the receiving environment. Land clearing, earthworks, and alterations to hydrology can cause gross loss of soil resulting in sediment accumulation in undesirable places (e.g. drainage lines, waterways, other land), and water pollution. It can also threaten the integrity of the pipeline.

Water erosion of landforms is dependant upon a number of factors including:

- Climate, in particular rainfall frequency, intensity, and duration
- Topography, including slope and hydrological conditions of the land form (run-on and run-off)
- Soil erodability and cover

The primary aim is the protection of the soil surface against raindrop impact.

The main techniques utilised for erosion control are minimising the period of exposure - i.e. only clearing that which needs to be cleared and rehabilitating such areas as quickly as possible. Other techniques include providing temporary cover in the form of mulch, or applying specific chemicals as soil stabilisers. These may include products that effectively glue the soil surface, or cause the fines to coagulate, effectively increasing their size and making them less erodible and quicker to settle.

5.1.2 Sediment Control

This includes techniques that are applied to settle the mobilised soil particles. These primarily slow the water and allow the influence of gravity to settle the particles. Some soils, particularly dispersive soils, require chemicals to accelerate, or effect flocculation.

5.1.3 Drainage Control

This is the transfer of water so as not to cause erosion. Predominantly this requires keeping velocities below that of the drain lining, and diverting the water regularly so as to keep catchments to manageable levels.

Appropriate planning and installation of erosion and sediment control measures is required to ensure that significant detrimental impacts on the surrounding environment do not occur as a result of the land disturbances associated with the gas transmission corridor, ancillary pipeline facilities, access tracks, and construction sites. Erosion along the GTP project generally cannot be eliminated completely, however implementation measures will minimise erosion and reduce sediment loss from disturbed areas to levels commensurate with the qualities of the receiving environment.

5.1.4 Pipeline Construction

Pipeline construction processes are well developed, and generally minimise the erosion issues through the speed of construction. Pipe-laying rates of approximately 1.5km/day are expected on this project.

However concerns are usually associated with poor practices that unnecessarily disturb new ground and fail to promptly rehabilitate the alignment. On this project there are particular concerns with regard to aggressive soil properties including sodicity, acidity, and salinity. These will need to be considered and management strategies developed by the contractor prior to disturbing such areas.

Erosion control procedures outlined below will be implemented where necessary to minimise the potential effects of erosion during construction. Technical notes and expected standard requirements for typical erosion and sediment controls are found in IECA 2008, and APIA, 2009.

Erosion control activities must be considered for the following stages of the construction process.

- Clear and Grade
- Access Tracks
- Trenching
- Longer-term disturbed areas such as construction camps and lay-down areas
- Reinstatement
- Rehabilitation

5.2 Clear and Grade

5.2.1 Staging of Works

The most effective means to minimise erosion, and the one over which the contractor has the most control is ground cover. Hence the most effective erosion mitigation strategy is to reduce the time between clearing and the re-establishment of a stable surface cover. Thus, areas should not be disturbed until necessary for the following works.

Construction activities need to consider climatic erosion risk ratings and soil erosion potential when scheduling works and considering appropriate erosion controls. Areas with high–moderate soil erosion potentials will need a more elevated level of planning control than those with low erosion potentials. In a similar manner, seasonality and periods of moderate high-moderate climate erosion risk ratings will also need a greater degree of controls than those with low climatic risk ratings.

It is recommended that when construction timeframes are being developed the maximum exposure periods be determined with consideration to the soil erosion potential and climatic erosion risk ratings. In this regard the following periods are proposed in Table 5.1 that indicate maximum periods between clearing vegetation from the soil surface, and seeding for primary revegetation.

Table 5.1 Suggested bare soil exposure periods

Soil Erosion Potential	Climatic Erosion Risk Rating		
	High	Medium	Low – Very low
High	2 months	3 months	4 months
Moderate	3 months	4 months	5 months
Low	4 months	5 months	6 months

This table reflects and confirms the preference for works to take place during the dry season where climatic erosion risk rating is low to very low. It is noted that key areas requiring close attention to loss of soil include the Expedition and Callide ranges, and Arcadia Valley.

Progressive rehabilitation should be prioritised in areas of moderate to high erosion risk. In particular, any required chemical treatment of sodic or acidic soils should preferably be undertaken during the earthworks phase to maximise the incorporation of these materials into the soil profile and to minimise the secondary impacts associated with erosion of these soils.

5.2.2 Minimise the area of disturbance

Whilst the pipeline construction processes are well developed, and the footprint is generally minimised, there needs to be a general awareness that there are costs associated with both erosion control and rehabilitation for all disturbed areas. Consequently, excessive disturbance should be avoided. i.e. the gap between grading the surface cover and rehabilitation should be minimised.

Temporary stabilisation effectively minimises the unstable areas. The most useful controls on this project are likely to be soil stabilising chemicals.

Sealing or gravelling sections of high-usage roads may reduce soil loss through dust and decrease maintenance costs. Chemical stabilisation is also likely to be cost-effective.

5.2.3 Retain vegetation

Cleared vegetation should be mulched and/or retained for uses such as erosion control and rehabilitation. Trees and shrubs mulched in situ may be retained as a soil blanket to protect from erosion until grading and topsoil stripping occurs.

In creek crossings and drainage lines, vegetation clearing should be delayed until immediately before trenching (as far as practical) so as to reduce the potential for stream bank destabilisation from rainfall events in the catchment. Potential rainfall events must be monitored to ensure any works within creek crossings and drainage lines are complete prior to the event.

In areas where sodic subsoils are present the merits of not grading topsoil the full width of the RoW either side of the trench should be considered as this will substantially reduce the risk to erosion where dispersive and sodic subsoils are present.

In areas of remnant native bushland, topsoil stockpiles should be no greater than 2 m deep to maintain microbial and seed viability.

5.2.4 Topsoil and vegetation storage

Selected trees, timber, and vegetation will be stockpiled on the working side of the RoW for re-use during rehabilitation to optimise re-growth and RoW reinstatement.

Existing water flows across the RoW will be maintained during clearing and grading, where necessary by the use of temporary drainage structures

Subsoil from the levelling of the RoW will be stockpiled separately from vegetation and topsoil.

In rock areas, surplus excavated rock material and surface boulders will be stockpiled separately within the RoW.

5.3 Access Roads and Tracks

The construction and usage of unformed access roads will be required to construct and maintain the pipeline with the potential for substantial erosion. The pipeline route largely governs the location of access roads, and there is likely to be little opportunity to avoid areas

that would be typically problematic to unformed roads. However, from an erosion and sediment control perspective, the following principles should be considered in the construction of new unformed roads (DECC, 2008c):

- The catchment area above the road or track may be reduced by locating the road along a ridge or as high as possible on side slopes
- Unformed roads and tracks should have at least a slight cross-sectional grade to allow free surface drainage and to avoid excessive ponding in wheel tracks
- The longitudinal grade of an unformed road or track should ideally be less than 10 degrees (18 %). However, short lengths of steeper grade may be needed subject to topography and geotechnical survey
- Where grades of unformed roads are between 3% and 20% then easily trafficable diversion banks should be used to prevent scouring. Where higher grades occur then gravelling and more sophisticated road drainage will be required (eg turn outs)
- Where table drains need to be established, they will be constructed to a broad dish shape, seeded and fertilised or lined appropriately, to prevent erosion. Table-drains will be slashed periodically to ensure vegetation growth is not restricting drainage flow
- Approaches on service tracks to gully and creek crossings should be as flat as practicable. The track should be sloped to direct runoff to a table-drain. In some vulnerable areas, it may be necessary to spread and compact coarse aggregate appropriately around / along the approaches to the crossing to provide stable access and to reduce erosion
- Cut and fill batters associated with service tracks will be formed to a safe slope and stabilised by groundcover vegetation, mulch, stone and rock armouring, or by the use of geo-fabric where appropriate
- Minimise the number of watercourse and drainage line crossings
- Avoid areas of riparian vegetation where possible, and maintain buffer strips between the road and any watercourse
- Where provision of access in gullies or creeks causes disturbance of vegetation, re-vegetation and stabilisation work should be undertaken
- All temporary construction tracks and associated disturbed areas will be stabilised / or revegetated when construction is completed
- Minimise disturbance to soil and vegetation

5.4 Camp Sites and Lay-down Area

Collectively these areas require a significant disturbance of land, and for an extended period. For this reason, erosion and sediment controls will be required for these sites in particular. A combination of soil stabilisers, temporary drainage structures, and sediment basins may be warranted at these locations.

Rehabilitation will require particular attention to de-compaction and topsoil re-spreading.

The requirement for disturbance of the subsoils for drainage and other utilities means that areas with underlying dispersive soils should be avoided. Where this cannot occur, the advice from a suitably qualified soil scientist should be sought as to appropriate methodologies.

5.5 Trenching

5.5.1 Trenching Across Grade

Where the trench runs parallel with the surrounding contours, excavated soil should be placed and compacted on the uphill side of the trench to form a diversion bank. The intention is to divert run-on water away from disturbed areas of the site and channel water such that it

is discharged in a controlled manner. The diversion banks should be placed and formed so that they do not trap pools of water at their bases, nor cause erosion at their outlets.

5.5.2 Trenching Down Grade

Trenches that run perpendicular to the surrounding contours (up or down grade) should have adequate measures to ensure that sediment-laden waters do not leave the site. Excavated soil stockpiled beside the trench will require controls to mitigate erosion and may include diversion banks, drains, and sediment fences. At the base of the slope, sediment-trapping devices such as sediment fencing or sediment basins may be required. If the potential for erosion from the trench appears high, check dams may be required in the trenches.

Where the trench runs perpendicular to the surrounding contours (up or down grade), adequate measures should be taken to prevent scouring of trenches and sediment-laden waters entering waterways. Plugs, collars, or trench stops may be required where gradients are considered steep enough to warrant them (eg < 3%), or where soils are dispersive and moderately to highly erodible.

On sloping ground, and in particular on slopes to drainage lines where surface runoff or sub-surface drainage along the pipeline trench may erode the backfill material, trench-breakers (vertical barriers to flow) should be installed at regular intervals to reduce flow along the trench and promote seepage to the groundwater. This is important where sodic and/or dispersive soils occur. The locations of the trench-breakers must be identified and submitted to GLNG Operations prior to backfilling of the trench.

5.5.3 Trenching Obliquely Across Grade

Where the trench runs obliquely across the grade, excavated soil should be heaped on the uphill side of the trench to form a diversion bank. Depending on the grade and potential soil loss the aforementioned measures for trenches running across the grade and down the grade may also be required.

5.5.4 Stream or Water Crossings

Where the pipeline crosses watercourses there is significant potential for environmental degradation:

- Where the pipeline crosses waterways measures may need to be undertaken to divert water, maintain flow and avoid upstream flooding while the pipeline is being installed. (Note an approval may be required for altering the flow of a waterway)
- Where water crossings are necessary bridge crossings or under-boring should be considered
- If a bridge crossing is required to allow construction access or for maintenance requirements, then the structure should be designed so that it does not become a channel constriction that may cause backup of flow or washouts during periods of high stream flow or cause any under cutting of structure, bed or bank of creek
- Where appropriate excavation and trenching through the streambed with water in it may be acceptable as the process can be quick, often completed within a day, resulting in waterway disturbance occurring as a pulse
- Works in and around all streams and waterways should meet all statutory and other requirements of regulatory authorities for works in waterways. Procedures developed for works in waterways should describe methods to minimise erosion, water quality impacts and other impacts

A risk assessment will be undertaken for each watercourse and drainage line crossing to identify the risk of flows occurring during construction, taking into account time of year, tidal

characteristics and catchment characteristics. For streams where there are permanent flows or a risk of flows during construction, a dedicated crossing method shall be applied that:

- Minimises the area of disturbance
- Minimises the overall length of time for disturbance, and in particular, the length of time that trenches will remain open in the bed and banks
- Provides for preservation of the sediment/soil profile
- Provides for prompt stabilisation of the bed and banks following pipe placement
- Provides for special reinstatement techniques to restore aquatic ecosystems and prevent scouring and/or pipeline exposure and damage by subsequent flows
- A diversion strategy will be developed and implemented that addresses flow management and fish passage. For tidal watercourses, this shall address flows and fish passage in both directions

Clear and grade operations at waterways will be restricted to the minimum necessary for construction purposes and shall be performed in a manner which will minimise the reinstatement requirements. Where trees and vegetation cannot be preserved aboveground, stabilising root material shall be undisturbed wherever possible.

The width of cut in the RoW in the vicinity of the waterway crossings will be minimised and topsoil removed from the banks and approaches to the crossing will be conserved.

After vegetation and topsoil removal, the bed and bank material will be separately stockpiled in a location that will not obstruct the watercourse or reasonable flood plain. Banks will be backfilled with bank material compacted and stabilised.

On completion of works the beds of the stream and watercourse will be restored and obstructions resulting from construction of the pipeline will be removed and disposed of. The banks of all watercourse crossings will be restored by grading to the natural contours, or to the natural angle of repose of the stream bank material, whichever is less steep.

5.5.5 Soil and Stockpile Management

Measures to minimise erosion and sediment release should be implemented before stripping or stockpiling of any material. Stockpiles should be:

- Constructed at least 2 m (preferably 5 m) from hazard areas and likely areas of concentrated water flows, e.g. waterways, roads, slopes steeper than 10 %, etc. Where rainfall events within the catchment are likely to cause the waterway to swell then this distance may need to be increased up to 50 m
- No greater than 2 m high if the stockpile material is topsoil. This is to avoid excessive heat being generated and composting conditions that will degrade soil health
- Protected from run-on water by installing water diversion structures upslope
- Formed with sediment fences placed immediately downslope to protect other lands and waterways from pollution
- Stabilised if they are expected to be in-situ for extended periods and receive extended periods of potentially erosive rain they should be stabilised (eg sprayed with a chemical stabiliser; covered, grassed, etc)
- Soil/spoil materials with appreciable fines contents that are windrowed or stockpiled beside near sensitive receptors (eg waterways, water bodies, wetlands, etc) and pose a pollution risk following a rainfall event should be stabilised

If excavated materials potentially contain acid sulfate or other contamination, these should be treated in accordance with the ASS Management Plan.

The HDD operations associated with the marine crossings will produce considerable quantities of spoil that will initially be stockpiled on the pads for removal by truck. Controls suitable to prevent the release of sediment to the nearby marine areas will be required. It is likely that this will be addressed through the controls required for the expected ASS from this operation.

5.6 Reinstatement

Backfilling and reinstatement should be conducted to return the land to as close as, or better than, prior to disturbance. The following principles are required to mitigate erosion:

- Treatment of aggressive soils
- Drainage controls such as diversion banks to channel water off disturbed areas into stable areas or sediment control structures. All temporary drainage structures will be removed when no longer required
- An appropriate allowance for settling of uncompacted backfill material needs to occur
- Scarify the ground surface along the line of the contour to break any compacted and/or smooth materials. Scarifying the ground helps bind topsoil and substrate layers reducing the possibility of sheet erosion and/or creep or slump of topsoil; and enhances water infiltration to the upper subsoil layers, increasing moisture storage within the root zone
- Topsoil should be replaced to match surrounding ground levels and revegetated as soon as possible. Any excess or unsuitable spoil from the site should be removed or managed to avoid erosion
- Respread mulched vegetative material to provide soil stability on bare areas and particularly those areas where landscape tree planting or bushland is to be established after works are complete
- On completion of the resspreading process, leave disturbed lands with a scarified surface to inhibit soil erosion, encourage water infiltration and help with keying topsoil later. Leaving surfaces in a glazed condition with hard, smooth surfaces is not acceptable, as seed strike and infiltration will be reduced

On steeper slopes permanent drainage control may be required to divert water from the alignment. In such cases push banks are generally preferred..

5.7 Rehabilitation

Rehabilitation of the site should be considered throughout the project. Rehabilitation is to be conducted progressively and in two stages; those being Primary Rehabilitation and Secondary Rehabilitation.

5.7.1 Primary Rehabilitation

The function of Primary Rehabilitation is to stabilise the soil surface. Stabilisation can be achieved with vegetation, mulching, armouring, or any other way that will reduce soil exposure. The better practices are those that reduce both the soil exposure to raindrop impact and the erosive effects of run-off. In general a soil surface cover of greater than 70% is required to provide a stable soil surface.

Primary revegetation with vegetation includes the use of groundcover species, in particular pasture grasses with a cover crop. The cover crop is a quick germinating and fast growing annual (eg Japanese millet or annual rye) intended to provide some initial soil protection as fast as possible whilst the groundcovers are establishing. Preferences in groundcover species should be to perennial grasses that are stoloniferous or rhizomatous in habit as these will provide a greater level of soil protection and surface cover than tussocky grasses.

The following principles are required to mitigate erosion:

- Soil surfaces should be stabilised as soon as possible after reinstatement occurs. The timeframes for stabilising soils are dependant upon the Erosion Potential Rating and Climatic Erosion Hazard as detailed in Table 3
- Soil surfaces that are to be vegetated should be stabilised with a suitable cover to achieve a minimum of 70 % ground cover, over 95 % of disturbed areas
- Select plant species that are consistent with the altered soil conditions at the site with preference for stoloniferous and rhizomiferous species that provide better soil cover and erosion protection. Plant selection may also be subject to landowner preferences/requirements
- Temporary erosion and sedimentation control works need to be retained until areas of revegetation have been established or the site has stabilised. Once stabilised the temporary measures should be removed
- In areas of low rainfall, placing a time period of achieving vegetative cover is generally unfeasible. However, the intention is to stabilise the soil surface as soon as is practicable

5.7.2 Secondary Rehabilitation

The function of Secondary Rehabilitation is to promote the land to its post construction land use. This includes any native tree plantings, landscaping works, or vegetation associated with landowner agreements.

It is recommended that Secondary Rehabilitation occurs once pipeline construction and hydro testing is complete (basically when everyone is out of the way) and after the primary rehabilitation is well established and the erosion potential has been reduced. This time lag will also allow any areas where aggressive soils are occurring to be identified and ameliorated prior to investing in tree plantings etc.

During Secondary Rehabilitation, any defunct erosion controls (e.g. sediment fences) that were left during Primary Rehabilitation can be removed. Also any areas where erosion controls are insufficient may be addressed.



6. MONITORING

Maintain a regular monitoring and maintenance program to ensure that the erosion control measures implemented are effective. This program must refer to the provided standard erosion and sediment control requirements

A monitoring programme needs to be put in place that includes both short and long-term inspections during the construction phase. The former should be undertaken following significant rain events so that erosion problems can be addressed whilst equipment is nearby and can be quickly and cost-effectively mobilised for repairs. Consideration may also need to be given to the option of undertaking such work when the site has dried sufficiently to minimise the impacts of accessing the site whilst the soils are wet and prone to disturbance and/or compaction.

The inspection should take particular notice of the high-risk soils for erosion (sodic soils) and revegetation success (acidic and saline) soils.

Remediation must be undertaken in a timely manner, particularly where loss of topsoil is an issue, and for dispersive soils.

7. REFERENCES

APIA, 2009. *Code of Environmental Practice – Onshore Guidelines*. The Australian Pipeline Industry Association Pty Ltd.

DECC, 2008^a. *Managing Urban Stormwater: Soils and Construction*. Volume 2A. Installation of Services. Department of Environment and Climate Change (DECC) NSW.

DECC, 2008^b. *Managing Urban Stormwater: Soils and Construction*. Volume 2C. Unsealed Roads. Department of Environment and Climate Change (DECC) NSW.

DMR 2002. *Road Drainage Design Manual*. Department of Main Roads (DMR) QLD.

DNRM, 2004. *Soil Conservation Measures – Design Manual for Queensland*. Department of Natural Resources and Mines, Brisbane.

Hazelton P.A. and Murphy B.W. (2007). *Interpreting Soil Result: What do all the numbers mean?* CSIRO Publishing.

IECA 2008. *Best Practice Erosion and Sediment Control*. International Erosion Control Association (Australasia).

Isbell, R. 1996. *The Australian Soil Classification System*. CSIRO, Vic.

Isbell, R, 1983. *Salt and sodicity*. In *Soils and Australian Viewpoint*. CSIRO Melbourne.

Landcom, 2004. *Managing Urban Stormwater: Soils and Construction*. New South Wales Government.

O'GEEN, A. 2006. *Erodibility of Agricultural Soils, with Examples in Lake and Mendocino Counties*. University of California Division of Agriculture and Natural Resources. Publication 8194.

Raine, S.R. and Loch, R.J. (2003). *What is a sodic soil? Identification and management options for construction sites and disturbed lands*. Roads, Structures and Soils in Rural Queensland. 29-30 July, Toowoomba. Queensland Department of Main Roads, Brisbane. 14pp.

Rengasamy, P, and Walters, L. 1994. *Introduction to soil sodicity*. Cooperative Research Centre for Soil and Land Management. Adelaide.

SSSA, 1984. *Glossary of Soil Science Terms*. Soil Science Society of America (SSSA). Wisconsin.

URS. 2009. *GLNG Environmental Impact Statement*. Prepared for GLNG.



APPENDIX A

Problem Soil



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

Rail

Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

D

Dispersion Class

- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

Note: All figures should be reviewed in conjunction with Table 7.1 "Generic Key to the identification of Terrain Units", URS 2009.

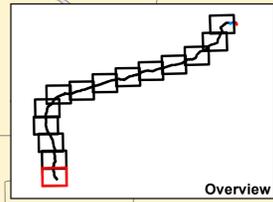
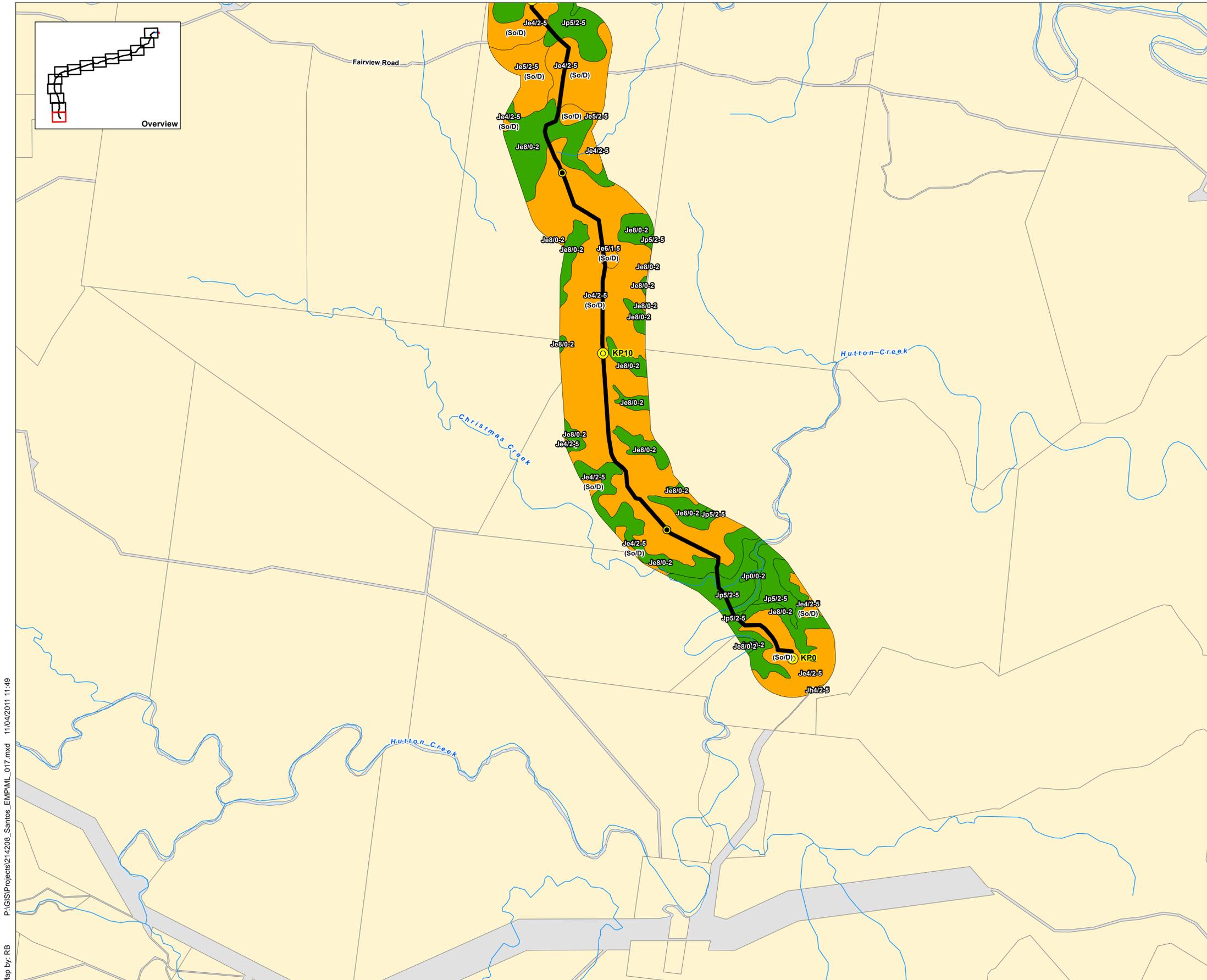
Source:

Gas Transmission Pipeline (GTP): Santos, Jan 2011.
Cadastre: Department of Management and Resource Management, Feb 2011.
GLNG Terrain Units: Supplementary EIS, URS, 2009.

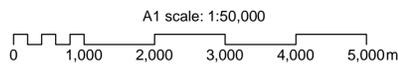
Soil Constraints: Problem Soils Appendix A (Page 1 of 15)

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Gas Transmission Pipeline (GTP)

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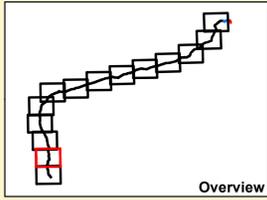
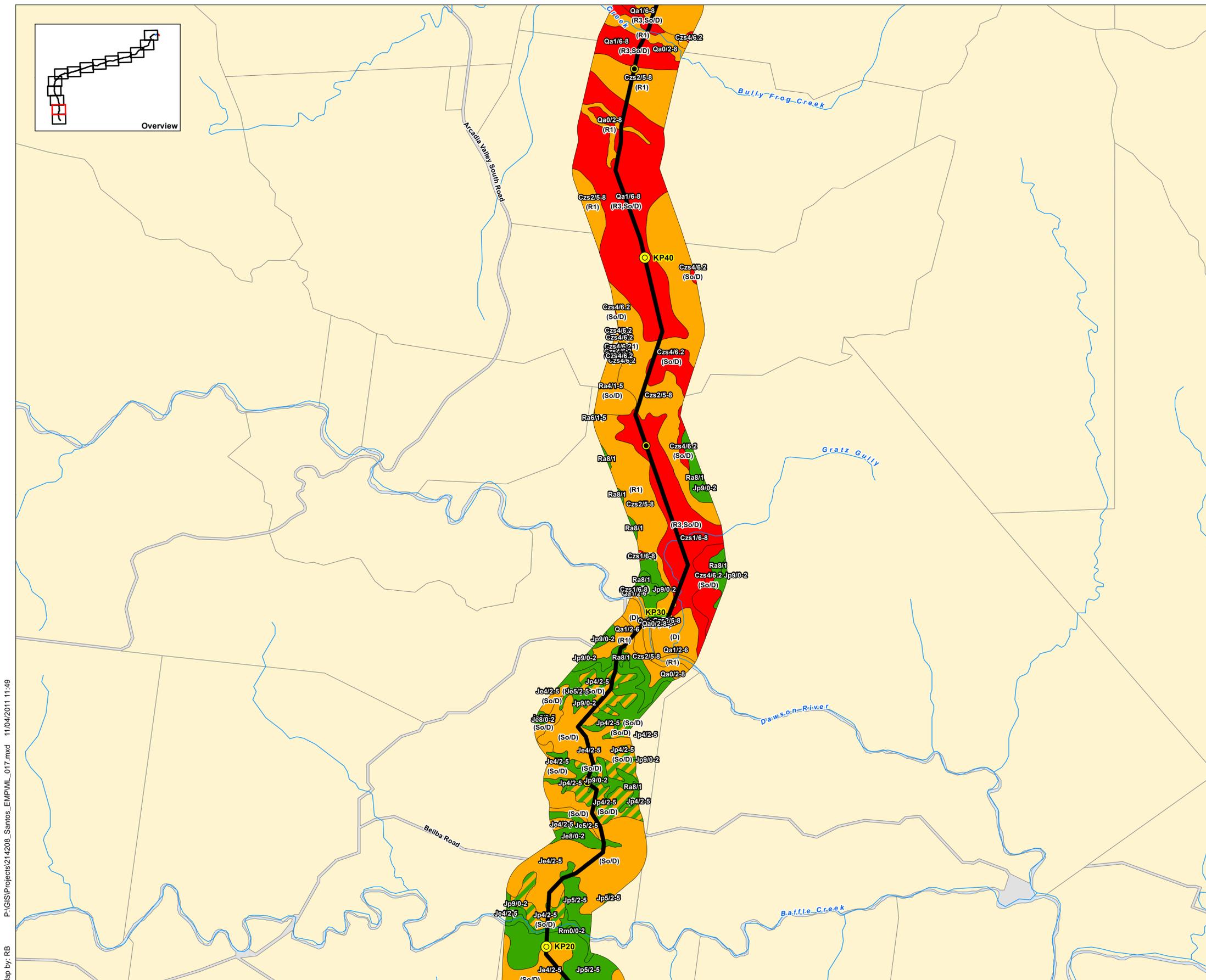
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- GLNG Terrain Units: Supplementary EIS, URS, 2009.

Soil Constraints: Problem Soils Appendix A (Page 2 of 15)

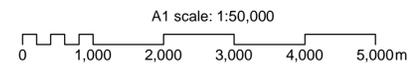
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Overview

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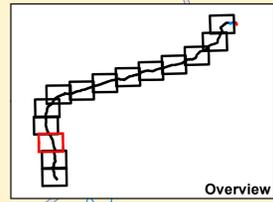
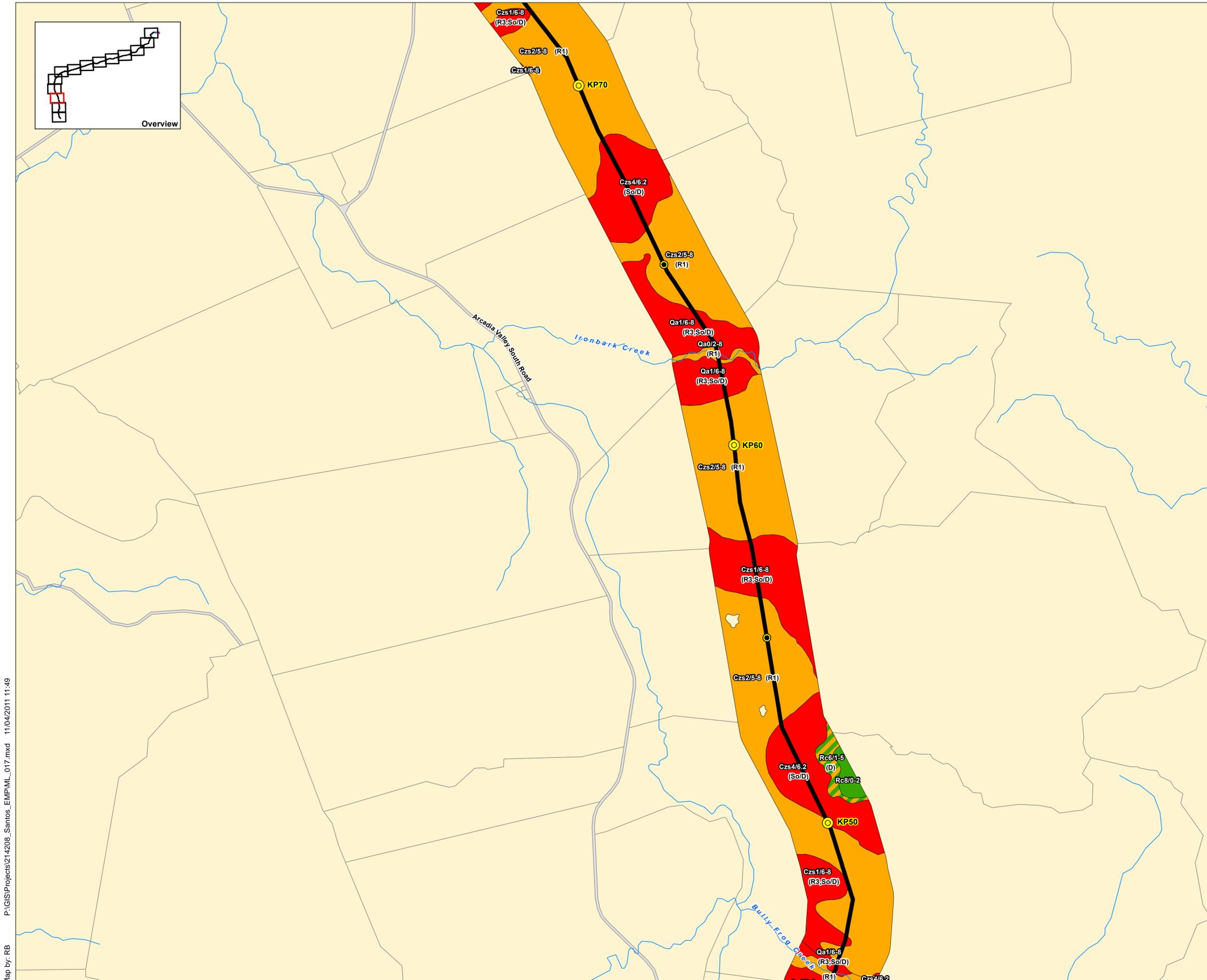
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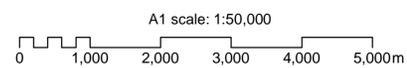
Soil Constraints: Problem Soils Appendix A (Page 3 of 15)

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- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

D

Dispersion Class

- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

Note: All figures should be reviewed in conjunction with Table 7.1 "Generic Key to the identification of Terrain Units", URS 2009.

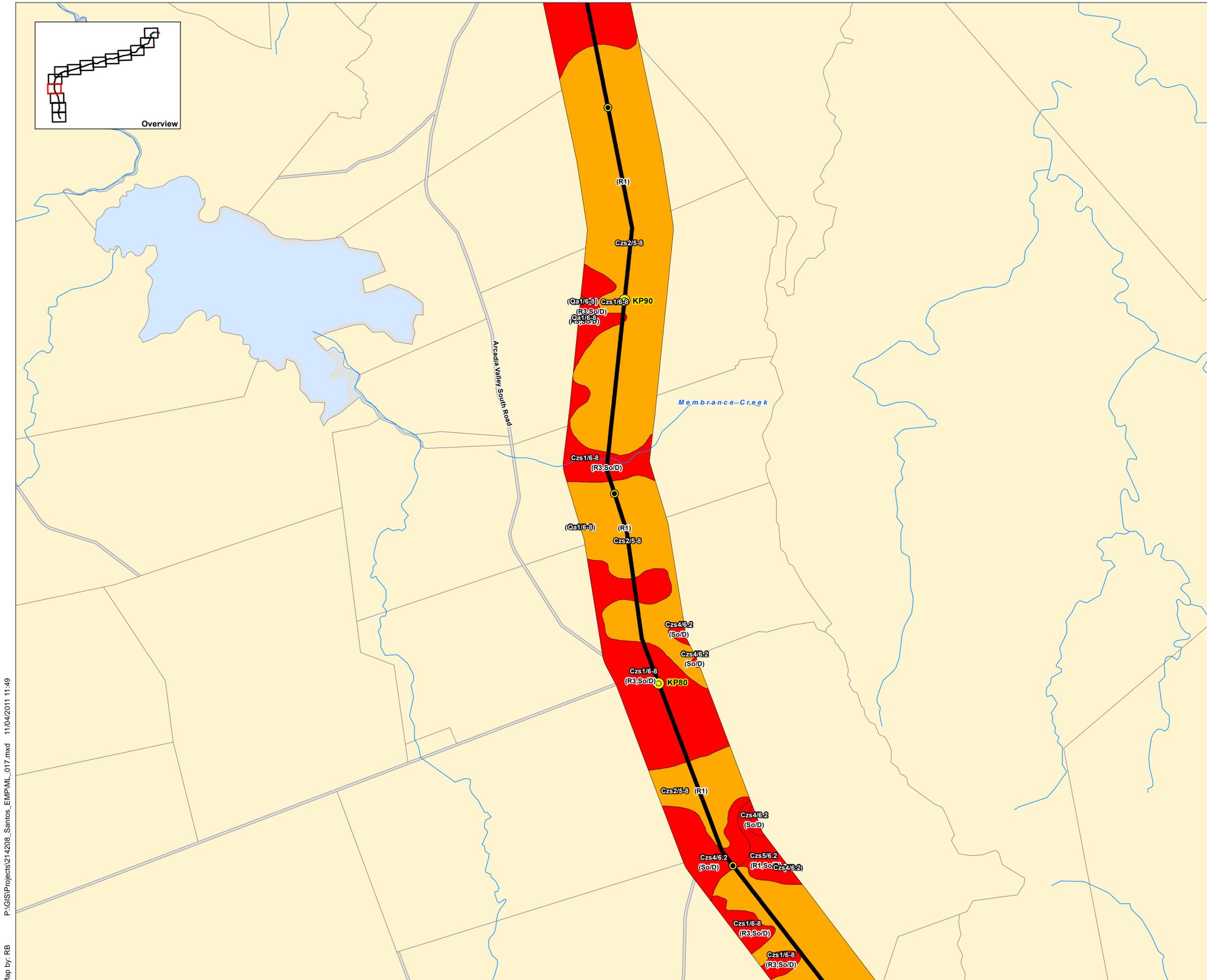
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- Cadastre: Department of Management and Resource Management, Feb 2011.
- GLNG Terrain Units: Supplementary EIS, URS, 2009.

Soil Constraints: Problem Soils Appendix A (Page 4 of 15)

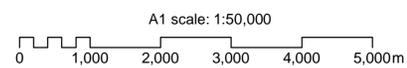
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Map by: RB



A1 scale: 1:50,000

GLNG No: 3381-40-0410

Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

- Cadastre
- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
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Dispersion Class

- N - Non-dispersive
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ASS

Acid Sulfate Soils

Note: All figures should be reviewed in conjunction with Table 7.1 "Generic Key to the identification of Terrain Units", URS 2009.

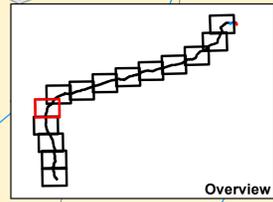
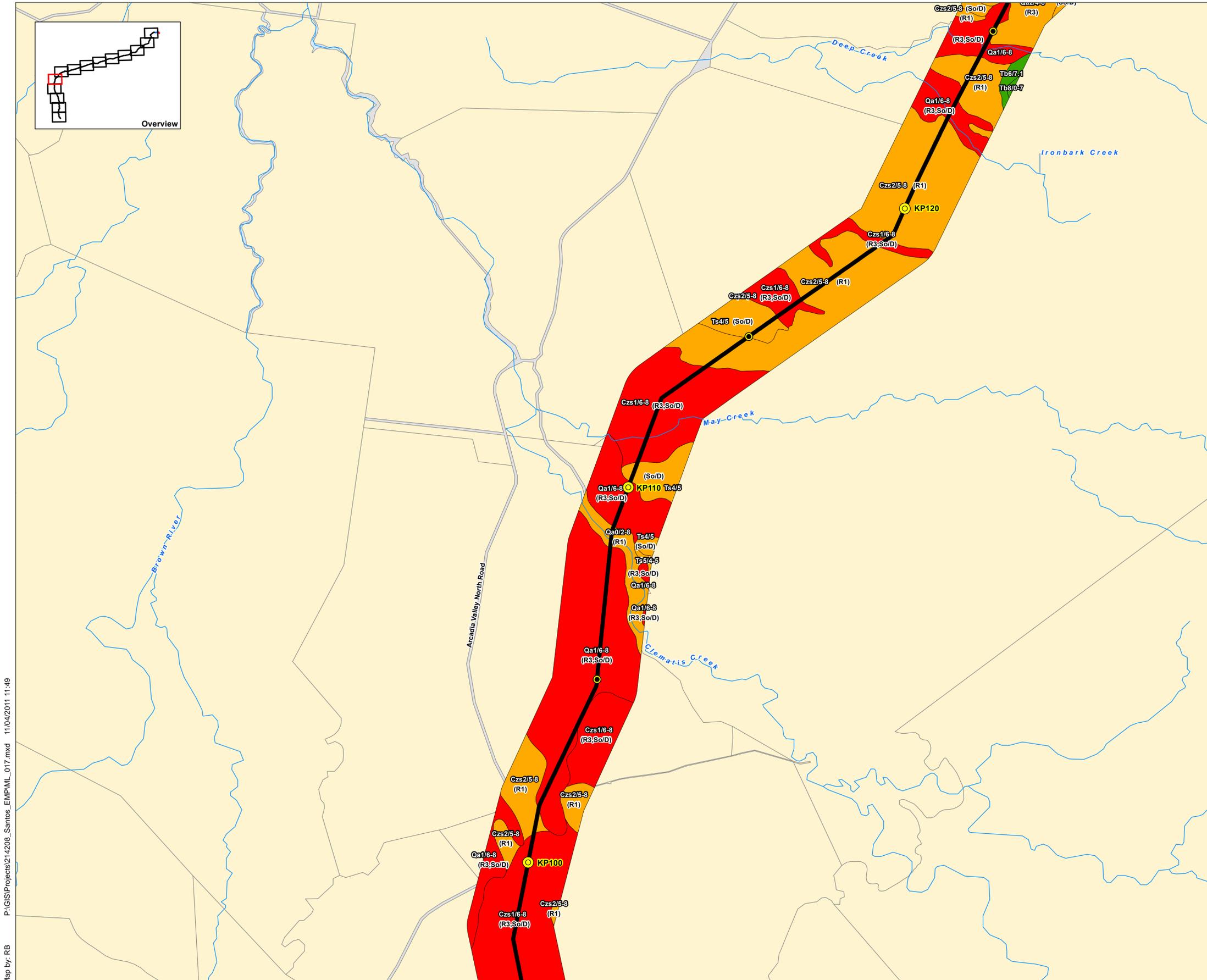
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- GLNG Terrain Units: Supplementary EIS, URS, 2009.

Soil Constraints: Problem Soils Appendix A (Page 5 of 15)

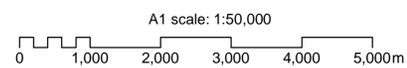
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Map by: RB



GLNG No: 3381-40-0410
 Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
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Soil Salinity

- L - Nil to Low Salinity
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Dispersion Class

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ASS

Acid Sulfate Soils

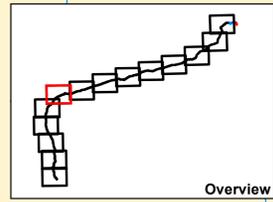
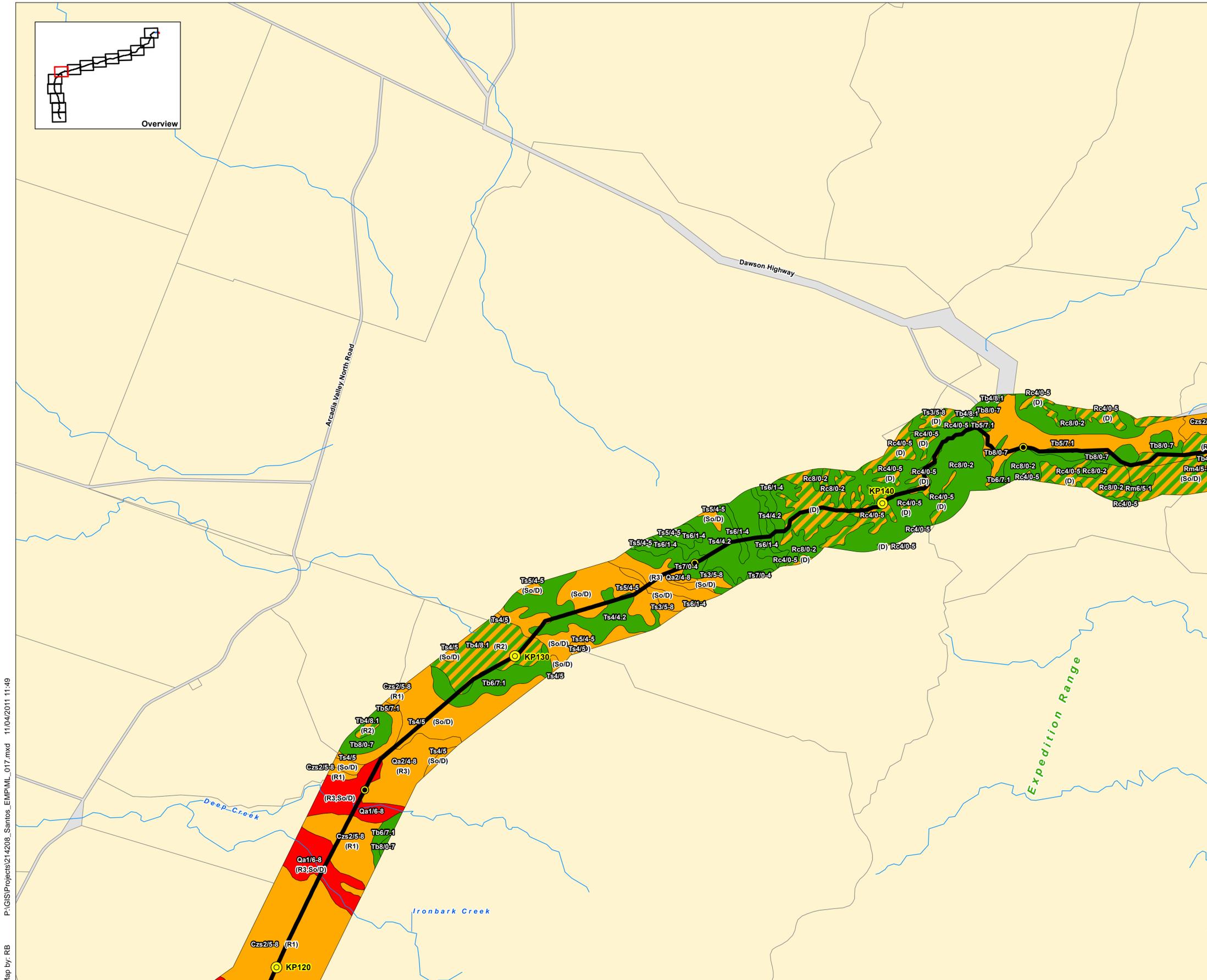
Note: All figures should be reviewed in conjunction with Table 7.1 "Generic Key to the identification of Terrain Units", URS 2009.

Source:
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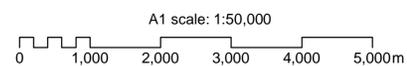
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Map by: RB



GLNG No: 3381-40-0410
Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

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Soil Salinity

- L - Nil to Low Salinity
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Dispersion Class

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- H - Strongly Dispersive

ASS

Acid Sulfate Soils

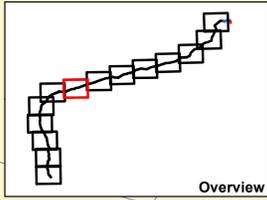
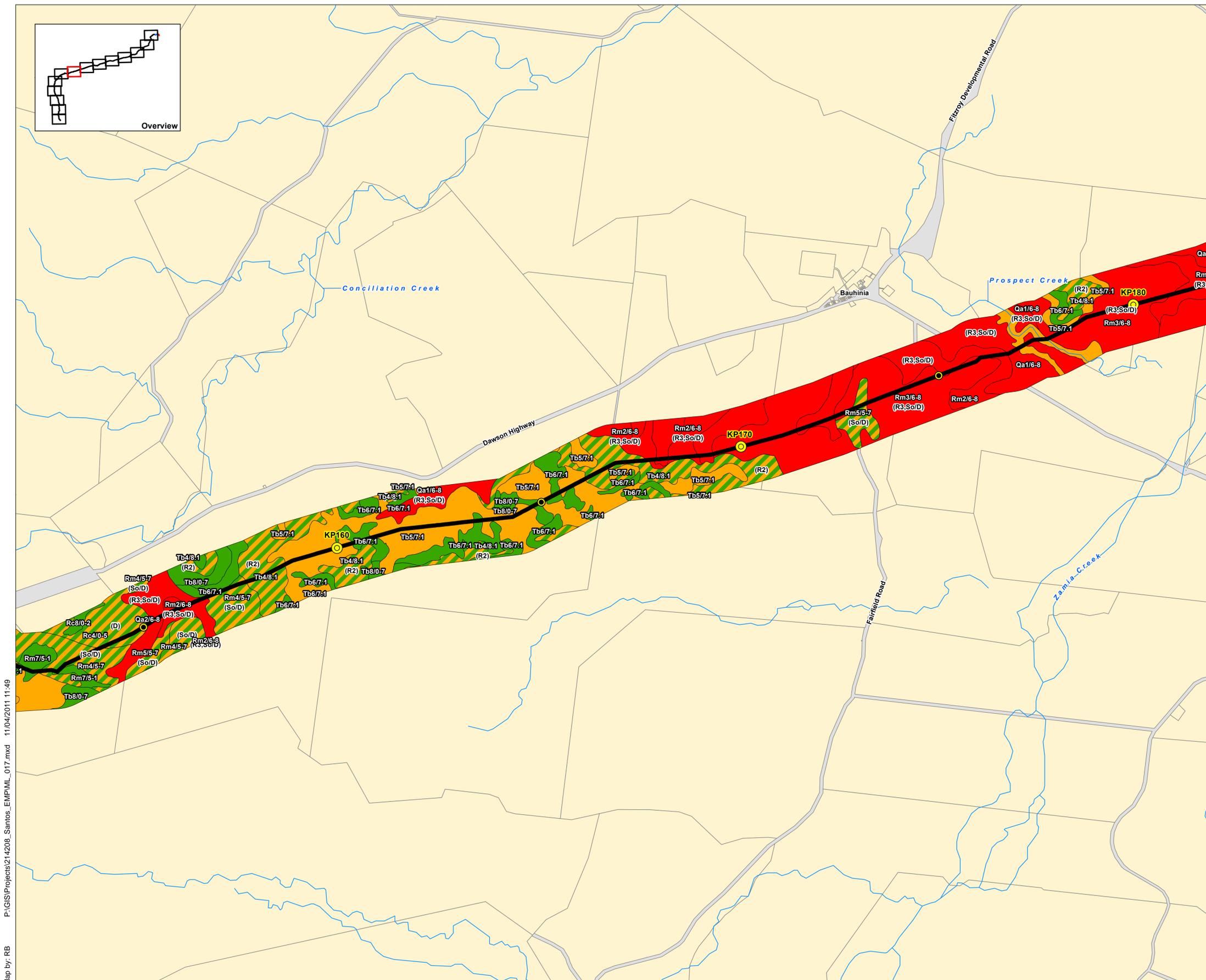
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 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
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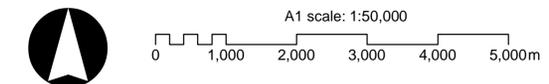
Soil Constraints: Problem Soils Appendix A (Page 7 of 15)

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Map by: RB



GLNG No: 3381-40-0410
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Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

- Cadastre
- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
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- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
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Sodicity (ESP)

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Dispersion Class

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- H - Strongly Dispersive

ASS

Acid Sulfate Soils

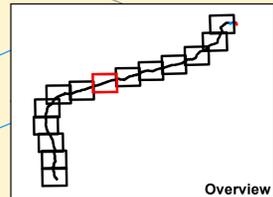
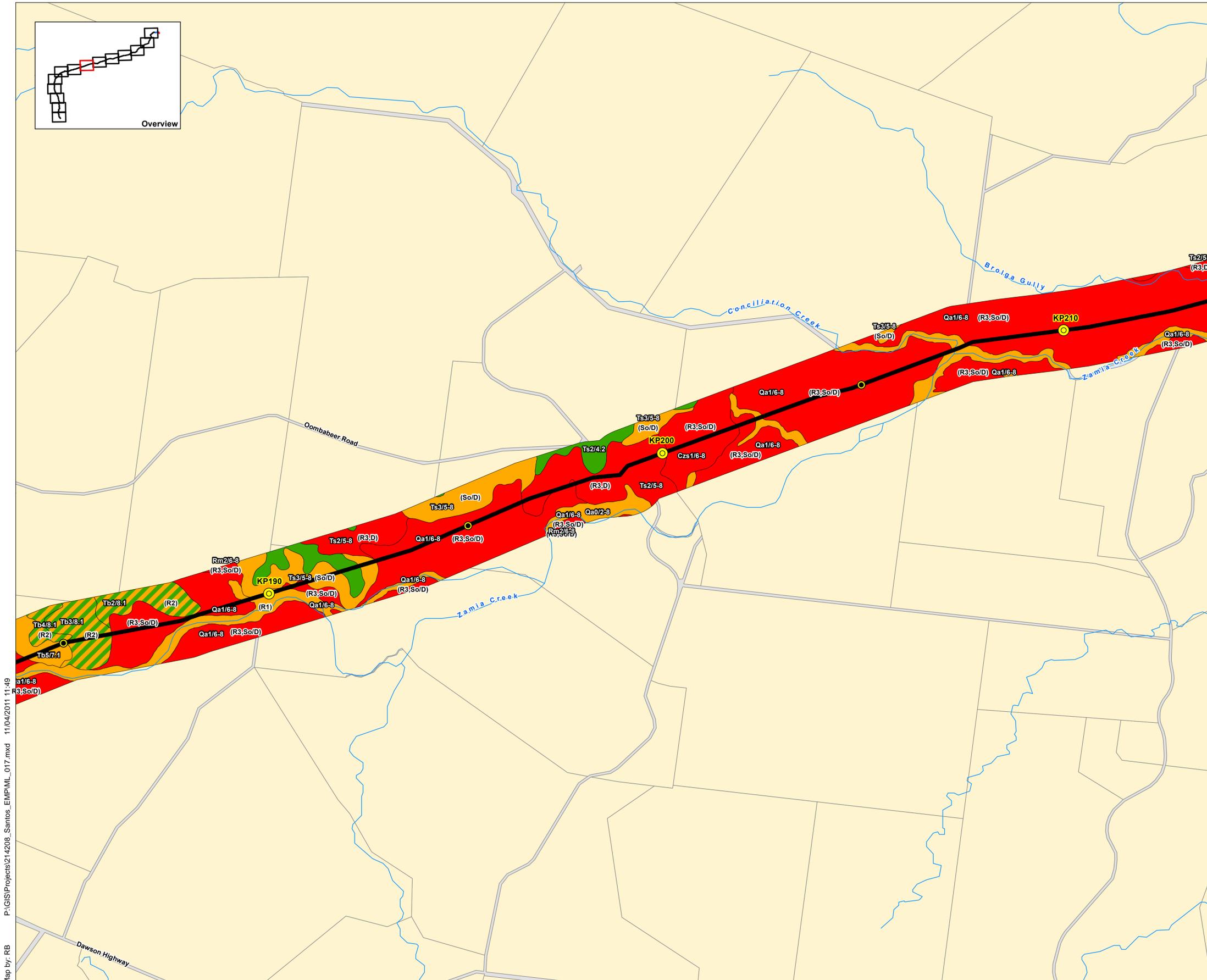
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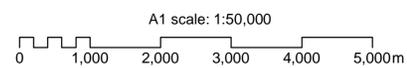
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Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km
- Cadastre

- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

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Dispersion Class

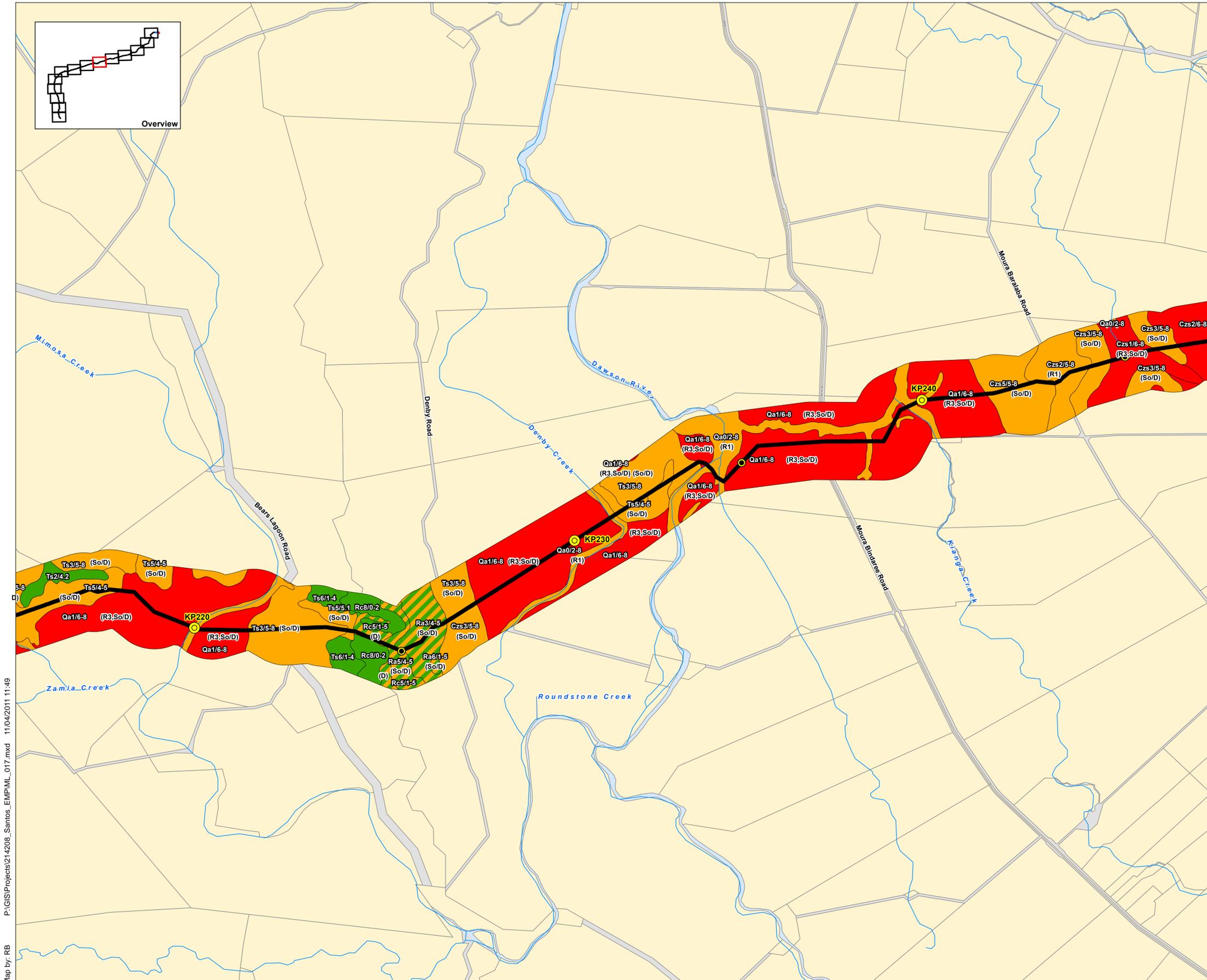
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ASS

Acid Sulfate Soils

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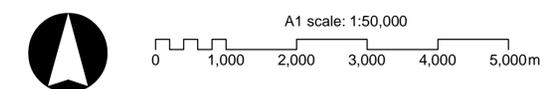
Soil Constraints: Problem Soils Appendix A (Page 9 of 15)

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GLNG No: 3381-40-0410
 Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

Rail

Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
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Soil Salinity

- L - Nil to Low Salinity
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Acid Sulfate Soils

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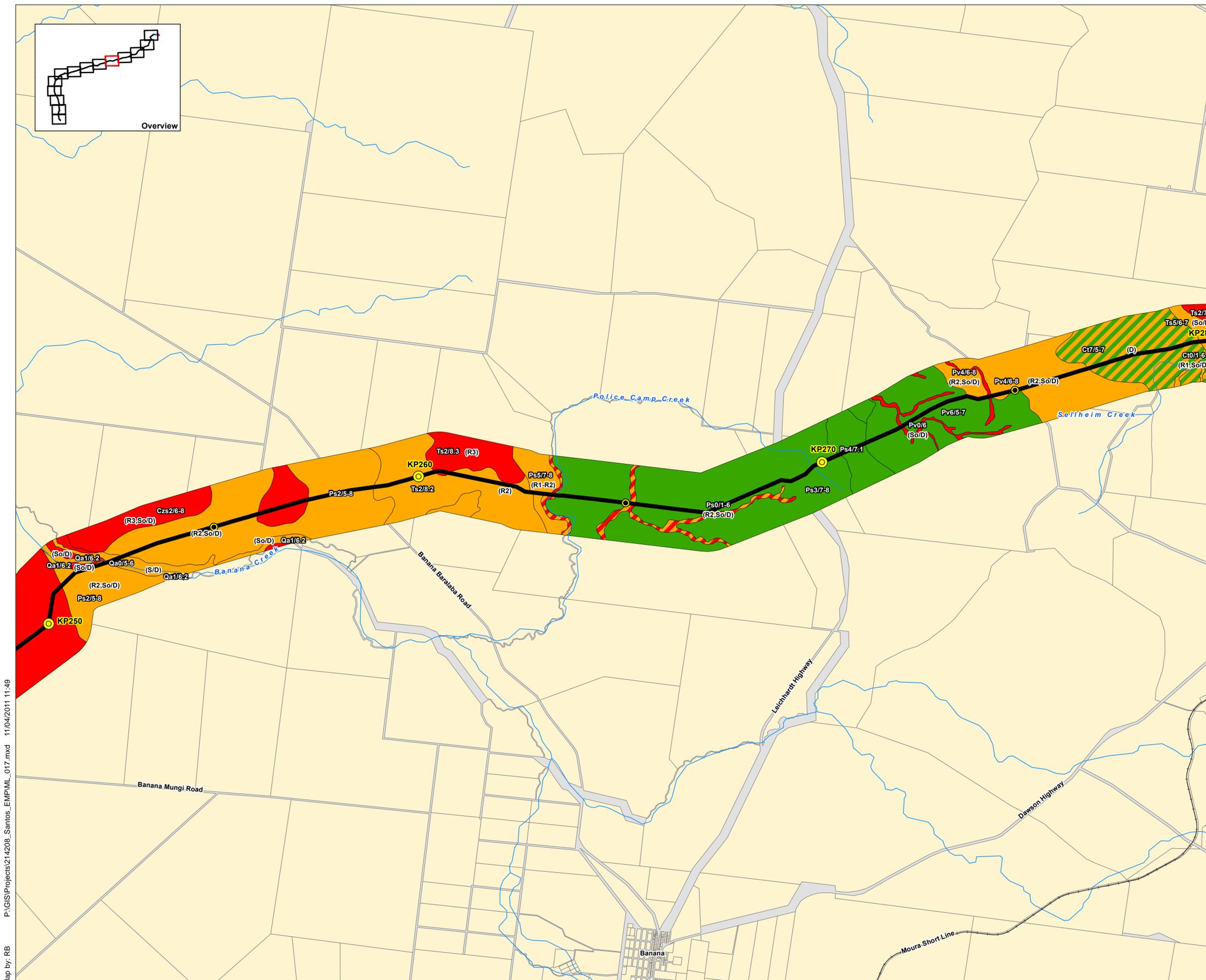
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GLNG Terrain Units: Supplementary EIS, URS, 2009.

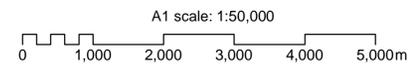
Soil Constraints: Problem Soils Appendix A (Page 10 of 15)

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Map by: RB



GLNG No: 3381-40-0410
Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
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Soil Salinity

- L - Nil to Low Salinity
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Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
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ASS

Acid Sulfate Soils

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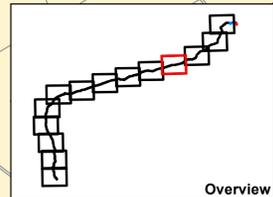
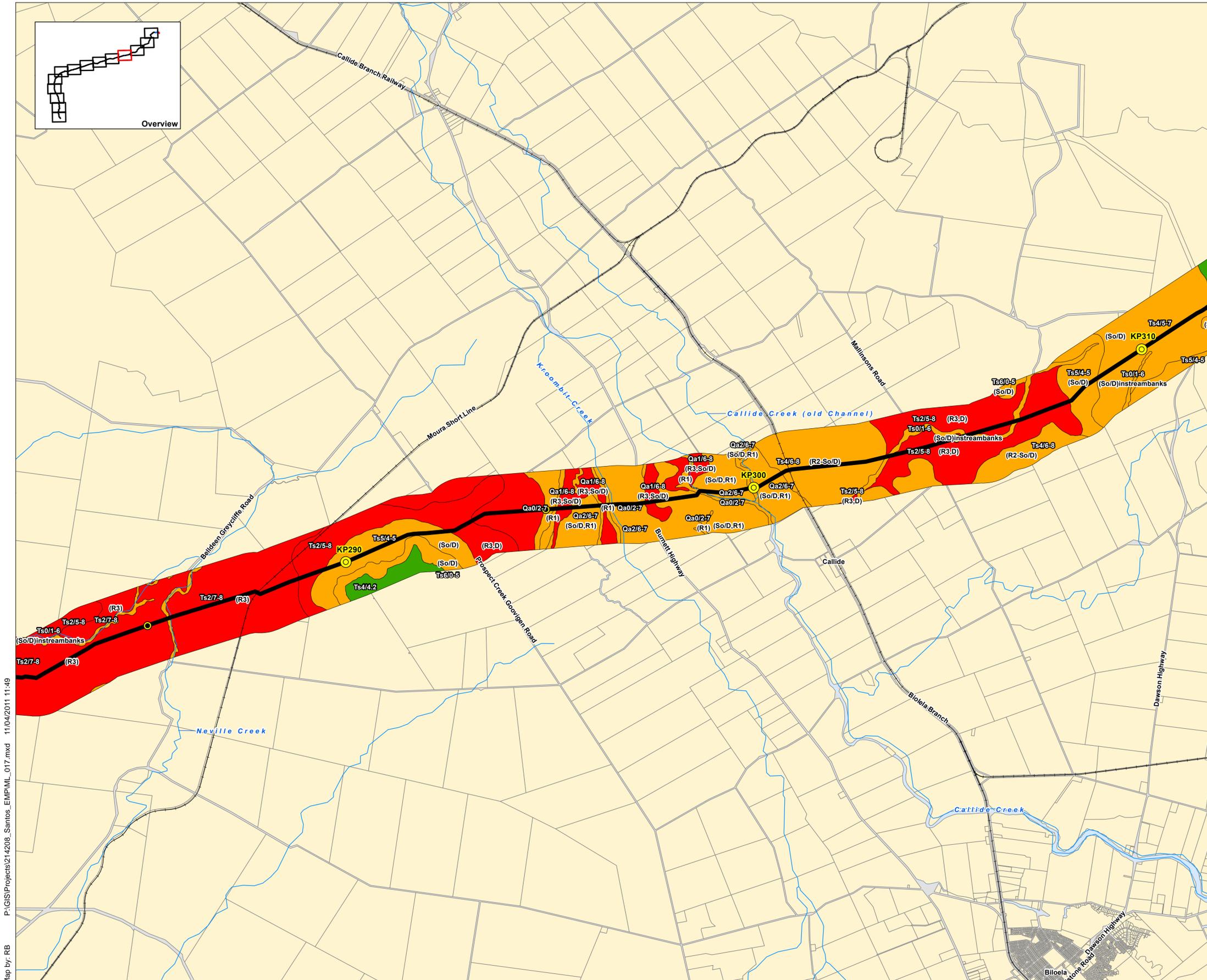
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- Cadastre: Department of Management and Resource Management, Feb 2011.
- GLNG Terrain Units: Supplementary EIS, URS, 2009.

Soil Constraints: Problem Soils Appendix A (Page 11 of 15)

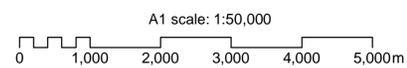
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Overview

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Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

Cadastre

- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

D

Dispersion Class

- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

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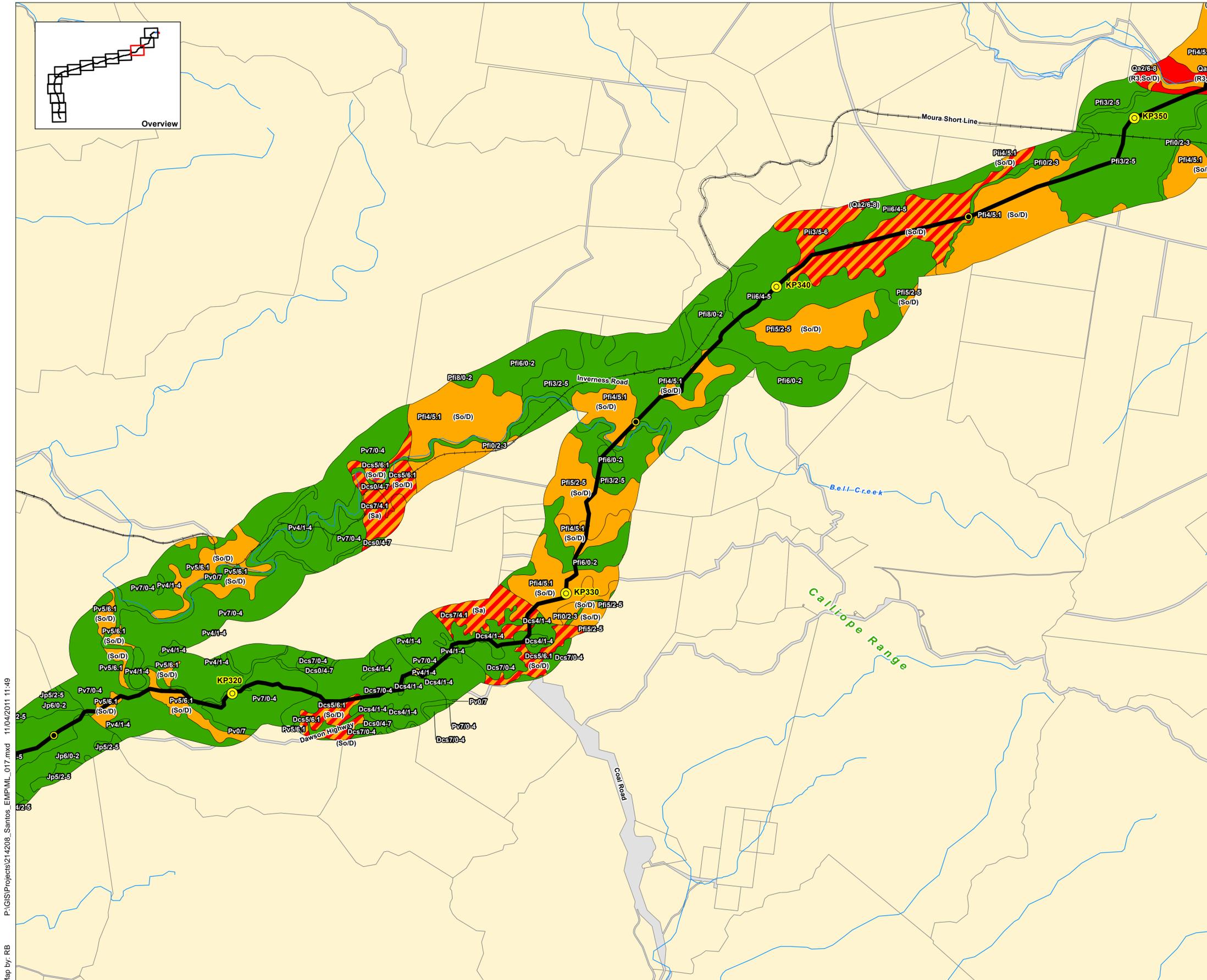
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- GLNG Terrain Units: Supplementary EIS, URS, 2009.

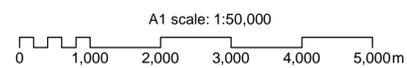
Soil Constraints: Problem Soils Appendix A (Page 12 of 15)

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GLNG No: 3381-40-0410
Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km
- Cadastre
- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

D

Dispersion Class

- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

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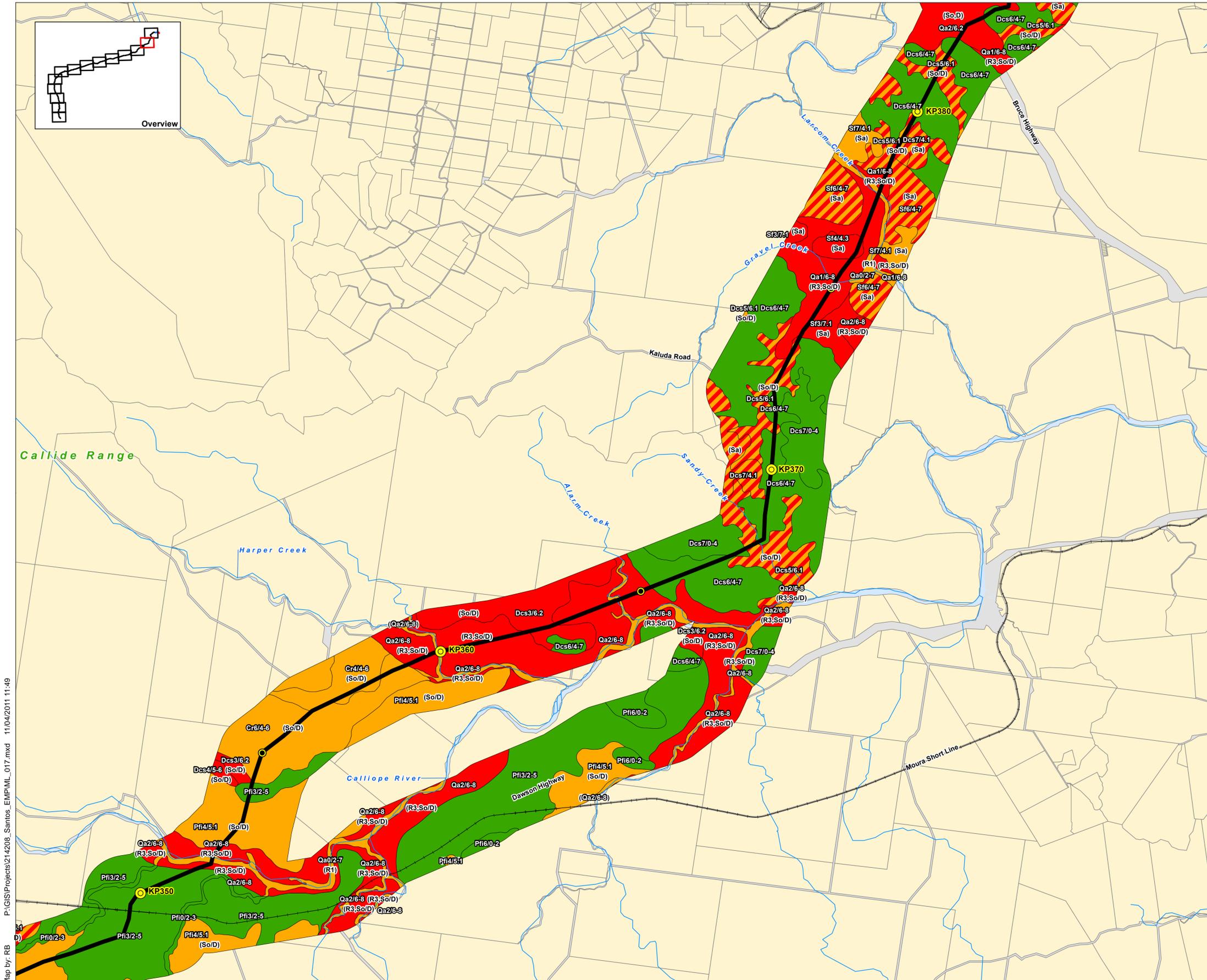
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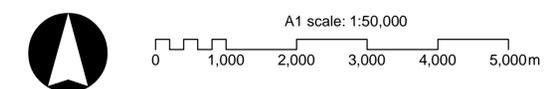
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Version: b



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Map by: RB



GLNG No: 3381-40-0410
Coordinate system: GCS_GDA_1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 10km
- 5km

- Cadastre
- Rail
- Watercourse

Problem Soils

- High
- Moderate - High
- Moderate
- Low - Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

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Dispersion Class

- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

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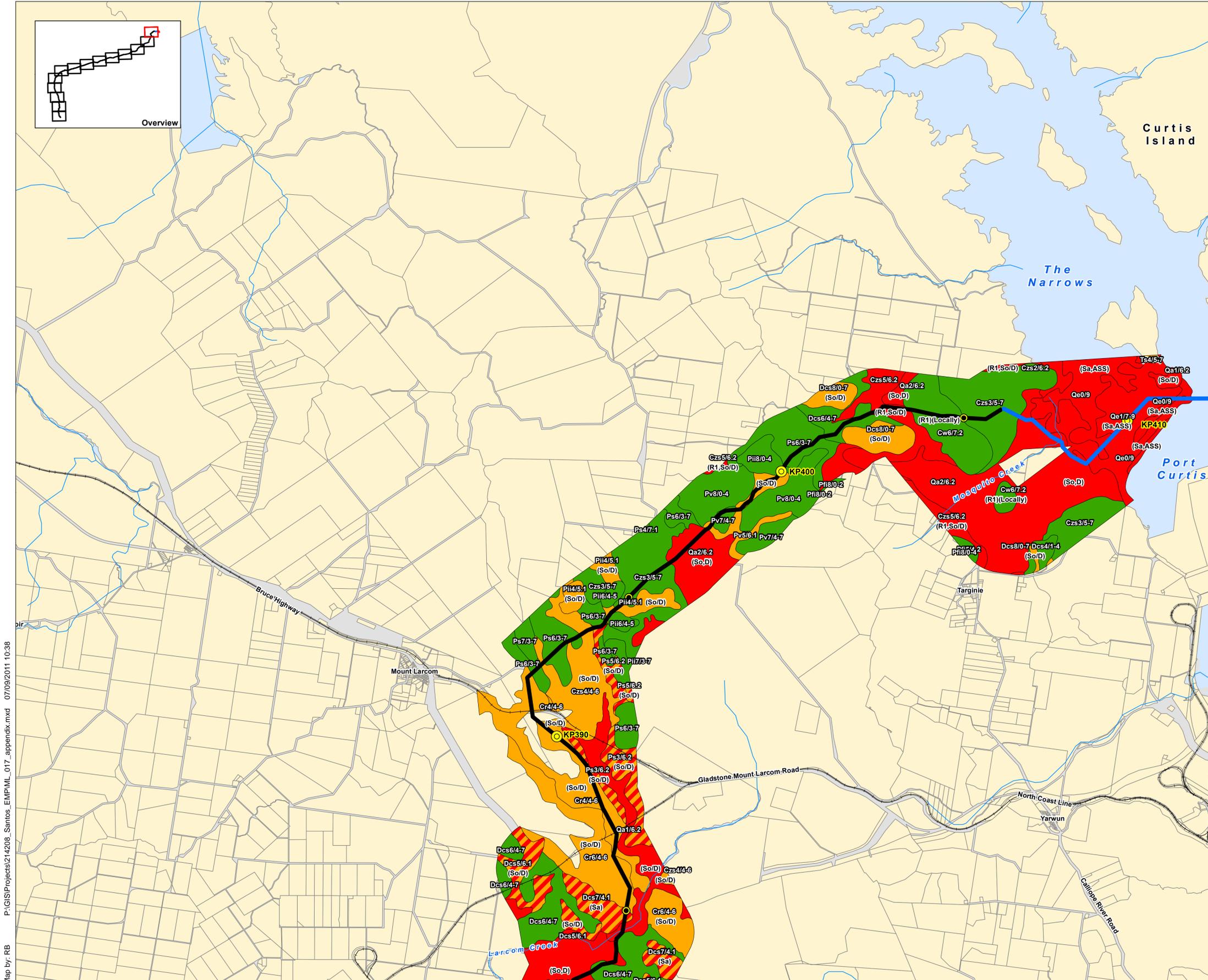
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- GLNG Terrain Units: Supplementary EIS, URS, 2009.

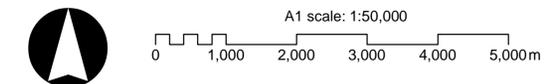
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Map by: RB



GLNG No: 3381-40-0410
Coordinate system: GCS_GDA_1994



Curtis Island GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 5km
- 1km

Problem Soil

- High
- Moderate
- Low

Description:

R

Soil Reactivity

- L - Nil or low soil
- R1 - Moderately reactive soils
- R2 - Shallow or medium deep, highly reactive (cracking) clay soils
- R3 - Deep, highly reactive (cracking) clay soils

Sa

Soil Salinity

- L - Nil to Low Salinity
- M - Medium Salinity
- H - High to Very High Salinity

So

Sodicity (ESP)

- N - Very low or non Sodic, ESP <6%
- Rating 1 - Sodic, ESP 6-14%
- Rating 2 - Strongly Sodic, ESP >14-25%
- Rating 3 - Very strongly Sodic, ESP >25%

D

Dispersion Class

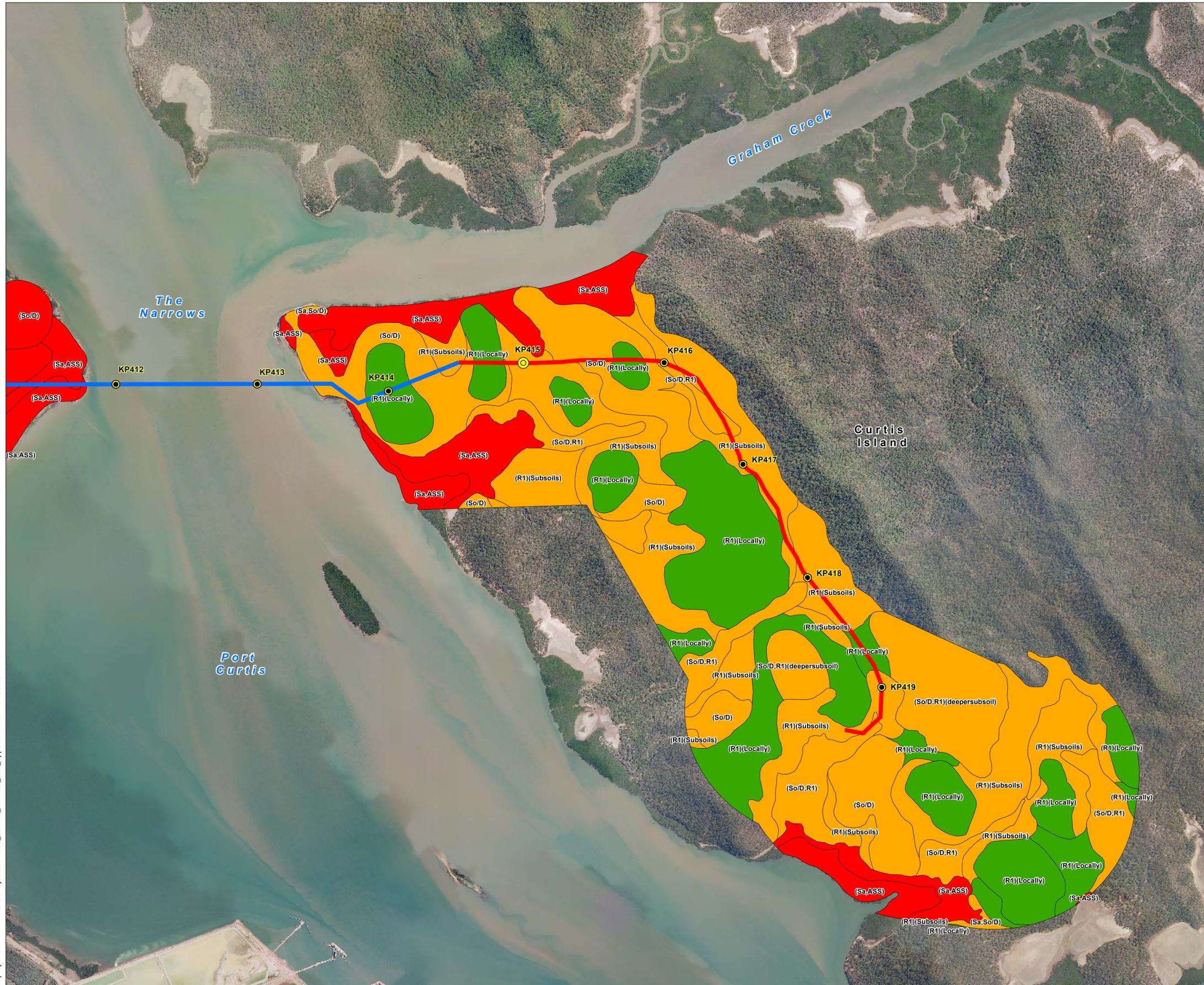
- N - Non-dispersive
- Sl - Slightly Dispersive
- M - Moderately Dispersive
- H - Strongly Dispersive

ASS

Acid Sulfate Soils

Note: All figures should be reviewed in conjunction with Table 7.1 "Generic Key to the identification of Terrain Units", URS 2009.

Source:
Gas Transmission Pipeline (GTP): Santos, Aug 2011.
Aerial: Santos, Feb 2011.
GLNG Terrain Units: Supplementary EIS, URS, 2009.



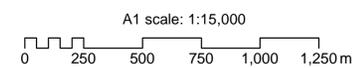
Soil Constraints: Problem Soils Appendix A (Page 15 of 15)

Date: 07/09/2011

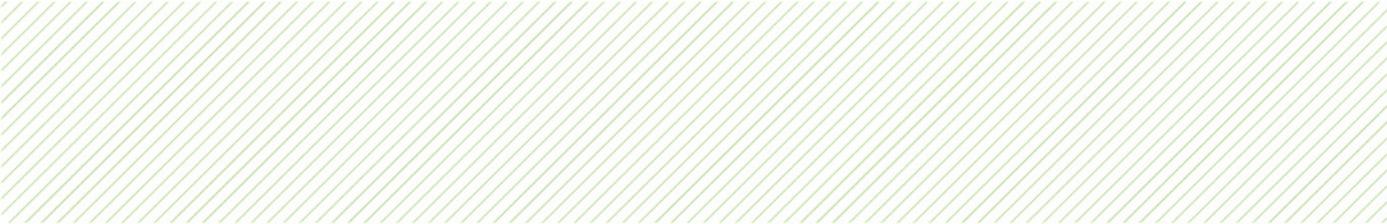
Version: 1

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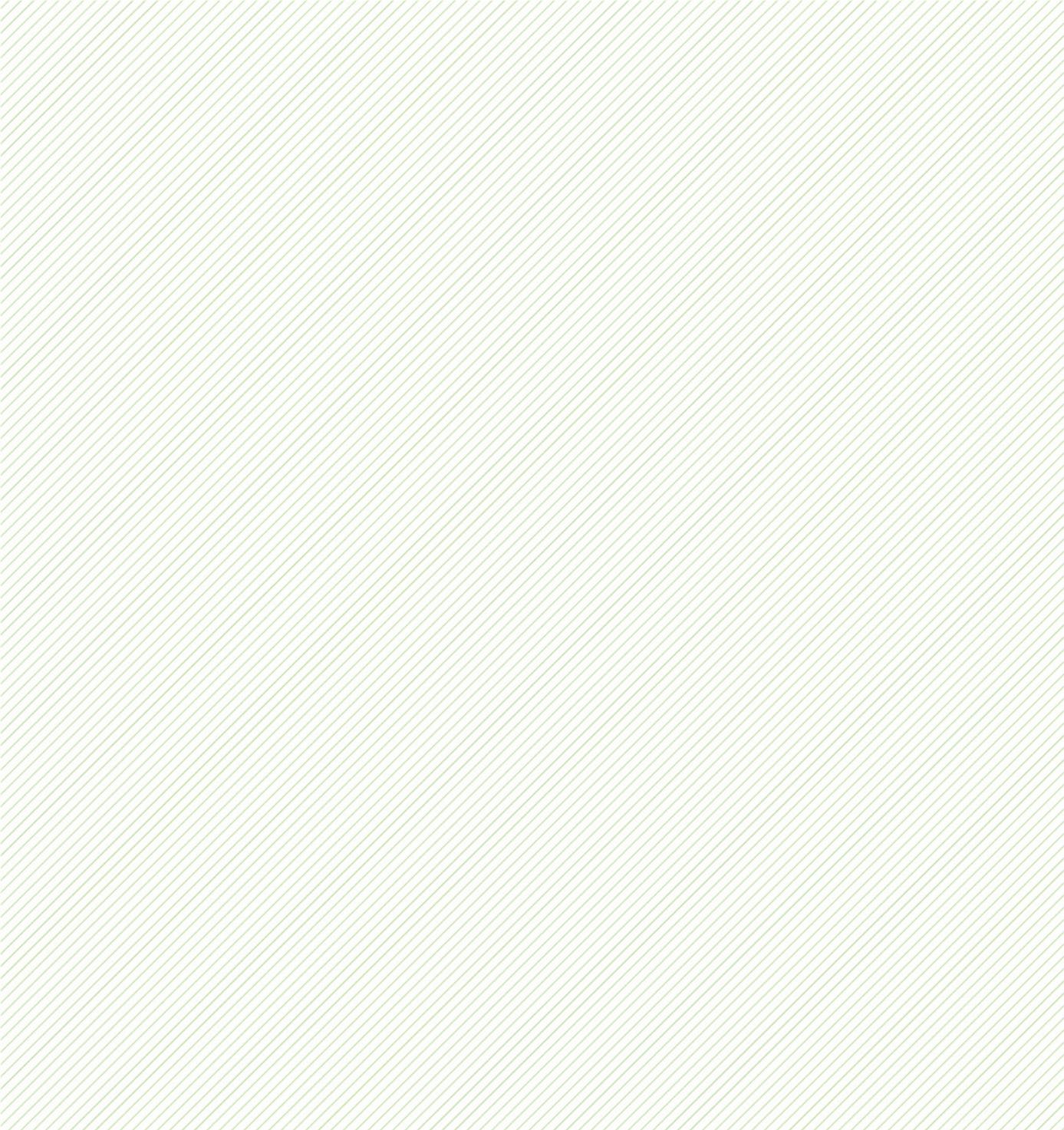
Map by: RB



GLNG No: 3381-40-0472
Coordinate system: GCS_GDA_1994

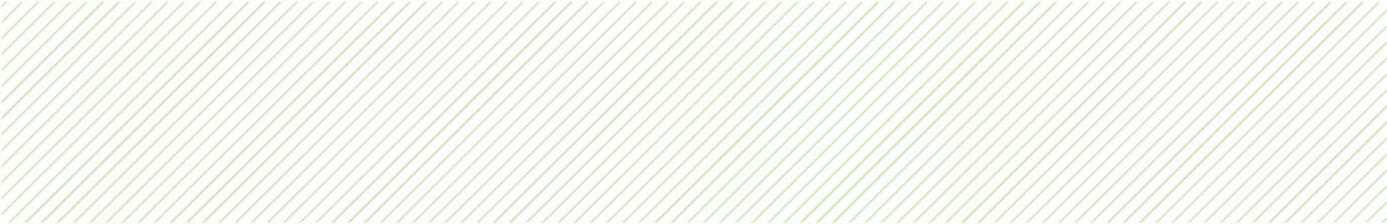


Appendix B
Species Management Plan





The Species Management Plan is now a standalone document (Document Number: 3380-GLNG-3-1.3-0036) and does not form part of this EM Plan.

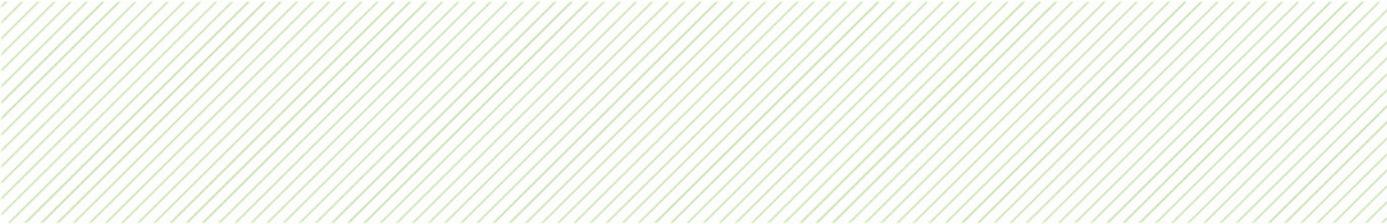


Appendix C
Significant Species Management Plan

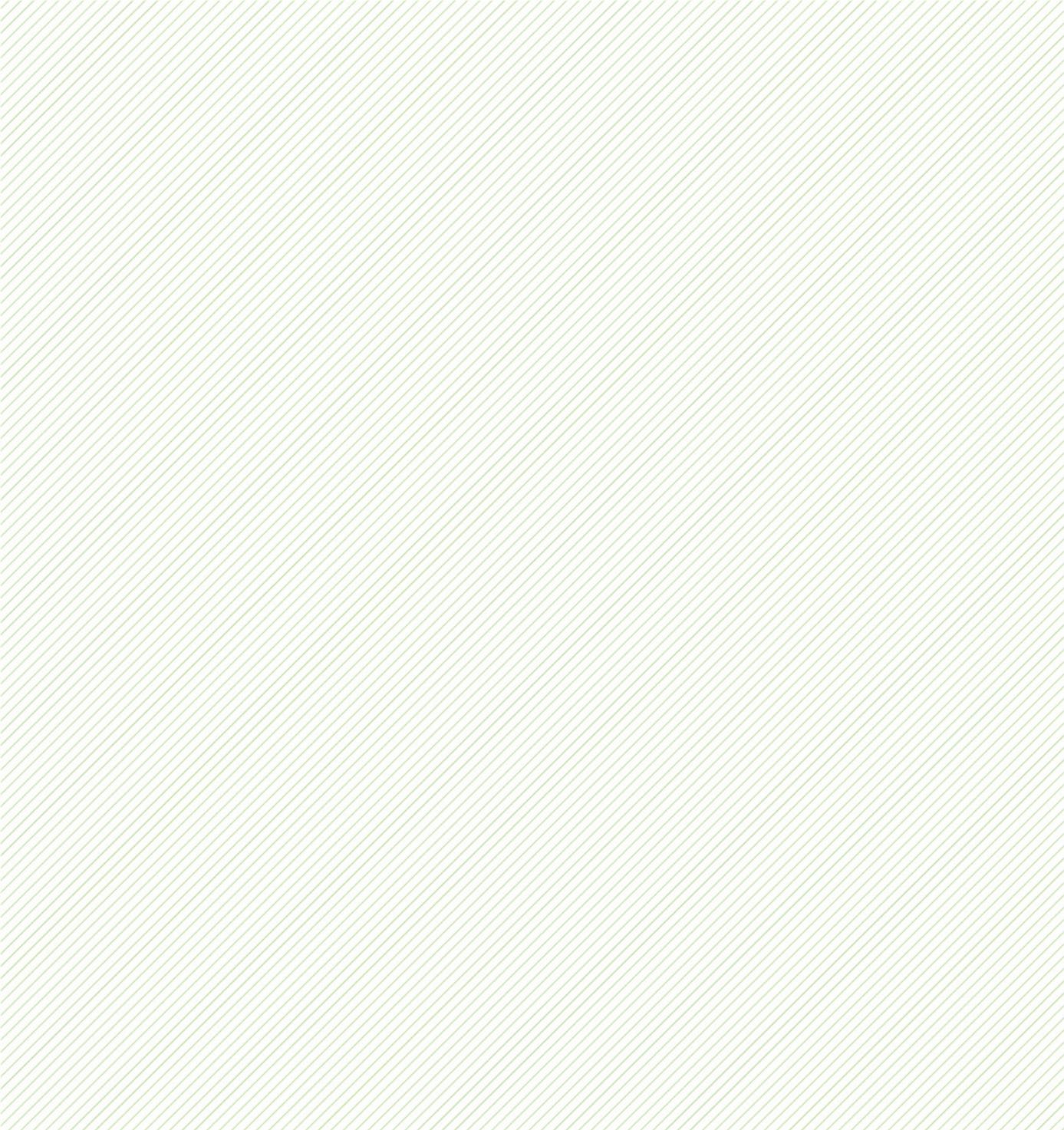




The Significant Species Management Plan is now a standalone document (Document Number: 3380-GLNG-3-1.3-0031) and does not form part of this EM Plan.



Appendix D
Pest and Weed Management Plan





GLNG

Gas Transmission Pipeline

Pest and Weed Management Plan

Document Number: 3380-GLNG-3-1.3-0006

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DATE	REV	REASON FOR ISSUE	AUTHOR	CHECKED	APPROVED
04/08/10	1	For Use	AW	BF	NC
23/11/10	2	For Contract Award	AW	BF	NC
02/06/11	3	Re-issued for Use	BH	IB	NC
15/07/11	4	For Agency Review	CC		
29/03/12	5	Revised for SEWPaC Review	AW	BF	NC
16/05/12	6	Revised for SEWPaC Second Review	AW	BF	NC

This document contains confidential information and is not to be disclosed to any third parties without prior written permission from the Vice President GLNG Operations





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- A Public Weed Washdown Facilities
- B Example Washdown – for Vehicles/Plant/Equipment
- C Example Washdown Register – for Washdown Facilities
- D Weed Management Plans
- E Pest Animal Profiles



1. Introduction

1.1 Purpose

The purpose of this Pest and Weed Management Plan (PWMP) is to detail the requirements for the management of weeds associated with the construction of the GLNG Gas Transmission Pipeline (GTP). The PWMP is applicable to GLNG Operations (the Company) employees, Contractors and all personnel associated with the planning and construction of the pipeline.

1.2 Scope

The scope of this document is to outline the pest and weed management protocols for the various stages of the GLNG GTP and to provide the Contractor with a baseline set of weed data and management strategies to assist the Contractor in developing an acceptable CPWMP.

Pre-construction:

Clearly define the boundaries and procedures throughout the Project Area to ensure all preconstruction activities (surveys, landholder access, site visits, infrastructure upgrades and preparation) to not transfer Class 1 or 2 weeds from areas currently infested to new “clean” areas.

Construction

To provide the physical and procedural parameters and boundaries to the EPC Contractor from which they can develop their project specific ‘Contractors Pest and Weed Management Plan’. Together, these plans will provide the procedures and guidelines on how the spread of weeds throughout the Project Area will be prevented and compliance with this document will be maintained.

Post Construction

To establish the boundaries and procedures for weed management along the Pipeline for all monitoring and maintenance procedures for the Project life.

This document has been prepared in accordance with the EIS and SEIS for the GLNG Project, as well as the Project Environmental Management Plans

1.3 Objectives and Performance Criteria

The objectives and performance criteria for the PWMP (Pest and Weed Management Plan), as detailed in the GLNG Project EIS, are:

Objective

- To prevent the introduction and spread of weed and pest species throughout areas associated with the construction of the GLNG Transmission pipeline

Performance Criteria

- No new weed infestations in the Project Area (pipeline, access tracks and ancillary Project Areas (laydown areas, camps, water points, quarries etc) as a result of construction activities
- No spread of weeds from infested areas to previously weed free areas
- No mature or seeding weeds located within the Project Area during construction

- Right of Way (ROW) restored to a state that minimises the potential for weed colonisation of disturbed areas
- No net increase in the abundance or distribution of pest animal species in the Project Area

1.4 Definitions

Term	Definition
Certified Clean	Washed down vehicle Certified clean by Weed Inspector
Class 1 Declared Plant or Declared Animal	<p>A plant or animal that:</p> <ul style="list-style-type: none"> • Is not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact • Are subject to eradication from the state <p>Landowners must take reasonable steps to keep land free of Class 1 pests</p> <p>It is a serious offence to introduce, keep or supply a Class 1 pest without a permit issued by the Department of Primary Industries and Fisheries</p>
Class 2 Declared Plant or Declared Animal	<p>A plant or animal that:</p> <ul style="list-style-type: none"> • Is established in Queensland and have, or could have, an adverse economic, environmental or social impact • Requires coordination and are subject to programs led by local government, community or landowners <p>Landowners must take reasonable steps to keep land free of Class 2 pests</p> <p>It is a serious offence to introduce, keep or supply a Class 2 pest without a permit issued by the Department of Primary Industries and Fisheries</p>
Class 3 Declared Plant ¹ or Declared Animal	<p>A plant or animal that:</p> <ul style="list-style-type: none"> • Is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact <p>Landowners may be required to manage Class 3 weeds in or near environmentally significant areas such as protected areas, important habitats for threatened species or areas of interest only</p>
Declared Pest	A live animal or plant confirmed to be a declared pest under the <i>Land Protection (Pest and Stock Route Management) Act 2002</i>
Infested Area	An area infested with a declared pest. These areas can be defined by local council, the regulatory body or local landholders – depending on the size of the infestation
Inspection	Inspection carried out by a trained Weed Inspector in compliance with the Queensland Government <i>Queensland Checklist for Inspection Procedures</i>

¹ This class has been inserted for information purposes only as weed surveys to date have not included Class 3 plants. However, as noted, Class 3 plants may need to be managed within environmentally significant areas and it is recommended that pre-construction surveys record the locations of such species in such areas.



Term	Definition
Project Area	Includes the pipeline ROW, access tracks and ancillary Project Areas (laydown areas, camps, water points, quarries)
Washdown Log	Log of washdowns completed for a specific vehicle/plant/equipment. The Log is maintained by the vehicle/equipment operator
Washdown	Washdown carried out, using the provisions of the Queensland Government <i>Queensland Checklist for Cleandown Procedures</i> as a Guideline, to remove organic matter and material from vehicles and equipment that may lead to the introduction or spread of weed species
Washdown Register	Washdown Facility specific Register of all washdowns completed at the particular Washdown Facility. The Register is maintained by the Weed Inspector for the particular facility
Weed Inspector	<p>Person who has completed Weed Inspector Training and is trained in the following nationally recognised units:</p> <ul style="list-style-type: none"> • RTD2312A Inspect Machinery of Plant Animal and Soil Material • RTD2313A Clean Machinery of Plant Animal and Soil Material <p>OR</p> <p>Person accepted by the Company as having the appropriate training to undertake the role as outlined in the PWMP e.g. nominated Environmental Officer(s)</p>
Weed Management Zones	The Project Area has been divided into Weed Management Zones to assist with the implementation of this PWMP. Refer to Section 2.2.1

1.5 Abbreviations

ACDC Act	Agricultural Chemicals Distribution Control Act 1966
CICSDA	Callide Infrastructure Corridor State Development Area
CPWMP	Contractor Weed Management Plan
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
GLNG	Gladstone Liquefied Natural Gas
GRT	Giant Rats Tail Grass
GSDA	Gladstone State Development Area
GTP	Gas Transmission Pipeline
ROW	Right of Way
WMP	Weed Management Plan (this document)

2. Background

2.1 Identification of Key Risks

2.1.1 Weed Survey

Weed surveys of the pipeline route and associated Project Area have been completed. Further weed surveys will be completed by the Contractor to further refine the nature and extent of weeds within the Project Area, such that the information is current at the time construction activities commence.

In addition to consultation with local authorities and landholders, weed surveys undertaken during 2009, 2010 and a field revision in 2011 have identified the following weeds to be of major concern within the Project Area and surrounds:

- *Parthenium hysterophorus* (Parthenium) – Class 2 weed
- *Sporobolus pyramidalis* (Giant rats tail grass) – Class 2 weed
- *Eragrostis curvula* (African love grass) – major concern to landholders

Details of all species identified during the field surveys along with their location are provided as Attachment D.

2.1.2 Pest animal survey

Fauna surveys of the pipeline route and associated Project Area were undertaken between 2008 and 2010 with the following pest animals were recorded:

Canis lupus dingo and *Canis familiaris* (Dingo and wild dog) – Class 2 pest animals
Vulpes vulpes (red fox) – Class 2 pest animal
Sus scrofa (feral pig) – Class 2 pest animal
Felis catus (feral cat) – Class 2 pest animal
Oryctolagus cuniculus (rabbit) – Class 2 pest animal
Rhinella marinus (cane toad) – not a declared pest animal

Note The National Management Group, Australia's key decision-making body on emergency pests, has officially declared that red imported fire ant has been eradicated from the area, following a successful eradication and pest freedom verification program carried out by Biosecurity Queensland. This means that the movement restrictions on high-risk materials can now be lifted. This is a big win for the fire ant eradication program and the Yarwun community. However, fire ants still pose a threat and restrictions remain in place in South East Queensland. Fire ants are easily spread in soil, mulch, plants and landscaping equipment, so movement controls must be adhered to in order to reduce the risk of further spread.

Source http://www.dpi.qld.gov.au/4790_18539.htm

2.1.3 Review of Activities

A review has been undertaken of the pipeline construction activities. Activities considered to pose the highest risk of introducing or spreading weeds and pest animals are listed below and will be subject to specific controls:

- Pre-construction route field studies (eg geotechnical studies, route review with landholders, route inspection with contactors)
- Activities on pipeline route prior to clearing and grading of the ROW
 - Survey Crew

- Fencing Crew
- Clear and grade activities
- First arrival of construction vehicles, equipment and supplies
- Accessing ROW and travelling back to camps
- Movement of vehicles between crews/activities
- Deliveries of materials to the ROW
- Travelling away from Project Area after accessing the ROW

2.2 Overview of Management Strategies

The Company's strategy is controls focused on preventing the introduction and/or spread of weed and pest animal species during the construction of the GLNG GTP. The Company has determined that the controls to prevent the introduction and/or spread of Parthenium and Giant Rats Tail Grass (GRT) will also be effective in controlling the introduction and/or spread of the other weed species.

There are numerous strategies available for weed management however it must be noted that individually, they cannot adequately manage or control the spread of weeds. The effective management of weed will only be attained through the combination of a series of weed management strategies. (i.e. vehicle washdowns will not get every seed off a vehicle). Weed spraying will not kill every plant and there is no chemical that kills seeds effectively. Isolating certain vehicles to certain areas is effective, however this relies on the integrity of project personnel, which is not a factor that this project is going to rely on. In addition, the pest animal species detected in the Project Area are widespread and established across the region, so their management will require an integrated, catchment-scale approach.

2.2.1 Weed Management Zones

It will be the responsibility of the Contractor to determine appropriate weed management zones for the Project Area and manage the zones accordingly. However as a minimum, the information and mapping provided in Attachment D should be used to determine 'clean' and 'dirty' locations and develop appropriate weed management protocols.

2.2.2 Summary of Strategies

The major strategies to be implemented in the PWMP to control the identified risks are:

- a) Ongoing weed surveys and weed spraying
- b) Training of personnel in the requirements of this PWMP
- c) Establishment of weed management zones
- d) **Control vehicle and equipment movements** between zones via a sticker identification system
- e) Establishment of weed washdown facilities staffed by appropriately qualified and experienced Weed Inspectors
- f) Ensuring all vehicles, equipment and supplies brought to the Project Area and departing are **certified clean**
- g) Implementation of inspection and monitoring protocols
- h) Post-construction weed monitoring and control strategy

Note The weed control strategies outlined in this PWMP are based upon weed surveys completed during 2009, 2010 and 2011. Upon completion of any additional surveys, the weed control strategies may be further revised



Pest animals

- Ensure all vehicles, equipment and supplies brought to the Project Area are free of pest animals
- Report all sightings of pest animals and monitor changes in abundance or distribution within the Project Area
- Secure waste organic material (eg food scraps) to deter scavenging by pest animals
- Avoid creating artificial water sources (eg depressions) that provide a source of drinking water to vertebrate pests or breeding habitat to invertebrate pests
- Support a broad scale, integrated pest management approach as identified in regional and state pest management strategies

3. General provisions

3.1 Responsibilities

Company – Implementation of the PWMP up to the point of the issue of the EPC contractor. The Company is also responsible for review and acceptance of the Contractor's CPWMP, monitoring compliance of the Contractor to the requirements of the WMP and CEMP, and management of the EPC contract which contains KPI's associated with implementation of this PWMP.

Contractor – Development and implementation of a Contractor Weed Management Plan (CPWMP) to comply with the PWMP. This will include (but not limited to) completion of pre-construction survey(s) and pre-construction weed control, training of personnel (see below), provision and maintenance of equipment, facilities and associated services and consumables and the monitoring of compliance to the CPWMP².

Supervisors (Contractors and the Company) – establishment of a best practice culture and monitoring, and enforcement of the requirements of this PWMP and the CPWMP. This will include ensuring that all sub-Contractors are aware of the requirements of the CPWMP prior to entering the Project.

Plant / vehicle operators – ensuring plant/equipment is certified as clean prior to arrival to the Project Area, undertaking washdown at required locations, maintaining a Washdown Log and ensuring activities are completed in accordance with WMP and CPWMP.

Weed/Pest inspector – inspection of vehicles, certification to cleanliness, administer weed zone stickers, maintain Washdown Register for the facility and ensure serviceability of washdown equipment on site.

Note The CPWMP will be designed to demonstrate the Contractors systems and procedures by which they will ensure compliance with this document. Where the CPWMP or any other contractual document refers to the PWMP, this will imply compliance with the Company PWMP through the complete implementation of the CPWMP. A breach of the CPWMP will be a breach of the PWMP and will imply a failure to meet a Key Performance Indicator.

3.2 Training

The Company and the Contractor are responsible for ensuring that the following training is completed.

Weed/Pest Inspector(s) – Completed Weed Inspector Training and is trained in the following nationally recognised units.

- RTD2312A Inspect Machinery of Plant Animal and Soil Material
- RTD2313A Clean Machinery of Plant Animal and Soil Material
- Alternate training and/or experience accepted by the Company (refer to Section 1.4)

All personnel – inducted to requirements of the PWMP including:

- Identification of key weed species and pest animal species
- Washdown requirements (on specific vehicles and where to clean)
- Access protocols (between the specified zones)
- Certification process (stickers, Washdown Log, Washdown Register, Weed Inspector)



² Records of all induction and training completed shall be maintained to demonstrate compliance with this PWMP. The CPWMP will be designed to *demonstrate the Contractors systems and procedures by which they will ensure compliance with this document. Where the CPWMP or any other contractual document refers to the PWMP, this will imply compliance with the GLNG PWMP through the complete implementation of the CPWMP. A breach of the CPWMP will be a breach of the PWMP and will imply a failure to meet a Key Performance Indicator.*

4. Company Pre-Construction Weed and Pest Animal Management

This section applies to all activities undertaken by the Company and associated Contractors or consultants prior to award of the EPC contract.

Upon award of the contract and approval of the CPWMP by the Company, all Project personnel shall comply with the requirements of the CPWMP.

4.1 Weed Identification and Control

4.1.1 Requirements

Weed Identification

- Weed surveys of the Project Area (including ROW, access tracks and any known ancillary areas) were undertaken by trained personnel/contractors in June and September of 2009 (dry season) and February and June of 2010 (post wet season). An additional review has been undertaken in April 2011 and the results have been attached in the update plans and material
- Weeds identified were recorded and have been mapped accordingly (refer Attachment D)
- The Company personnel will continue to liaise closely with local Council officers and landholders for existing weed information
- Survey findings will be utilised by Project personnel and Contractors to define the specific weed control measures for construction and the targeted weed control program

Weed Control

- Prior to the appointment of the Contractor, weed control of the Project Area (ROW, camps, storage areas, access) will be undertaken by appropriately qualified and experienced contractors who are appropriately licensed under the *Agricultural Chemicals Distribution Control Act 1966* (ACDC Act)
- Where possible, weed control will be scheduled to occur prior to weed seeding
- Prior to weed spraying, relevant land holders will be consulted
- Significant weed infestation areas will be monitored after treatment and repeat treatment undertaken as required

4.1.2 Performance Indicators

- Weed surveys undertaken during at least one dry and one wet season.
- Weed outbreaks recorded in GIS
- Weed control completed and recorded
- Weed zones established, monitored and marked on project maps (updated as applicable)
- No mature weeds or seeding plants within Project Area

4.2 Pre-Construction Access to Project Area

This section applies to all vehicles accessing the Project Area and travelling off sealed public roads.

4.2.1 Requirements

- Planning for access to the Project Area will include:
 - Identification of existing vehicle washdown facilities and planning work around the location of washdown facilities (refer to Attachment A for a list of public facilities)
- If applicable, fixed washdown facilities and washdown procedures shall comply with:
 - *Queensland Guideline for the Construction of Vehicle and Machinery Washdown facilities* (refer to Section 8)
 - *Queensland Government Checklist for Clean-down* (refer to Section 8)
- When moving between ‘dirty’ and ‘clean’ areas, within the Project Area, vehicles, plant and/or equipment will:
 - Be washed down and certified clean
 - Provide/be issued with a Weed Hygiene Declaration Form
 - All vehicles/equipment/plant shall have a Washdown Log (refer to Attachment B for an example of a washdown log) that must be maintained by the vehicle operator. This includes washdowns that require certification and washdowns completed by the vehicle operator. Washdown Logs are auditable and shall be provided upon request
- Vehicle operators:
 - Shall remain on designated access tracks and avoid driving through weeds as far as possible
 - Must not drive through flowering or seeding plants
- The location of any mature and/or seeding weed species is to be reported to the Company Pipeline Environmental Manager within 24 hrs

4.2.2 Performance Indicators

- Weed locations marked on Project maps
- Washdown Logs implemented and maintained
- Washdown Logs demonstrate washdown occurring to coincide with vehicle/equipment/plant movements
- Washdown facilities are available at all times (mobile/temporary units are available prior to establishment of fixed facilities)
- Weed Inspectors present at active washdowns
- No driving through seeding or flowering weed plants

5. EPC Contractor Pre-Construction Weed and Pest Animal Management

This section applies to all activities undertaken by the EPC Contractor prior to the commencement of construction. The only field activities that may be carried out under this section prior to the establishment of washbays and other weed control infrastructure will be weed surveys, or weed management work and/or work associated with the establishment of fixed weed washdown facilities.

5.1 Project Establishment

5.1.1 Requirements

Development of Construction Weed Management Plan

- CPWMP shall:
 - Be prepared by the Contractor and submitted to the Company for approval prior to any work under the EPC contract commencing
 - Comply with the requirements of this PWMP
 - Establish a system to control the movement of vehicles and equipment between weed management zones (refer to Section 2.2.1)
 - Provide the procedures that detail how compliance will be implemented
 - Establish a system to monitor and report on pest animal abundance and distribution
 - Identify the control measures that will be adopted to manage the impacts of existing pest animals within the Project area

Weed Zones

- Weeds management zones will be developed and implemented by the Contractor
- The construction area will be divided into weed management zones for the purpose of defining and preventing the unrestricted movement of vehicles from 'dirty' to 'clean' zones
- The zones shall be clearly identified both in the CPWMP and on the ground and work programs and flow designed around the zones
- Zones shall be clearly marked on construction drawings and within the field

Establishment of Washdown Facilities

- The location of project specific weed washdown facilities will be determined in consultation with weed management zone maps
- These washdown facilities shall be established to enable the efficient movement of vehicles between the weed zones whilst ensuring material that may facilitate the introduction or spread of weeds is removed. This may include the use of mobile washdown facilities where appropriate
- As a minimum, these washdown facilities shall be installed at the following locations:
 - At each construction camp
 - Boundaries of each weed zone
 - Major access points to the ROW, corresponding with weed zone boundaries
- Additional washdown facilities shall be constructed/resourced as required
- Each active washdown facility that is established for certification of vehicles shall be permanently staffed by an appropriately experienced and qualified Weed Inspector (when works are not occurring in that area there will be no need for an

inspector, however arrangements will be required to be made for an inspector to certify the vehicle if movement through the facility is required)

- Washdown facilities shall:
 - Be sized and equipped to facilitate the quick movement of vehicles and equipment within the Project Area whilst ensuring compliance with the CPWMP or this PWMP
 - *Comply with Queensland Guideline for the Construction of Vehicle and Machinery Washdown facilities* (refer to Section 8)
 - Include equipment to remove material from within the vehicle
- The location of Washdown Facilities shall be recorded in the project GIS, clearly marked on project maps and included in the inspection and monitoring program

Location of Infrastructure and Access routes

- It is recommended that construction camps be established such that crews can work within a defined zone and travel to and from camp without crossing a zone
- The location of construction access routes, delivery areas, stockpiles and laydown areas shall take into consideration the location of these zones and weed management strategies outlined in this PWMP
- Access routes shall be planned to achieve the following:
 - Vehicles operate in such a manner as to limit crossing of weed zone boundaries
 - Vehicles start in clean areas and then move into the dirty areas
 - Vehicles do not drive through or contact any seeding or flowering weeds
 - Vehicles are subject to washdown and certification to move between zones

5.1.2 Performance Indicators

- CPWMP developed and approved by the Company prior to entry to the field (HOLD POINT)
- Weed zones established and marked on project maps
- Project specific weed washdown facilities are immediately established and identified on project maps
- Weed Inspectors are present at designated washdown facilities

5.2 Weed and Pest Animal Identification and Control

5.2.1 Requirements

Weed Identification

- Prior to construction, regular weed surveys of the Project Area (including ROW, access tracks and any known ancillary areas) shall be undertaken
- Weed surveys shall be:
 - Undertaken by trained personnel or Contractors
 - Scheduled for times of high weed growth ie within 2 weeks or as soon as possible after first significant rainfall event and/or after periods of high rainfall
- Weeds identified shall be recorded in project GIS and included in project mapping

Pest animal identification

- Prior to construction, regular pest animal surveys of the Project Area (including ROW, access tracks and any known ancillary areas) shall be undertaken;
- Pest animal surveys shall be: Undertaken by appropriately qualified and experienced personnel or Contractors. Scheduled for both night (spotlight

searches) and day. Undertaken incidentally dependent on environmental conditions (eg pest predator populations may irrupt following periods of high rainfall):

- Incidental sightings of pest animals should be recorded and included in weekly Environmental Reports
- Pest animals identified shall be recorded in project GIS and included in project mapping

Weed Control

- Prior to construction, weed control of the Project Area (ROW, camps, storage areas, access) shall be undertaken by appropriately qualified and experienced Contractors who are appropriately licensed under the ACDC Act
- Weed control shall be scheduled to occur prior to weed seeding
- Prior to any weed spraying, permission shall be obtained from the Company
- Significant weed infestation areas shall be monitored after treatment and repeat treatment undertaken as required

Pest animal control

- If deemed necessary (ie where infestations occur), prior to construction, pest animal control of the Project Area (ROW, camps, storage areas, access) shall be undertaken by appropriately qualified and experienced Contractors who are authorised persons under the *Land Protection (Pest and Stock Route Management) Act 2002*
- Pest animal control shall be humane, strategic, integrated and adopt best practice principles as outlined in the following publications:
 - NSW Department of Primary Industries Humane Pest Animal control: Code of Practice and Standard Operating Procedures and related Model Codes of Practice for the Humane Control of Vertebrate Pests which are available at the following link <http://www.feral.org.au/tag/COP/>
 - The Animal Care and Protection Act 1994 specifically in relation to the appropriate treatment and euthanasia of pest animals. Any euthanasia will be undertaken in accordance with the Australian Code of Practice for the Care of Animals for Scientific Purposes, 7th Edition, 2004
 - Threat Abatement Plans for key species. GLNG will act within the requirements of threat abatement plans. Specifically the plans require a property management plan; in this case the pest and weed management plan will fulfil this requirement. The threat abatement plan requires input to local and regional databases for pest animal distribution. GLNG will collect data on pest species captured and will make this data available for reporting
 - The QLD government pest animal fact sheets
- The approach will be to manage pests encountered within the RoW during trenching activities. The Fauna Handler is to euthanise the animal as per the Fauna Handling Procedure. Where pest numbers are a concern to human safety (e.g. high numbers of feral pigs), a suitably qualified vertebrate pest field officer is to be contacted to implement a mitigation strategy (i.e. culling activities). Prior to any pest animal control, permission shall be obtained from GLNG
- Significant pest animal infestation areas shall be monitored after treatment and repeat treatment undertaken as required

5.2.2 Performance Indicators

- Weed and pest animal surveys monthly or more frequently after rain events
- New weed outbreaks recorded in GIS



- Weed control completed and recorded
- No flowing or seeding weeds within Project Area
- Company approval obtained prior to spraying
- Incidental sightings of pest animals recorded

6. Project Weed Management

6.1 Management of Access to the Project Area

6.1.1 Requirements

The Contactor shall establish a system for the control of vehicles within and between weed management zones and this system shall be documented in the CPWMP submitted to the Company for approval. The minimum requirements are outlined below.

- Prior to entering or leaving the Project Area vehicles, plant and/or equipment shall:
 - Be washed down and certified clean
 - Provide/be issued with a Weed Hygiene Declaration Form
- Additional washdown and certification will be required:
 - When travelling from a 'dirty' weed management zone to a 'clean' weed management zone (refer to Section 2.2.1). Vehicles will require the old sticker to be removed and a new one issued
 - All vehicles shall display the appropriate sticker(s) to define the zone they are approved to access and travel within
 - Different stickers shall represent authorisation for different zones and each sticker shall be numbered
 - Signage shall be installed at key points within the Project Area clearly outlining the Zone and certification requirements for entry and exit
 - Site specific washdown facilities shall be established in accordance with Section 5.1 and operated in accordance with Section 6.3
 - Boundary fence lines shall be marked both on alignment sheets and in the field, and crews shall not transfer anything across these lines unless authorised by the relevant Supervisor
 - No organic material shall be moved between zones
 - No haybales or equivalent materials shall be used on the project

Clear and Grade Crew

- Clear and grade crew will be subject to additional washdown at defined locations along the ROW where the specific weed infestation changes occur (eg Prickly Acacia, Mother of Millions and Rubber Vine)
- This will apply between specified properties within relevant zones
- The location of additional washdown points shall be clearly identified both on alignment sheets and in the field
- Washdowns in this situation shall be recorded by the Environmental Officer or the Weed Inspector in the relevant Washdown Log

6.2 Road Vehicles and Deliveries

The protocols for access to the Project Area outlined in Section 6.1 shall apply to all vehicles, including delivery vehicles, buses etc, even if they are only travelling on sealed public roads. The Contractor may propose an alternate system (must be approved by the Company prior to implementation) that includes the following requirements:

- Vehicles that are limited to travel on public roads must not leave a public road unless it is washed down and certified again prior to re-entering that public road



- Delivery vehicles travelling off sealed public roads must wash down and be certified for all travel from a 'dirty' to a 'clean' zone

6.3 Operation of Washdown Facilities

6.3.1 Requirements

- Site specific weed facilities shall be established in accordance with Section 5.1
- Stickers designating vehicle cleanliness and zone authorisation shall only be administered:
 - By a Weed Inspector
 - Once a vehicle is certified clean
 - For the zone where access is required
- Stickers may only be removed by a Weed Inspector
- Procedures for the washdown and inspection of vehicles shall:
 - Be established and documented in the CPWMP
 - Comply with the *Queensland Government Checklist for Clean-down and Inspections* (refer to Section 8)
- The vehicle/plant/equipment operator shall maintain the Washdown Log for all washdowns completed (refer to Attachment B)
- The Weed Inspector shall maintain a Washdown Register of all washdowns and vehicle/plant/equipment certifications completed at their allocated facility (refer to Attachment C for an example of a washdown register)
- Stickers shall be numbered and the corresponding number recorded on the Washdown Logs and Washdown Registers
- Upon departure from the Project Area, all stickers shall be removed by a Weed Inspector

Both a washdown log and washdown register are shown in Attachments B and C respectively. The washdown log is for the vehicles and is carried around in each piece of machinery. Signoff will be by the person operating the machinery. The washdown register is for the washdown bays themselves and will have signoff by a certified inspector.

6.3.2 Performance Indicators

- Washdown Registers and Washdown Logs consistent and correspond to vehicle movements
- Vehicles displaying correct stickers
- Weed Inspectors present and certifying to appropriate standard at active washdowns
- Washdown facilities are maintained and fully operable
- No mature weeds in flower or seed throughout the ROW and Ancillary works areas

6.4 Inspection and Monitoring

The Contractor shall establish an Inspection and Monitoring Program defining the scope, the interval and responsibility. The program shall be documented within the CPWMP.

As a minimum, the inspection and monitoring program shall include:

- Random checks on cleanliness of vehicles/plant/equipment and completion of Washdown Logs



- Daily inspection of vehicles within each zone to ensure correct stickers are displayed
- Weekly inspection/monitoring of Project Area for evidence of weeds
- Spraying of weed infestations by licensed Contractors (as approved by the Company)
- Random inspection of Washdown Logs and facility Washdown Registers – for consistency and correspond to vehicle movements
- Inspection of facility Washdown Registers and random cross checking of Washdown Registers versus Vehicle Washdown Logs

Corrective Action

- Equipment/vehicles failing inspections will be subject to be rewashed prior to certification
- Weed spraying of weed outbreaks
- Incident report or non-conformance report raised for non-compliances identified
- Contractor will assume responsibility for future management of weeds in an area of non-compliance
- Repeated non-compliance will result in stop-work, recertification of equipment and retraining of individuals

6.5 Records to be Maintained

The Contractor shall document within the CPWMP, the records that will be maintained to demonstrate compliance with this PWMP. This shall include the title, responsible person and the storage location for that record. As a minimum, this shall include:

- Washdown Logs for vehicles/plant/equipment
- Washdown Registers for facilities
- Records of Inspections completed as outlined in Section 6.4
- Induction and Training Records
- Incident Reports
- Non-compliance reports
- Audit Reports
- Evidence of weed surveys and monitoring activities
- Records of weed control activities

7. Project Pest Management

7.1 Prevent establishment of pest animals

7.1.1 Requirements

Pest animals known to occur in the Project Area are listed in section 2.1.2. Any new pest animals detected are to be reported immediately to Company and recorded in the Project GIS.

7.1.2 Performance indicators

- Pest animals are not proliferated in the Project Area

7.2 Management of existing pest animals

7.2.1 Monitoring

Spotlight and diurnal surveys

The Contractor will establish a regular monitoring program of nocturnal (spotlight) and diurnal ground pest animal surveys. These surveys shall:

- Occur at least every two months
- Be either on foot or by slow moving vehicle
- Be representative of all regions of Project Area (ROW, camps, storage areas, access)
- Be undertaken by appropriately qualified and experienced personnel
- Follow accepted survey methodology for transect surveys of ground-dwelling vertebrate fauna (see for example, EPA (1999) and Eyre et.al (1997))
- Be recorded in the Project GIS

Incidental and opportunistic sightings

All staff shall report all sightings of the pest animal species listed in section 2.1.2 to the Environmental Manager (see Attachment E to aid identification), which will be included in weekly environmental reporting and recorded in the Project GIS. 'Sightings' include:

- Seeing the actual animal
- Tracks and scats
- Indicative habitat disturbance (eg digging/uprooting by pigs)
- Evidence of habitat use (eg Den sites of foxes, rabbit burrows)

Indirect evidence of incidental pest animal sightings should be confirmed by appropriately qualified and experienced personnel wherever possible.

Regular monitoring will be used to estimate relative abundance and distribution of pest animals, and identify areas that may require control measures.

7.2.2 Performance indicators

- Regular transect surveys are undertaken and reported in the Project GIS
- Incidental sightings are reported and recorded in the Project GIS and weekly environmental reports. Relative abundance and distribution of pest species is closely monitored to detect increases and/or areas requiring control measures

7.3 Pest animal control

7.3.1 Legislative definitions and requirements

The pest animals listed in section 2.1.2. are declared as class 2 pests under schedule 2 of the *Land Protection (Pest and Stock Route Management) Regulation 2003*, with the exception of the cane toad (*Bufo marinus*) which is not a declared pest. Class 2 pests are defined under section 38 of the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), as:

“Established in the State and (is) causing, or has the potential to cause, an adverse economic, environmental or social impact in the State”.

Under section 77 of the LP Act, landowners must take reasonable steps to keep their land free of Class 2 pests.

Under The *Pest Management Act 2001*, any pest control or fumigation activity must be carried out by an appropriately qualified and licensed technician.

Section 42 of the *Animal Care and Protection Act 2001* instructs that any act to control a pest animal must be done in a way that causes the animal as little pain as is reasonable. The Australian Government Department of Sustainability, Environment, Water, Population and Communities provide model codes of practice for the humane control of each of the class 2 pests listed in section 2.1.2., which may be accessed at the following links:

<http://www.environment.gov.au/biodiversity/invasive/publications/humane-control.html>

This Department has also published threat abatement plans for rabbits, feral cats and foxes, available here:

<http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>

and has drafted a threat abatement plan for cane toads, which may be accessed here:

<http://www.environment.gov.au/biodiversity/threatened/tap-drafts.html>

The Queensland Government Department of Employment, Economic Development and Innovation publish operational guidelines for the management of each of the class 2 pests listed in section 2.1.2., which may be accessed here:

http://www.dpi.qld.gov.au/4790_8422.htm

This list of legislative requirements is not exhaustive, and there are many other pieces of State and Commonwealth legislation that may influence pest animal management in Queensland.

Pests and Weeds will be managed throughout the life of the project (including both operational and decommissioning phases) in accordance with the legislative requirements and guidelines listed above.

7.3.2 Pest management planning framework

A range of pest management planning instruments exist at the National, State, Regional and Local Government level. Those that relate to pest animal management in the Project Area are listed in Table 1.

Table 1 Pest Management Planning Framework

National	State	Regional	Local Government
Australian Pest Animal Strategy 2007	Qld Pest Animal Strategy 2002-2006	Capricorn Pest Management Group Regional Pest Management Strategy 2004-2009	Calliope Shire Council Pest Management Plan 2005-2008*
Threat Abatement Plan for Competition and Land Degradation by Rabbits 2008	Wild Dog Management Strategy 2010-2015 (Consultation Draft)		Gladstone City Council Pest Management Plan 2005-2008
Threat Abatement Plan for Predation by European Red Fox 2008	Feral Pig Management Strategy 2004		Bananna Shire Council Pest Management Plan 2005-2009
Threat Abatement Plan for Predation by European Feral Cats	Rabbit Management Strategy 2001-2006		
	Pest Management Plan Areas Managed by Qld Parks and Wildlife Service July 2003-2008		

*Calliope Shire Council and Gladstone City Council amalgamated in 2008 to form Gladstone Regional Council

This PWMP is consistent with the principles of the relevant planning instruments outlined above. The contractor will ensure that the CPWMP is also aligned with these principles.

7.3.3 Active control of pest animals

Effective control of pest animals may include any or a combination of the following methods:

- Killing/removal (eg trapping, baiting)
- Exclusion (eg fencing)
- Habitat manipulation (eg rabbit warren ripping)

Control of the pest animal species listed in Section 2.1.2 will occur according to the legislative instruments in Section 7.3.1 and the planning documents in Section 7.3.2. Permission must be sought from The Company before undertaking any of the control methods in this section.

Killing/removal

Only to be undertaken by authorised personnel as prescribed by the relevant Acts (see section 7.3.1) where outbreaks are known to have occurred and control is mandatory under the legislation listed in section 7.3.1.

Exclusion

All areas that contain organic waste material (e.g. food scraps) will be fenced or otherwise adequately secured to prevent scavenging by pest animals.



All areas of significant water ponding that are created during the course of construction will be enclosed by temporary fencing to prevent access by pest animals.

Habitat manipulation

Wherever practicable, and subject to the approval of the Company and compliance with all relevant legislation, any rabbit warrens or fox dens that are encountered will be destroyed.

7.3.4 Performance Indicators

All relevant legislation is complied with :

- CPWMP is consistent with Commonwealth, state, regional and local pest management planning instruments
- Pest animal control methods adhere to recommended guidelines and best practice principles according to the documents in Section 7.3.1
- Pest animal outbreaks are contained and managed effectively and in a timely manner
- All pest animal control actions are recorded in the Project GIS and reporting tools
- The distribution and abundance of pest animals in the Project Area does not increase



8. Post Construction

8.1 Monitoring and Control Program

Pests and Weeds will be managed as required throughout the life of the project, including during operational and decommissioning phases of the pipeline.

Monitoring will determine the success of management measures or requirements for further actions. Any pest or weed species identified during site inspections and audits will be recorded, and appropriate management measures will be employed in response to the presence of these species.

A Weed Monitoring and Control Program (to be included as part of the CPWMP) will be developed and implemented and will include (but not limited to):

- The rate of monitoring and control post completion will be as follows:
 - Post rain event – once a month for three months
 - Otherwise, once every two months
 - In response to landholder or operator request
- Weed monitoring and control activities shall include all Project Areas (eg tracks, ROW, camps, laydown and storage areas)
- Weed control shall be undertaken by appropriately qualified and experienced Contractors who are appropriately licensed under the ACDC Act

Weed monitoring and subsequent weed control will continue under the control of the Contractor for 2 years after completion of pipeline construction. During pipeline operation and decommissioning this responsibility will be handed to the Pipeline Operator.



Reference Material

Queensland Checklist for Clean Down Procedures

http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Cleanup-Procedures.pdf

Queensland Checklist for Inspection Procedures

http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Inspection-Procedures.pdf

Queensland Guideline for the Construction of Vehicle and Machinery Washdown facilities

http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Washdown-Fac-Guidelines.pdf

Weed Hygiene Declaration Form

http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Weed-Hygiene-Declaration.pdf

2009 Pipeline Weed Survey

GLNG Pipeline FEED – Weed Survey Report August 2009, prepared by GHD.,
GLNG DOC No. 3380-GHD-3-3.3-0323.

2010 Weed Survey Report June 2010

GLNG Pipeline FEED – Weed Survey Report June 2010, prepared by GHD.DOC
No. 21386-D-RP-012 REV A.

Coordinator-General's Evaluation Report for an EIS May 2010 – Appendix 3 Gas
Transmission Pipeline – Part 4 Schedule E – Pest and Weed Management
Conditions (E37) a, b and c

DSEWPC – EPBC Approval No2008/4096, Conditions (3) f and g.



Attachments

Attachment A Existing Washdown Facilities

Taken from

http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/4790_8243_ENA_HTML.htm

<p>Baralaba Landmark: near showground and old saleyards Address: Rannes Road Contact: Banana Shire Council Telephone: (07) 4992 9512 Maximum vehicle size: machinery Height limit: no Hose detail: high pressure; high volume hose Cost: \$2 for 15 minutes Surface: concrete slab with tilt Hours: n/a</p>	<p>Biloela Landmark: adjacent to water treatment plant Address: Quarry Road Contact: Gordon Twiner, Banana Shire Council Telephone: 0427 148783 Maximum vehicle size: road train Height limit: no Hose detail: high pressure; high volume hose Cost: \$2 for 15 minutes Surface: concrete slab with tilt Hours: n/a</p>
<p>Bingegang Landmark: near substation and pump station Address: Mackenzie River Capella Road Maximum vehicle size: semitrailer Height limit: no Hose detail: high pressure hose Cost: free Surface: concrete slab Hours: 24 hours</p>	<p>Calliope Landmark: Country Club turnoff Address: Stowe Road Contact: Gladstone Regional Council Telephone: (07) 4975 8100 Maximum vehicle size: semitrailer Height limit: no Hose detail: high volume hose Cost: tokens (\$2 for 15 minutes) available from Choice Service Station: Calliope Cross Roads CQP service station Gladstone Regional Council Surface: concrete slab/bitumen</p>
<p>Injune Landmark: saleyards Address: Roma Road, Injune Contact: Steve Murray, Roma Regional Council Telephone: (07) 4622 1144 Mobile: 0428 261290 Maximum vehicle size: body truck and car (side-by-side); road trains or headers Height limit: no Hose detail: high pressure water; high pressure air and Town pressure Cost: 50 cents per minute Surface: cement slab with ramp Hours: 7 am - 5 pm with key access operational 24 hours</p>	<p>Gladstone Landmark: Gladstone Superwash Address: 154 Goondoon Street Telephone: (07) 4972 9202 Maximum vehicle size: cars and 4WDs Height limit: n/a Hose detail: high pressure spray Cost: \$1 for 2 minutes Surface: n/a Hours: n/a</p>



<p>Moura Landmark: west of town near water treatment plant Address: Dawson Highway Contact: Gordon Twiner, Banana Shire Council Telephone: 0427 148783 Maximum vehicle size: road train (also has a facility for smaller vehicles) Height limit: no Hose detail: high pressure; high volume hose Cost: \$2 for 15 minutes Surface: concrete slab with tilt Hours: n/a</p>	<p>Rolleston Landmark: near sports ground; cattle dip and old saleyards Address: One Mile Road Contact: Central Highlands Regional Council Telephone: (07) 4984 1166 Maximum vehicle size: semitrailer with prime mover Height limit: no Hose detail: high pressure low volume hose 20 L per minute Cost: \$2 per 30 minutes Surface: 23 m concrete slab Hours: 24 hours</p>
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Attachment B – Example Washdown Log for Vehicles/Plant/Equipment

Vehicle / Plant and Rego/ID Number : _____

Date	Driver	Washdown Location	Sticker Number Added	Sticker Number Removed	Authorised Signature
			eg Zone 2 #234	eg Zone 1 #123	



Attachment C – Example Washdown Register

Washdown Facility Name : _____

	Vehicle/Plant	Rego/ID No	Sticker number Added	Sticker number Removed	Authorised officer's Name and Signature



Attachment D – Weed Management Plans



CLIENTS PEOPLE PERFORMANCE



GLNG Pipeline FEED Report for Weed Survey Report - June 2010

[GHD DOC No.: 21386-D-RP-012 REV A]

[GLNG DOC No.: 3381-GHD-3-3.3-0628]



Rev	Date	Description of Revision	Author	Reviewer	Approved	GLNG Approved
A	18/062010	Issue to GLNG	<i>J. Muller</i>	<i>A. Fuchs</i>	<i>James Mills</i> PP JME	



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Appendices

- A GLNG Weed Survey Results Table
- B Weed Management Plan Overview Maps



1. Introduction

GLNG Operations Pty Ltd is planning the development of a liquid natural gas (LNG) processing facility on Curtis Island in the Gladstone port precinct. A high pressure gas pipeline, of approximately 435 km length, will transport coal seam gas (CSG) to the LNG plant from existing and future fields in the Roma, Fairview and Arcadia Valley area. Preliminary route selection indicates that the pipeline will closely follow the route of the existing Queensland Gas Pipeline (QGP) from Wallumbilla to Gladstone.

1.1.1 Existing Environment

The gas transmission pipeline is predominantly located within the Brigalow Belt Bioregion with only a small portion of the northern section located within the Southeast Queensland Bioregion. The proposed pipeline will traverse a number of alluvial valleys (including the Arcadia Valley) separated by the Calliope, Dawson, Expedition and Carnarvon Ranges. Within the alluvial valleys a number of ephemeral and a limited number of perennial creeks and rivers are present and will be required to be traversed by the pipeline. Two major river crossings of the Calliope and Dawson Rivers will be required. The pipeline will also traverse four railway lines, the Dawson, Leichhardt, Burnett and Bruce Highways, as well as a number of sealed and unsealed roads and tracks (including Fairview Road and the Anglo Coal Haul Road).

The terrain traversed by the pipeline includes farmland, forest, and grassland and will involve the crossing of over 140 stakeholder and landholder properties. Field surveys carried out by URS Pty Ltd during 2008 along the proposed pipeline alignment identified that approximately 83% of the pipeline route is situated within land that has been cleared for cropping or grazing. Remnant vegetation is mainly restricted to mountain ranges and major waterways that the pipeline crosses. A number of weed species, including those declared under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), are present along the pipeline alignment.

1.2 Scope of Works

GHD was commissioned by GLNG to carry out weed surveys to provide background weed information and verification of weeds located on properties affected by the GLNG pipeline alignment. The aim of the weed surveys were to establish the location of Class 1, Class 2 and Class 3 weeds declared under the LP Act and to provide maps indicating the distribution of declared weed species.

Separate weed surveys have been conducted over different periods of growth during the dry season of 2009 and the post wet season of 2010. The deliverables of the weed survey completed to date have included the following:

- ▶ Recording locations of all Class 1 and Class 2 declared plants under the LP Act;
- ▶ Recording locations of Class 3 declared plants under the LP Act and other non-declared environmental weeds identified by landholders or local government officers as of concern;
- ▶ Compilation of additional weed information from communication with landholders, council officers, State Government officers and GLNG Land Agents; and



- ▶ Preparation of reports, results tables and mapping detailing the findings of the weed surveys completed in 2009 (GHD document number: 21386-D-RP-006_D.pdf, November 2009) and 2010; and
- ▶ Preparation property scale maps indicating the distribution of declared weed species identified during the weed surveys and background information collation.

1.3 State of Declared Weeds

Weeds (both declared and non-declared) are considered detrimental to landholders as they establish rapidly, spread easily and compete with plants used for pasture and cropping. A weed is defined as any plant that requires some form of action to reduce its harmful effects on the economy, the environment, human health and amenity (Natural Resource Management Ministerial Council, 2006). There are two types of invasion: introduction of exotic plants and movement of native species into new areas well outside their native range. Weeds have an adverse effect on an area's environmental values and ecological functioning for the following reasons:

- ▶ Competition with native species;
- ▶ Change in the structure of a plant community through addition or removal of strata;
- ▶ Suppress recruitment of native species;
- ▶ Change the natural fire fuel characteristics, which can change the natural fire regime to the detriment of native species, often resulting in the loss of native species;
- ▶ Change the food sources and habitat values available to native fauna, reducing some and increasing others;
- ▶ May change geomorphological processes such as erosion; and
- ▶ May lead to changes in the hydrological cycle.

Under the LP Act, introduced species that represent a threat to primary industries, natural resources and the environment can be declared as Class 1, 2 or 3 Pests. The categories of declared plants in Queensland are outlined in the table below.

Table 1 Categories of Declared Plants in Queensland

Priority Class	Description
Class 1	A Class 1 pest is one that is not commonly present in Queensland, and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests.
Class 2	A Class 2 pest is one that is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact. The management of these pests requires coordination and they are subject to local government, community or landowner-led programs. Landowners must take reasonable steps to keep land free of Class 2 pests.



Priority Class	Description
Class 3	A Class 3 pest is one that is established in Queensland and has or could have a substantial adverse economic, environmental or social impact. Its impact or potential impact is however considered to be less significant than that of a Class 2 pest. Landowners may be required under the LP Act to manage Class 3 pests in or near environmentally significant areas, such as protected areas, important habitats for threatened species or areas of interest, but landowners are not required to manage Class 3 pests elsewhere.



2. Methodology

Weed surveys were conducted over different periods of active weed growth, the dry season of 2009 and the post wet season of 2010. As such, the two weed surveying events will herein be referred to the dry season field survey and the post wet season field survey respectively.

2.1 Dry Season Field Survey

A combination of both desktop background information searches and field investigations were adopted to assess the distribution of declared weeds along the GLNG pipeline alignment. Background weed information was compiled for the dry season field survey included reviews of the following information sources:

- ▶ GLNG Environmental Impact Statement;
- ▶ Queensland Herbarium HERBRECS database;
- ▶ Regional council weed information;
- ▶ Initial ecological field surveys along the GLNG alignment;
- ▶ GLNG Land Agent information; and
- ▶ Landholder feedback.

Dry season field surveys were conducted on accessible properties intersected by the GLNG pipeline alignment between the months of June and September 2009. Field surveys were conducted over the suboptimal dry cooler months when plant growth was low and most species were not flowering, or were in a period of dieback.

Details of the full methodology and results of the background information searches and field investigations from the dry season field survey during 2009 are located in the GLNG Pipeline FEED Weed Survey Report – November 2009 (GHD document number: 21386-D-RP-006_D.pdf).

2.2 Post Wet Season Field Survey

The main aims of the post wet season field survey were to:

- ▶ Verify existing weed recordings from the results of the background information searches and dry season field surveys; and
- ▶ To record new infestations of declared and of concern environmental weeds along the GLNG pipeline alignment, with particular focus on previously clean properties and properties with weeds stated in the background information but none recorded during dry season field surveys.

Background weed information had been compiled from all available information sources during the dry season field survey. As no updates had been made to regional council weed management plans, no additional background information was required for the post wet season field survey.



Post wet season field surveys were conducted by GHD ecologists on properties intersected by the GLNG pipeline alignment over four field survey events between the months of February and June 2010. Field surveys involved regular communication with GLNG Land Agents to negotiate best access to areas of the pipeline alignment on each property. Field surveys aimed to cover as much of the pipeline alignment as possible either by walking or vehicular travel (if possible). However, due to weather and ground conditions, poor access to some areas, distances between access points and limited time given to complete field surveys, some areas of the pipeline alignment could not be surveyed. Where field access was difficult, representative samples of each property were surveyed and areas with greater potential for weed infestations were targeted, for example, creeklines and areas with distinct changes in vegetation characteristics. Due to difficulty with access and time restrictions, the GLNG pipeline alignment on Curtis Island was not surveyed during the post wet season field survey period.

As a result of cyclonic activity, monsoonal troughs brought heavy rains to much of the GLNG pipeline alignment and surrounding areas between mid summer and early autumn of 2010. The towns of Injune and Biloela, nearby to the GLNG pipeline alignment, received over 300 mm of rain between January and March 2010. Rolleston and Gladstone both received over 580 mm rain over the same time period (BOM 2010). As a result, moderate flooding occurred over a period of several weeks throughout much of the region. It is likely that such high volumes of water moving over the landscape provided favourable conditions for greater dispersal of weed seeds in the region. As a result of late wet season rains and extreme weather events in early 2010, post wet season field surveys were conducted during periods of optimal weed growth in the months following this large weather event.



3. Results

3.1 Declared Weeds

Along the length of the GLNG pipeline alignment, 14 weeds declared as either Class 2 or Class 3 weeds under the LP Act were recorded during the dry season and post wet season field surveys. No Class 1 weeds were encountered. The following weeds were recorded:

Class 1

- ▶ No Class 1 weeds observed during field surveys.

Class 2

- ▶ *Acacia nilotica* (prickly acacia);
- ▶ *Bryophyllum delagoense* (mother-of-millions);
- ▶ *Cryptostegia grandiflora* (rubber vine);
- ▶ *Harrisia martinii* (harrisia cactus) – formerly *Eriocereus martinii*;
- ▶ *Opuntia* spp. (prickly pear) – including *O. stricta* and *O. tomentosa*;
- ▶ *Parthenium hysterophorus* (parthenium); and
- ▶ *Sporobolus pyramidalis* (giant rat's tail grass).

Class 3

- ▶ *Anredera cordifolia* (Madeira vine);
- ▶ *Aristolochia elegans* (Dutchman's pipe);
- ▶ *Cascabela thevetia* (yellow oleander);
- ▶ *Celtis sinensis* (Chinese celtis);
- ▶ *Lantana camara* (lantana);
- ▶ *Lantana montevidensis* (creeping lantana); and
- ▶ *Macfadyena unguis-cati* (cat's claw creeper).

3.2 Environmental Weeds

Non-declared environmental weeds, listed as of concern by landholders and local government agencies, that were also recorded during weed surveys included the following 10 species:

- ▶ *Alternanthera pungens* (khaki burr);
- ▶ *Bidens pilosa* (cobbler's pegs);
- ▶ *Chloris virgata* (feathertop rhodes grass);
- ▶ *Eragrostis curvula* (African love grass);



- ▶ *Praxelis clematidea* (praxelis);
- ▶ *Sclerolaena birchii* (galvanised burr – a native burr);
- ▶ *Senecio pinnatifolius* (native fireweed);
- ▶ *Themeda quadrivalvis* (grader grass);
- ▶ *Xanthium occidentale* (noogoora burr); and
- ▶ *Xanthium spinosum* (Bathurst burr).

Additional environmental weeds to those listed above were encountered during weed field surveys. The locations of the distribution of any additional environmental weeds to those stated above were not recorded for the purposes of these weed surveys.

Results of the weeds identified on each property intersected by the GLNG pipeline alignment during dry season and post wet season surveys are listed in the GLNG Weed Survey Results Table in Appendix A. Data captured by GHD during these weed surveys is represented on the Weed Management Plan Overview Maps, located in Appendix B, which have been created externally by GLNG.

The following photos depict examples of some declared weeds recorded during field surveys.



giant rat's tail grass



parthenium



mother-of-millions and rubber vine



prickly pear

3.3 Parthenium and giant rat's tail grass

Although the recording of all declared weeds are important for weed management along the GLNG pipeline alignment, parthenium and giant rat's tail grass have been identified by landholders and GLNG personnel as the two declared weeds of most concern for control and the reduction of spread along the GLNG pipeline alignment during construction and operational phases of the project.

The following sections (section 3.3.1, 3.3.2, 3.3.3 and 3.3.4) provide a breakdown of the results for parthenium and giant rat's tail grass in terms of distinguishing properties with dense infestations of parthenium or giant rat's tail grass to those with only minor infestations or properties where these weeds were not recorded at all.

The density and size of infestations of parthenium and giant rat's tail grass may determine different management actions for the control and spread of these weeds within and between the different properties that the GLNG pipeline alignment intersects. Plate 1 depicts photos of dense infestations of parthenium and giant rat's tail grass compared to minor infestations, shown in Plate 2, of the same weeds on different properties.

3.3.1 Properties with dense infestations of parthenium or giant rat's tail grass

Results of the dry season and post wet season field surveys identified 20 properties as containing dense infestations of parthenium or giant rat's tail grass. For the purposes of this survey, a dense infestation has been characterised as:

- ▶ Where the listed weed scored a cover/abundance rank of Plentiful, with cover between 5-25% or greater, relative to the surrounding area during field surveys; and/or
- ▶ The weed appeared to dominate the surrounding groundcover vegetation in multiple locations throughout the property during field surveys.

Dense infestations of parthenium were recorded on properties between the Expedition Range and the Dawson River (approximately between KP 140 and KP 243). All infestations of giant rat's tail grass were recorded along the GLNG pipeline alignment within the western portion of the GSDA from the Bruce



Highway to Cullens Road (approximately between KP 393 and KP 405). Properties identified as containing dense infestations of parthenium or giant rat's tail grass are outlined in Table 2.



Plate 1: Examples of dense infestations of parthenium on properties T-076 and T-100

Table 2 Properties with dense infestations of parthenium or giant rat's tail grass as identified from dry season and/or post wet season field surveys

Property Parcel Number	Weed		Notes
	Giant Rat's Tail Grass	Parthenium	
CI-013	✓	-	▶ Grass tufts scattered throughout property
CI-014	✓	-	▶ Grass tufts scattered throughout property
T-075.6	-	✓	▶ Large infestations throughout property
T-076	-	✓	▶ Large infestations throughout property ▶ Parthenium infestations along property access track
T-078	-	✓	▶ Large infestations throughout property ▶ Pasture and stock management has helped reduce infestations in some areas of the property
T-080.1	-	✓	▶ Large infestations throughout property ▶ Parthenium infestations along property access tracks
T-080.2	-	✓	▶ Large infestations throughout property ▶ Parthenium infestations along property access tracks
T-081	-	✓	▶ Large infestations throughout property
T-082	-	✓	▶ Large infestations throughout property ▶ Parthenium infestations along property access track



Property Parcel Number	Weed		Notes
	Giant Rat's Tail Grass	Parthenium	
			<ul style="list-style-type: none"> Land management and spraying of parthenium has reduced infestations within areas of cultivation
T-083	-	✓	<ul style="list-style-type: none"> Infestations scattered throughout property Land management and spraying of parthenium has reduced infestations within areas of cultivation
T-086	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access track and boundary fence lines
T-087	-	✓	<ul style="list-style-type: none"> Infestations scattered throughout property Land management and spraying of parthenium has reduced infestations within areas of cultivation
T-088	-	✓	<ul style="list-style-type: none"> Infestations scattered throughout property
T-089	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks Land management and spraying of parthenium has reduced infestations within areas of cultivation
T-091	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks Parthenium infestations also present in adjacent road reserves of the Dawson Highway and Fairview Road
T-092	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations also present in adjacent road reserve of the Dawson Highway
T-095	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks
T-097	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks
T-098	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks
T-100	-	✓	<ul style="list-style-type: none"> Large infestations throughout property Parthenium infestations along property access tracks

Weed management recommendations: these properties containing dense infestations of parthenium or giant rat's tail grass should be strictly managed to control weed spread or be isolated from properties containing little or no weed infestations.



3.3.2 Properties with small infestations of parthenium

Results of the dry season and post wet season field surveys identified 15 properties as containing small infestations of parthenium. For the purposes of this survey, a small infestation has been characterised as:

- ▶ Parthenium occurrences which scored a cover/abundance rank of Sparsely Present, with cover between 5-25% or less, relative to the surrounding area during field surveys; and/or
- ▶ The weed was observed as a single plant or a small number of plants at one or a small number of locations within the property (i.e. not abundantly scattered throughout the property) during field surveys.

Properties identified as having small infestations of parthenium were located between the Dawson River and Police Camp Creek (approximately between KP 243 and KP 272). Properties identified as containing small infestations of parthenium are outlined in Table 3.



Plate 2: Examples of small infestations of parthenium on properties T-075 and T-101



Table 3 Properties with small infestations of parthenium as identified from dry season and/or post wet season field surveys

Property Parcel Number	Number of infestations	Size of infestations ^A	Location of infestations	Landholder control measures used ^B
T-001	One infestation recorded along GLNG alignment at Larcom Creek	1 juvenile plant	56 K 295923, 7352992	Unknown
T-006	Two infestations recorded along GLNG alignment	<ol style="list-style-type: none"> 50 m x 70 m triangle small patch within riparian vegetation of Gravel Creek 	<ol style="list-style-type: none"> 56 K 293957, 7348830 to 56 K 293974, 7348806 to 56 K 293932, 7348782 56 K 294986, 7350779 	Unknown
T-063.1	One linear infestation recorded along GLNG alignment	300 m long infestation from Police Camp Creek to paddock fenceline, worst infestations are within 20 m of northern property boundary fenceline	56 J 206163, 7302372 to 56 J 205889, 7302390	Unknown
T-066.1	One infestation recorded in small creepline on GLNG alignment and adjacent Jemena easement	20 m x 20 m patch	56 J 198494, 7301472	Yes Landholder controls parthenium by spraying
T-066.2	Four infestations recorded along GLNG alignment	<ol style="list-style-type: none"> 5 mature plants 5 m x 5 m patch 2 m x 2 m patch Mature plants scattered around dam 	<ol style="list-style-type: none"> 56 J 196822, 7300881 56 J 196763, 7300852 56 J 196730, 7300841 56 J 196193, 7300550 	Yes Landholder controls parthenium by spraying



Property Parcel Number	Number of infestations	Size of infestations [^]	Location of infestations	Landholder control measures used [^]
T-068	Three infestations recorded along GLNG alignment	<ol style="list-style-type: none"> 1 mature plant 5 m x 5 m patch 200 m long patch surrounding a gully 	<ol style="list-style-type: none"> 55 J 804188, 7300341 55 J 804188, 7300375 55 J 803582, 7300083 to 55 J 803790, 7300202 	Unknown
T-070	One infestation recorded	2 mature plants	55 J 802346, 7298321	Yes Landholder sprays any outbreaks
T-071	Seven infestations recorded along GLNG alignment	All seven infestations are 10 m x 10 m patches around gulgais or water sources	<ol style="list-style-type: none"> 55 J 801654, 7297825 55 J 801670, 7297771 55 J 801652, 7297756 55 J 801537, 7297728 55 J 801501, 7297723 55 J 801496, 7297695 55 J 801448, 7297683 	Unknown
T-072	Five infestations recorded along GLNG alignment and potential access tracks	<ol style="list-style-type: none"> Scattered along access track as mature individuals and small 2 m x 2 m patches 10 m x 50 m patch Scattered plants around water sources (50 m x 100 m patch) Scattered plants around water sources (50 m x 100 m patch) Scattered mature plants 	<ol style="list-style-type: none"> 55 J 801260, 7297635 to 55 J 801740, 7297586 55 J 798132, 7296859 55 J 798252, 7297056 55 J 798282, 7297071 55 J 798114, 7297025 	Yes Land management



Property Parcel Number	Number of infestations	Size of infestations [^]	Location of infestations	Landholder control measures used [^]
T-072.6	Four infestations recorded near Kianga Creek	<ol style="list-style-type: none"> 3 mature plants 1 m x 1 m patch 2 mature plants 2 m x 2 m patch 	<ol style="list-style-type: none"> 55 J 793673, 7296113 55 J 793734, 7296123 55 J 793761, 7296109 55 J 793899, 7296133 	<p>Yes</p> <p>Pasture and stock management and spraying has restricted Parthenium to western side of property only</p>
T-075	Nine infestations recorded. Larger infestations occur around the Dawson River and Kianga Creek as a result of recent flood events, very isolated distribution elsewhere on property	<ol style="list-style-type: none"> Many scattered individuals around Kianga Creek 3 mature plants 2 mature plants 2 mature plants 3 mature plants 2 mature plants 3 mature plants 30 m x 300 m patch from Back Creek to Dawson River 	<ol style="list-style-type: none"> 55 J 793271, 7295938 55 J 792915, 7295354 55 J 792819, 7295186 55 J 792658, 7295148 55 J 789658, 7295043 55 J 789390, 7295006 55 J 789371, 7294996 55 J 789282, 7294964 	<p>Yes</p> <p>Pasture and stock management and spraying has helped restrict infestations to around the Dawson River and Kianga Creek</p>
T-075.3	One infestation recorded	3 mature plants	55 J 792096, 7295126	<p>Yes</p> <p>Landholder sprays any outbreaks</p>
T-099	Four patches and scattered mature plants recorded along GLNG alignment and within property [#]	<ol style="list-style-type: none"> 3 patches of 4 m x 4 m One 10 m x 10 m patch Scattered mature plants 3 mature plants 	<ol style="list-style-type: none"> 55 J 709044, 7271620; 55 J 708833, 7271614; 55 J 708767, 7271600 55 J 705135, 7272397 55 J 705213, 7272740 	<p>Unknown</p>



Property Parcel Number	Number of infestations	Size of infestations [^]	Location of infestations	Landholder control measures used [`]
T-101	Three infestations recorded along GLNG alignment and potential access track	<ol style="list-style-type: none"> 4 mature plants 2 m x 2 m area 1 mature plant 	<ol style="list-style-type: none"> 55 J 689868, 7262145 55 J 690421, 7263253 55 J 691374, 7266283 	<p>Yes</p> <p>Landholder sprays any outbreaks</p>
T-109	Scattered within banks of Clematis Creek and some small patches on high banks of creek	<ol style="list-style-type: none"> Clematis Creek banks are approximately 15 m wide 1 m x 1 m patch on creek high bank 	<ol style="list-style-type: none"> 55 J 681337, 7250446 55 J 681286, 7250427 	<p>Yes</p> <p>Landholder sprays to contain Parthenium to Clematis Creek only</p>

- The entire GLNG pipeline alignment through property T-099 was not traversed so these results are an indication only from what was observed during field surveys. As T-099 is surrounded by properties with dense infestations of parthenium, this property is likely to have larger infestations than what was recorded during field surveys.

^ - size of infestations is a best estimate only

` - information obtained from dry season field survey background information



Weed management recommendations: Properties where only small infestations of parthenium exist are still considered 'dirty' in terms of the presence of parthenium. Weed management of these properties should however be considered differently to those properties with dense infestations of parthenium, listed in Section 3.3.1. This will minimise the occurrence of dense parthenium infestations establishing as a result of GLNG pipeline activities. Small infestations of parthenium can be controlled and most landowners have implemented measures to try and control parthenium outbreaks on their properties. Recommendations for the management of parthenium along the GLNG alignment on these properties could include early weed control through pre-construction spraying of parthenium and ongoing monitoring to ensure dense infestations of parthenium have not established.

3.3.3 Properties where parthenium and/or giant rat's tail grass were not identified

From the results of the dry season and post wet season field surveys, 87 properties recorded no infestations of parthenium and/or giant rat's tail grass. These properties were generally located within the Arcadia Valley (approximately between KP 0 and KP 115) and from the Leichhardt Highway to Mount Alma Road (approximately between KP 275 and KP 380). No infestations of parthenium and/or giant rat's tail grass have been recorded on the GLNG pipeline alignment on Curtis Island. The details of properties where no infestations of parthenium and/or giant rat's tail grass were recorded during dry season and post wet season field surveys are outlined in the GLNG Weed Survey Results Table in Appendix A.

3.3.4 Verification of background information results

Table 4 lists the properties that were stated as having parthenium, giant rat's tail grass and/or African lovegrass during the background information gathering process prior to the dry season field surveys, however these weeds were not recorded along the GLNG pipeline alignment or associated access tracks during dry season or post wet season field surveys.

Details of the methodology behind the background information gathering process and findings are outlined in the GLNG Pipeline FEED Weed Survey Report – November 2009 (GHD document number: 21386-D-RP-006_D.pdf).

As these weeds were not recorded during field surveys, for the purposes of this report, properties listed in Table 4 are now classified as 'clean' from either parthenium, giant rat's tail grass and/or African lovegrass stated as occurring on the property from the background information. Additional weeds listed as occurring from the background information may still be present on the properties. Results of weed species recorded during dry season and post wet season field surveys are listed in the GLNG Weed Survey Results Table in Appendix A of this report. Results of the background information are outlined in the GLNG Pipeline FEED Weed Survey Report – November 2009 (GHD document number: 21386-D-RP-006_D.pdf).



Table 4 Properties where suspected parthenium, giant rat's tail grass and/or African lovegrass infestations from background information were not identified during dry season or post wet season field surveys

Property Parcel Number	Suspected weed infestations from background information
CI-009	giant rat's tail grass
CI-010	giant rat's tail grass
CI-011	giant rat's tail grass
CI-012	giant rat's tail grass
T-012	parthenium
T-016	parthenium and African lovegrass
T-017	parthenium
T-018	parthenium
T-021	parthenium and African lovegrass
T-029	African lovegrass
T-030	parthenium
T-032	parthenium and African lovegrass
T-032.5	parthenium
T-032.9	parthenium
T-034.71	African lovegrass
T-034.72	African lovegrass
T-036	African lovegrass
T-044	parthenium
T-053	parthenium
T-054	parthenium
T-055.1	parthenium
T-055.2	parthenium
T-058	parthenium
T-061	parthenium
T-063.2	parthenium
T-064	parthenium, giant rat's tail grass and African lovegrass
T-144	parthenium



Weed management recommendations: Properties where parthenium and giant rat's tail grass were not recorded during field surveys will require vigilance and careful management to ensure weed infestations do not become apparent. Weed management could include ongoing weed surveys within these properties along the GLNG alignment and associated access tracks at yearly intervals during peak growing conditions to record the presence of any new weed outbreaks not previously recorded so appropriate management strategies can be developed.



4. Conclusion

This weed survey was conducted to form baseline data for populations of weed species occurring along the GLNG pipeline alignment. The results presented in this report, attached results table and supporting mapping depict the weeds present at surveyed locations within each property intersected by the GLNG pipeline alignment at the time of survey.

Field surveys were conducted over different seasons and growth cycles to capture optimal growth periods for a number of different weed species. Detailed methodologies and results of the 2009 dry season weed surveys are located in the GLNG Pipeline FEED Weed Survey Report – November 2009 (GHD document number: 21386-D-RP-006_D.pdf) and results are also incorporated into this report.

As a result of time limitations in the field and poor ground conditions of some properties surveyed, not all of the GLNG pipeline alignment or property access tracks could be surveyed on all properties, therefore additional weeds or infestations to those listed in this report, associated results table and supporting mapping may occur. Despite best efforts to record all declared weed species and the locations of minor weed infestations occurring on each property, additional weed infestations may also occur at locations not recorded in this report as a result of different growth cycles of some weed species. Ongoing landholder weed management practices may also provide additional controls to some minor weed infestations that were previously recorded.

The information gathered in this survey will form the basis for decision making regarding weeds and will form an overview of information for the preparation of the GLNG Pipeline Weed Management Plan. The information outlined in this report should be regarded as baseline information. Ongoing weed surveys and monitoring will be required after disturbance events, such as vegetation clearing, and during construction activities to further add to this baseline information and allow sound weed management of the GLNG pipeline to be achieved.



5. References

Bureau of Meteorology. 2010. Daily Weather Observations for Queensland. Available at: <http://www.bom.gov.au/climate/dwo/IDCJDW0400.shtml> accessed 17/06/10.

Natural Resource Management Ministerial Council (2006). Australian Weed Strategy – A national strategy for weed management in Australia. Australian Government Department of the Environment and Water Resources, Canberra ACT.



Appendix A
GLNG Weed Survey Results Table

Last updated: 17 June 2010

GLNG Weed Survey Results Table

Last updated: 17 June 2010

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
Curtis Island	28DS220	LL	The State of Queensland (DIP)	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	✓ ✓ ✓	- - -	Date of dry season survey: 11-12 May 2009 Property not surveyed during post wet season
Curtis Island	11DS220	LL	The State of Queensland (DIP)	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	✓ ✓ ✓	- - -	Date of dry season survey: 11-12 May 2009 Property not surveyed during post wet season
Curtis Island	10DS220	LL	The State of Queensland (DIP)	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	✓ ✓ ✓	- - -	Date of dry season survey: 11-12 May 2009 Property not surveyed during post wet season
Curtis Island	7DS220	LL	The State of Queensland (DIP)	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	✓ ✓ ✓	- - -	Date of dry season survey: 11-12 May 2009 Property not surveyed during post wet season
not advised	1RP612108	FH	not advised	<i>Opuntia</i> spp. (prickly pear)	-	✓	Property not surveyed during dry season. Date of post wet season survey: 15-17 February 2010
not advised	137FTY1831	SF	not advised	<i>Lantana camara</i> (lantana)	-	✓	Property not surveyed during dry season. Date of post wet season survey: 15-17 February 2010
CI-001A	92DS654	LL					Property not surveyed due to time restrictions
CI-002A	401DT4026	FH	Wells Butler C & B	<i>Bryophyllum delagoense</i> (mother-of-millions)		✓	Property not surveyed during dry season
not advised	2MPH34582	FH	not advised	<i>Lantana camara</i> (lantana) <i>Lantana montevidensis</i> (creeping lantana)	- -	✓ ✓	Date of post wet season survey: 15-17 February 2010
not advised	2RP897093	FH	not advised	<i>Lantana camara</i> (lantana)	-	✓	Property not surveyed during dry season. Date of post wet season survey: 15-17 February 2010
CI-009	2DS725	FH	The Coordinator-General	<i>Bryophyllum delagoense</i> (mother-of-millions)	-	✓	Property not surveyed during dry season
CI-010	3MPH14076	FH	The Coordinator-General	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear)	- -	✓ ✓	Date of post wet season survey: 15-17 February 2010 Property not surveyed during dry season
CI-010	1MPH14076	FH	The Coordinator-General	<i>Cryptostegia grandiflora</i> (rubber vine) <i>Lantana camara</i> (lantana)	- -	✓ ✓	Date of post wet season survey: 15-17 February 2010 Property not surveyed during dry season
CI-010	86DS636	FH	The Coordinator-General	<i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	- -	✓ ✓	Date of post wet season survey: 15-17 February 2010 Property not surveyed during dry season
CI-011	1SP108915	FH	The Coordinator-General	<i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear)	- -	✓ ✓	Property not surveyed during dry season Date of post wet season survey: 15-17 February 2010
CI-011	2SP108915	FH	The Coordinator-General	<i>Cryptostegia grandiflora</i> (rubber vine) <i>Lantana camara</i> (lantana)	- -	✓ ✓	Property not surveyed during dry season Date of post wet season survey: 15-17 February 2010
CI-012	45RP894241	FH	The Coordinator-General	<i>Opuntia</i> spp. (prickly pear) <i>Cryptostegia grandiflora</i> (rubber vine)	- -	✓ ✓	Property not surveyed during dry season Date of post wet season survey: 15-17 February 2010
CI-013	1DT4044	FH	The Minister for Industrial Relations	<i>Sporobolus pyramidalis</i> (giant rat's tail grass) <i>Lantana camara</i> (lantana)	- -	✓ ✓	Property not surveyed during dry season Date of post wet season survey: 15-17 February 2010
CI-013	2SP157677	FH	The Minister for Industrial Relations	<i>Opuntia</i> spp. (prickly pear) <i>Sporobolus pyramidalis</i> (giant rat's tail grass)	- -	✓ ✓	Property not surveyed during dry season Date of post wet season survey: 15-17 February 2010

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
				<i>Lantana camara</i> (lantana)	✓		Date of post wet season survey: 15-17 February 2010
				<i>Opuntia</i> spp. (prickly pear)	✓		
CI-014	8SP200847	FH	The Minister for Industrial Relations	<i>Sporobolus pyramidalis</i> (giant rats tail grass)		✓	Property not surveyed during dry season. Date of post wet season survey: 15-17 February 2010
CI-014	9SP200837	FH	The Minister for Industrial Relations	<i>Sporobolus pyramidalis</i> (giant rats tail grass)		✓	Property not surveyed during dry season
CI-014	2SP147877	FH	The Minister for Industrial Relations	<i>Cryptostegia grandiflora</i> (rubber vine)		✓	Date of post wet season survey: 15-17 February 2010
CI-014	6SP101558	FH	The Minister for Industrial Relations	<i>Sporobolus pyramidalis</i> (giant rats tail grass)		✓	Property not surveyed during dry season. Date of post wet season survey: 15-17 February 2010
CI-014	4RP620657	FH	The Minister for Industrial Relations	<i>Sporobolus pyramidalis</i> (giant rats tail grass)		✓	Property not surveyed during dry season
CI-015	525CL40243	FH	Rideout BR, DE, IL & RA	<i>Opuntia</i> spp. (prickly pear)		✓	Date of post wet season survey: 15-17 February 2010
CI-015	3RP801363	FH	Rideout BR, DE, IL & RA	<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009
CI-015	67CL40347	FH	Rideout BR, DE, IL & RA	<i>Bryophyllum delagoense</i> (mother-of-millions)	✓		Date of post wet season survey: 26-30 April 2010
T-001	525CL40243	FH	Rideout BR, DE, IL & RA	<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009
T-001	524CL40243	FH	Rideout BR, DE, IL & RA	<i>Parthenium hysterophorus</i> (parthenium)	✓		Date of post wet season survey: 26-30 April 2010
T-001	524CL40243	FH	Rideout BR, DE, IL & RA	<i>Bryophyllum delagoense</i> (mother-of-millions)	✓		Date of dry season survey: 7-8 September 2009
T-006	479CL40215	FH	Chapman TR & LC	<i>Lantana camara</i> (lantana)	✓		Date of post wet season survey: 26-30 April 2010
T-006	48CTN512	FH	Chapman TR & LC	<i>Parthenium hysterophorus</i> (parthenium)	✓		Date of dry season survey: 7-8 September 2009
T-006	48CTN512	FH	Chapman TR & LC	<i>Bryophyllum delagoense</i> (mother-of-millions)	✓		Date of post wet season survey: 26-30 April 2010
T-009	49CTN512	FH	JM White	<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009
T-009.5	4RP860093	FH	Reynolds JA & JK	<i>Parthenium hysterophorus</i> (parthenium)	✓		Date of post wet season survey: 26-30 April 2010
T-010	6CTN812615	FH	Dingle DR & JA	<i>Lantana camara</i> (lantana)	✓		Date of post wet season survey: 15-17 February 2010
T-010	218CL4081	FH	Dingle DR & JA	<i>Praxelis clematidea</i> (praxelis)	✓		Date of post wet season survey: 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 7-8 September 2009
				<i>Praxelis clematidea</i> (praxelis)	✓		Date of post wet season survey: 26-30 April 2010
				<i>Bidens pilosa</i> (cobbler's pegs)	✓		Date of dry season survey: 7-8 September 2009
				<i>Parthenium hysterophorus</i> (parthenium)	✓		Date of post wet season survey: 26-30 April 2010
				<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009
				<i>Lantana montevidensis</i> (creeping lantana)	✓		Date of post wet season survey: 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 7-8 September 2009
				<i>Praxelis clematidea</i> (praxelis)	✓		Date of post wet season survey: 26-30 April 2010
				<i>Praxelis clematidea</i> (praxelis)	✓		Date of dry season survey: 7-8 September 2009
				<i>Lantana montevidensis</i> (creeping lantana)	✓		Date of post wet season survey: 15-17 February 2010
				<i>Praxelis clematidea</i> (praxelis)	✓		Date of post wet season survey: 26-30 April 2010
				no declared weeds recorded			Date of post wet season survey: 26-30 April 2010
				<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009
				<i>Lantana montevidensis</i> (creeping lantana)	✓		Date of post wet season survey: 15-17 February and 26-30 April 2010
				<i>Cryptostegia grandiflora</i> (rubber vine)	✓		

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
T-018	19CTN345	FH	Redshirt Pastoral Company Pty Ltd	<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 7-8 September 2009 Date of post wet season survey: 26-30 April 2010
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Cryptostegia grandiflora</i> (rubber vine)	✓		
				<i>Cascabela thevetia</i> (yellow oleander)		✓	
				<i>Xanthium occidentale</i> (noogoora burr)		✓	
				<i>Bidens pilosa</i> (cobblers pegs)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
T-018.5	25CTN406	RE	GRC	<i>Lantana montevidensis</i> (creeping lantana)			Date of dry season survey: 7-8 September 2009 Date of post wet season survey: 15-17 February and 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓		
				<i>Cryptostegia grandiflora</i> (rubber vine)		✓	
				<i>Eragrostis curvula</i> (African love grass)		✓	
				<i>Xanthium occidentale</i> (noogoora burr)		✓	
				<i>Praxelis clematidea</i> (praxelis)		✓	
				<i>Bidens pilosa</i> (cobblers pegs)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Opuntia</i> spp. (prickly pear)		✓	
T-021	23CTN1233	FH	Wilson ARL	<i>Lantana camara</i> (lantana)			Date of dry season survey: 7-8 September 2009 Date of post wet season survey: 15-17 February 2010
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Cryptostegia grandiflora</i> (rubber vine)	✓		
				<i>Lantana camara</i> (lantana)		✓	
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)		✓	
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Acacia nilotica</i> (prickly acacia)		✓	
T-029	2RN1093	LL	Neilsen FK, VJ, WK & PM	<i>Lantana camara</i> (lantana)	✓		Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓		
				<i>Xanthium occidentale</i> (noogoora burr)		✓	
				<i>Bidens pilosa</i> (cobblers pegs)		✓	
				<i>Acacia nilotica</i> (prickly acacia)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Cryptostegia grandiflora</i> (rubber vine)	✓		
				<i>Opuntia</i> spp. (prickly pear)	✓		
				<i>Eragrostis curvula</i> (African love grass)		✓	
T-030	41RN800347	FH	Tarry WL, KM & DE, Foote DL	<i>Bidens pilosa</i> (cobblers pegs)			Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 26-30 April 2010
				<i>Praxelis clematidea</i> (praxelis)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Eragrostis curvula</i> (African love grass)		✓	
				<i>Bidens pilosa</i> (cobblers pegs)		✓	
				<i>Praxelis clematidea</i> (praxelis)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
T-030.5	1RP843125	FH	Bond CH & AA	<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 15-19 June 2009. Property not surveyed during post wet season
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Acacia nilotica</i> (prickly acacia)	✓		
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
T-031	2RP843125	FH	Baker MJ & McFadden KL	<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 15-19 June 2009. Property not surveyed during post wet season
				<i>Lantana montevidensis</i> (creeping lantana)	✓		
				<i>Acacia nilotica</i> (prickly acacia)	✓		
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
T-031.5	3RP843125	FH	Pickering TF & CA	<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 26-30 April 2010
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
T-032	5RP843128	FH	Ferry WGJ & DE	<i>Opuntia</i> spp. (prickly pear)	✓		Date of dry season survey: 15-19 June 2009. Property not surveyed during post wet season
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		
				<i>Lantana montevidensis</i> (creeping lantana)		✓	
				<i>Opuntia</i> spp. (prickly pear)		✓	
				<i>Lantana camara</i> (lantana)	✓		

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
T-041	35RN1155	FH	MILLER	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 15-19 June 2009, Date of post wet season survey: 26-30 April 2010
T-041.1	138RN976	FH	Miller RG	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 15-19 June 2009, Date of post wet season survey: 26-30 April 2010
T-041.1	31RN349	FH	Miller RG	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 15-19 June 2009, Date of post wet season survey: 26-30 April 2010
T-041.1	139RN350	RE	Miller RG	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 15-19 June 2009, Date of post wet season survey: 26-30 April 2010
T-042	32RN1155	FH	Zischke LN & JGR	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 15-19 June 2009
T-043	23RN347	FH	Heid WK	<i>Bryophyllum delagoense</i> (mother-of-millions)	-	✓	Date of post wet season survey: 26-30 April 2010
T-044	24RN347	FH	Heid LK	no declared weeds recorded	-	-	Date of dry season survey: 29 June - 3 July 2009, Date of post wet season survey: 26-30 April 2010
T-044	25RN347	FH	Heid LK	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 29 June - 3 July 2009
T-044.2	11RP618897	FH	Urquhart AD	<i>Macfadyena unguis-cati</i> (cat's claw creeper)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
T-046	1RN347	FH	Heid WL	<i>Cryptostegia grandiflora</i> (rubber vine)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
T-047	75PM207	FH	Carige JW & BM	<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	Date of post wet season survey: 26-30 April 2010
T-048	84PM207	FH	Carige JM & GL	<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
T-050	82PM222	FH	De Landelles KLS & PM, Muller GM & MJ	<i>Sclerolaena birchii</i> (galvanised burr)	✓	✓	Date of post wet season survey: 26-30 April 2010
T-051	81PM222	FH	De Landelles PM	<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
T-052	91PM224	FH	Thompson BR	<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	Date of post wet season survey: 26-30 April 2010
T-053	61PM224	FH	Howard IM, VA and Estate of Howard NJ	<i>Bryophyllum delagoense</i> (mother-of-millions)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
T-054	59PM224	FH	Howard VA	<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of post wet season survey: 26-30 April 2010
T-055.1	58PM229	FH	Howard JG	<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of dry season survey: 29 June - 3 July 2009
T-055.2	57PM83	LL	Howard JG	<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post wet season survey: 26-30 April 2010
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Xanthium occidentale</i> (noogoora burr)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Xanthium occidentale</i> (noogoora burr)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Bryophyllum delagoense</i> (mother-of-millions)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Xanthium occidentale</i> (noogoora burr)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	Date of post wet season survey: 26-30 April 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Bidens pilosa</i> (cobbler's pegs)	✓	✓	Date of post wet season survey: 26-30 April 2010
				<i>Praxelis clematidea</i> (praxelis)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post wet season survey: 26-30 April 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	Date of dry season survey: 29 June - 3 July 2009

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
T-058	34RP621029	FH	Hobson GV	<i>Xanthium spinosum</i> (bathurst burr) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Opuntia</i> spp. (prickly pear) <i>Xanthium occidentale</i> (noogoora burr) <i>Scierolaena birchii</i> (galvanised burr) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-058	2SP122586	FH	Hobson GV	<i>Bryophyllum delagoense</i> (mother-of-millions) <i>Opuntia</i> spp. (prickly pear) <i>Xanthium occidentale</i> (noogoora burr) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓		
T-061	4FN6	FH	Calungba Pty Ltd	<i>Bidens pilosa</i> (cobbler's pegs) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed) <i>Xanthium occidentale</i> (noogoora burr) <i>Scierolaena birchii</i> (galvanised burr) <i>Bidens pilosa</i> (cobbler's pegs)	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-061	20FN491	FH	Calungba Pty Ltd	<i>Bryophyllum delagoense</i> (mother-of-millions) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-061	3FER4025	FH	Calungba Pty Ltd	<i>Bryophyllum delagoense</i> (mother-of-millions) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed) <i>Xanthium occidentale</i> (noogoora burr)	✓ ✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-063.1	5FN10	LL	Hills Family Property Pty Ltd	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Xanthium occidentale</i> (noogoora burr) <i>Scierolaena birchii</i> (galvanised burr) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-063.2	22FN301	FH	Hills Family Property Pty Ltd	<i>Bidens pilosa</i> (cobbler's pegs) <i>Opuntia</i> spp. (prickly pear) <i>Senecio pinnatifolius</i> (native fireweed) <i>Xanthium occidentale</i> (noogoora burr)	✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-064	25FN302	FH	Galletly JS	<i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass)	✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-064.5	26FN302	LL	Littleton	no declared weeds recorded	-		
T-065	21FN306	FH	Dingle WB & KL	<i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Xanthium occidentale</i> (noogoora burr) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-066.1	40FN305	FH	Palmtree Wetaru Aboriginal Corporation for Land & Culture	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed) <i>Xanthium occidentale</i> (noogoora burr)	✓ ✓ ✓ ✓ ✓	Date of dry season survey: 29 June - 3 July 2009 Date of post wet season survey: 2-6 June 2010	
T-066.2	39FN305	LL	Palmtree Wetaru Aboriginal Corporation for Land & Culture	<i>Parthenium hysterophorus</i> (parthenium)	✓	Date of dry season survey: 29 June - 3 July 2009	

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	
				<i>Xanthium occidentale</i> (noogoora burr)	✓	-	
T-068	49FN352	LL	Muller KJ, CL, DW & NG	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post wet season survey: 2-6 June 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
T-070	2FN197	LL	Gillis AJ & RW	<i>Parthenium hysterophorus</i> (parthenium)	✓	-	Date of dry season survey: 29 June - 3 July 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	
T-071	10FN207	FH	Rider RG	<i>Parthenium hysterophorus</i> (parthenium)	✓	-	Property not surveyed during dry season
				<i>Opuntia</i> spp. (prickly pear)	-	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
T-072	3FN207	LL	Swan SJ & JW	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 29 June - 3 July 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	-	
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
T-072.6	12CP895590	LL	Swan JW	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Cryptostegia grandiflora</i> (rubber vine)	✓	-	Date of post wet season survey: 2-6 June 2010
				<i>Bryophyllum delagoense</i> (mother-of-millions)	✓	-	
				<i>Opuntia</i> spp. (prickly pear)	✓	-	
				<i>Xanthium occidentale</i> (noogoora burr)	✓	-	
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	
T-075	37FN606	FH	Price G & LM	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Cryptostegia grandiflora</i> (rubber vine)	-	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
T-075	1RP901793	FH	Price G & LM	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post wet season survey: 2-6 June 2010
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
				<i>Bidens pilosa</i> (cobblers pegs)	-	✓	
T-075	16FN606	FH	Price G & LM	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
				<i>Bidens pilosa</i> (cobblers pegs)	-	✓	
T-075.3	38FN606	FH	Morris BA	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	-	Date of post. wet season survey: 2-6 June 2010
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
T-075.6	8KM87	FH	Fedderson GC & CL	<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of post. wet season survey: 2-6 June 2010
				<i>Parthenium hysterophorus</i> (parthenium)	✓	✓	Date of dry season survey: 15-19 June 2009
T-076	7KM142	FH	Maclean LA	<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of dry season survey: 15-19 June 2009
				<i>Chloris virgata</i> (feathertop rhodes grass)	✓	-	Date of post wet season survey: 2-6 June 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
T-078	4KM74	FH	Hood AGB	<i>Parthenium hysterophorus</i> (parthenium) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Cryptostegia grandiflora</i> (rubber vine) <i>Opuntia</i> spp. (prickly pear) <i>Bidens pilosa</i> (cobbler's pegs)	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-080.1	5KM65	FH	Dahl JP & JJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓	✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-080.2	4KM152	FH	Dahl DO & JJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓	✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-081	1SP197365	FH	Dales PD	<i>Parthenium hysterophorus</i> (parthenium) <i>Lantana camara</i> (lantana) <i>Opuntia</i> spp. (prickly pear) <i>Xanthium occidentale</i> (noogoora burr)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-082	10BH223	FH	Hood EE & McBryde DK	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-083	13RP620842	FH	Fairweather LR & D	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-086	1SP136872	FH	Stephenson GJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Chloris virgata</i> (feathertop rhodes grass) <i>Senecio pinnatifolius</i> (native fireweed)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-087	9BH97	FH	Simmonds CH, Byriell RJ & JP	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-088	5BH138	LL	Nobbs SA	<i>Parthenium hysterophorus</i> (parthenium) <i>Parthenium hysterophorus</i> (parthenium)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-089	28RP911528	FH	Simmonds CH	<i>Opuntia</i> spp. (prickly pear) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Chloris virgata</i> (feathertop rhodes grass)	✓ ✓ ✓	✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-089	14BH207	FH	Simmonds CH	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear) <i>Bryophyllum delagoense</i> (mother-of-millions) <i>Chloris virgata</i> (feathertop rhodes grass)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-091	28BH244	FH	Mars CR & FJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-091	15BH243	FH	Mars CR & FJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-091	27RP911528	FH	Mars CR & FJ	<i>Parthenium hysterophorus</i> (parthenium) <i>Opuntia</i> spp. (prickly pear)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-092	36BH278	FH	Crowther SAR	<i>Bryophyllum delagoense</i> (mother-of-millions) <i>Parthenium hysterophorus</i> (parthenium)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010
T-095	16BH269	FH	Carter DA	<i>Opuntia</i> spp. (prickly pear) <i>Parthenium hysterophorus</i> (parthenium)	✓ ✓	✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 2-6 June 2010

Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
T-141	4WT217	LL	Ward DL	Opuntia spp. (prickly pear) Xanthium spinosum (bathurst burr) Senecio pinnatifolius (native fireweed) Bidens pilosa (cobbler's pegs)	✓ ✓ - -	✓ ✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-142	20WT32	LL	Warrion RH	Opuntia spp. (prickly pear) Xanthium occidentale (noogoora burr) Senecio pinnatifolius (native fireweed) Sclerolaena birchii (galvanised burr) Alternanthera pungens (khaki burr)	✓ ✓ - - -	✓ ✓ - - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-143	13WT18	FH	Warrion GHN	Opuntia spp. (prickly pear) Sclerolaena birchii (galvanised burr) Harrisia martinii (harrisia cactus)	✓ ✓ -	✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-144	8AB200	FH	Doce Pty Ltd	Xanthium occidentale (noogoora burr) Harrisia martinii (harrisia cactus) Opuntia spp. (prickly pear) Sclerolaena birchii (galvanised burr)	✓ ✓ ✓ -	✓ ✓ ✓ -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-151	6TR11	FH	O'Sullivan ST & GP	Opuntia spp. (prickly pear) Alternanthera pungens (khaki burr) Sclerolaena birchii (galvanised burr) Xanthium occidentale (noogoora burr) Senecio pinnatifolius (native fireweed) Xanthium spinosum (bathurst burr)	✓ ✓ ✓ - - -	✓ - ✓ ✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-153	7TR39	FH	Ratcliffe RL	Opuntia spp. (prickly pear) Xanthium occidentale (noogoora burr) Alternanthera pungens (khaki burr)	✓ ✓ -	✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-154	8TR15	FH	Hardenley Pty Ltd	Senecio pinnatifolius (native fireweed) Sclerolaena birchii (galvanised burr) Xanthium spinosum (bathurst burr)	✓ ✓ -	✓ ✓ -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-155	9TR17	LL	Benn OK & DK	Opuntia spp. (prickly pear) Sclerolaena birchii (galvanised burr) Senecio pinnatifolius (native fireweed)	✓ ✓ -	✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-156	5TR18	LL	Peart WJ	Opuntia spp. (prickly pear) Sclerolaena birchii (galvanised burr) Xanthium occidentale (noogoora burr)	✓ ✓ -	✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-157	6TR20	FH	Groat MC & KC	Opuntia spp. (prickly pear) Sclerolaena birchii (galvanised burr) Xanthium occidentale (noogoora burr) Bidens pilosa (cobbler's pegs) Xanthium spinosum (bathurst burr)	✓ ✓ - - -	✓ - ✓ ✓ -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-158	7TR22	FH	Winter CJ	Opuntia spp. (prickly pear) Senecio pinnatifolius (native fireweed) Sclerolaena birchii (galvanised burr) Xanthium occidentale (noogoora burr)	✓ ✓ ✓ -	✓ - - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-159	8TR23	FH	Price AW	Opuntia spp. (prickly pear) Xanthium occidentale (noogoora burr) Senecio pinnatifolius (native fireweed) Sclerolaena birchii (galvanised burr)	✓ ✓ ✓ -	✓ ✓ - -	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010
T-160	807PH1979	SL	State of Queensland (DERM)	Sclerolaena birchii (galvanised burr) Harrisia martinii (harrisia cactus) Opuntia spp. (prickly pear)	✓ ✓ ✓	✓ ✓ ✓	Date of dry season survey: 15-19 June 2009 Date of post wet season survey: 10-14 May 2010

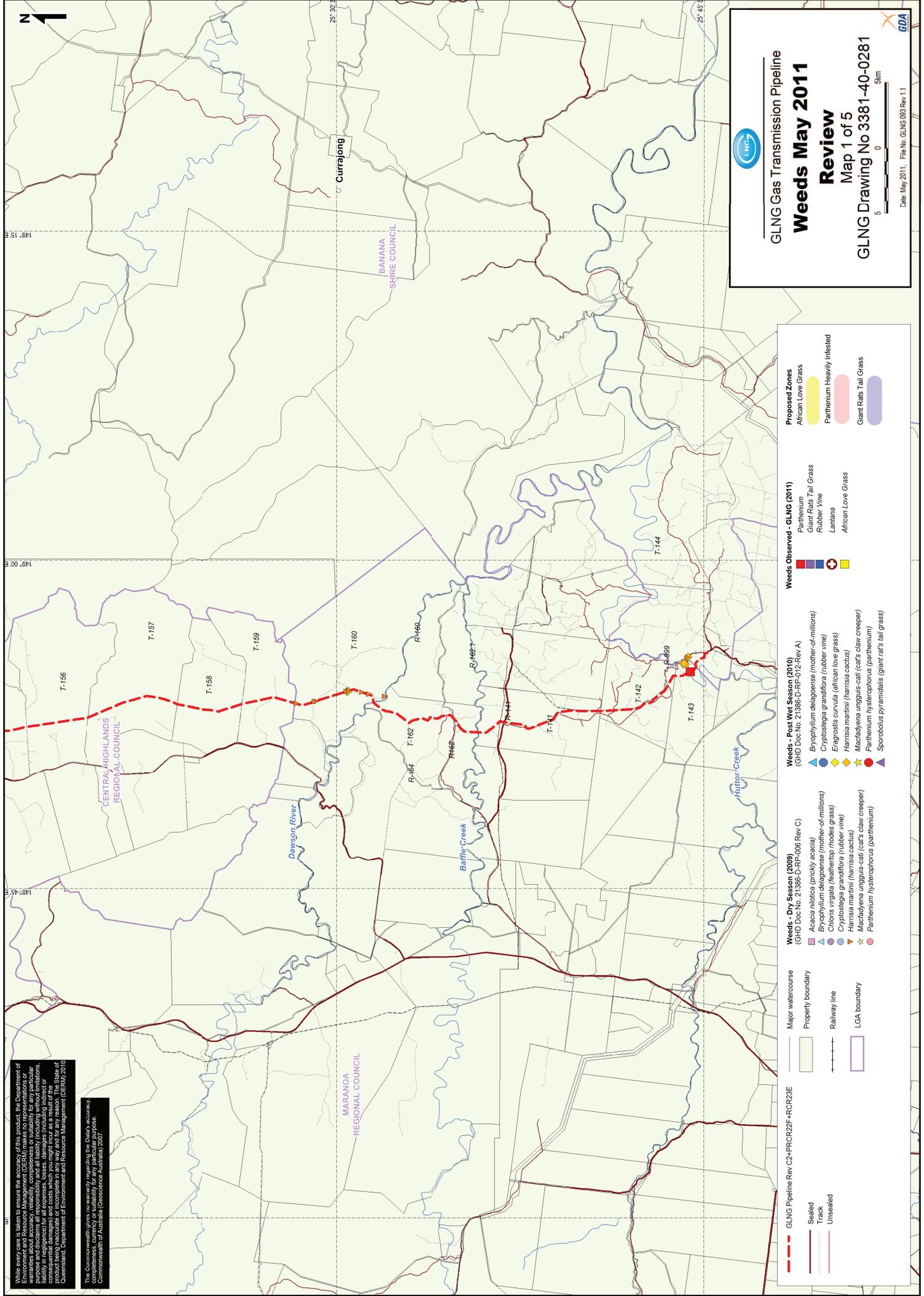
Property Parcel Number	Lot on Plan	Tenure	Landholder	Weed Names	Weeds Identified During Field Surveys		Notes
					Dry Season (2009)	Post Wet Season (2010)	
				<i>Senecio pinnatifolius</i> (native fireweed)	✓	✓	
				<i>Xanthium occidentale</i> (noogoora burr)	-	✓	
				<i>Bidens pilosa</i> (cobblers' pegs)	-	✓	
				<i>Opuntia</i> spp. (prickly pear)	✓	✓	Date of dry season survey: 15-19 June 2009
T-162	1WT37	FH	Peterson JG	<i>Xanthium occidentale</i> (noogoora burr)	-	✓	Date of post wet season survey: 10-14 May 2010
				<i>Senecio pinnatifolius</i> (native fireweed)	-	✓	
				<i>Bidens pilosa</i> (cobblers' pegs)	-	✓	



Appendix B

Weed Management Plan Overview Maps

Data for the Weed Management Plan Overview Maps has been provided by GHD from the results of the 2009 dry season and 2010 post wet season weed field surveys along the GLNG pipeline alignment. Mapping of this data has been produced externally by GLNG



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GLNG Gas Transmission Pipeline
Weeds May 2011
Review
 Map 1 of 5
 GLNG Drawing No 3381-40-0281

Scale: 1:50,000
 0 5 10 km
 Date: May 2011, File No. GLNG 093 Rev 1.1


GLNG Pipeline Rev. C5+PRCR2F+RCR23E

Major watercourse
 — Dawson River
 — Baffle Creek
 — Hutcheon Creek

Property boundary
 —

Railway line
 —

LGA boundary
 —

Sealed
 —

Track
 —

Unsealed
 —

Weeds - Dry Season (2009)
 (GHD Doc No. 21386-D-PP-006 Rev C)
 ■ Acacia nilotica (prickly acacia)
 ▲ Bryophyllum delagoense (mother-of-millions)
 ● Choris virgata (feathertop rhodes grass)
 ● Cryptostegia grandiflora (rubber vine)
 ● Harrisia martinii (harrisia cactus)
 ☆ Macclayena unguis-cati (cat's claw creeper)
 ● Parthenium hysterophorus (parthenium)

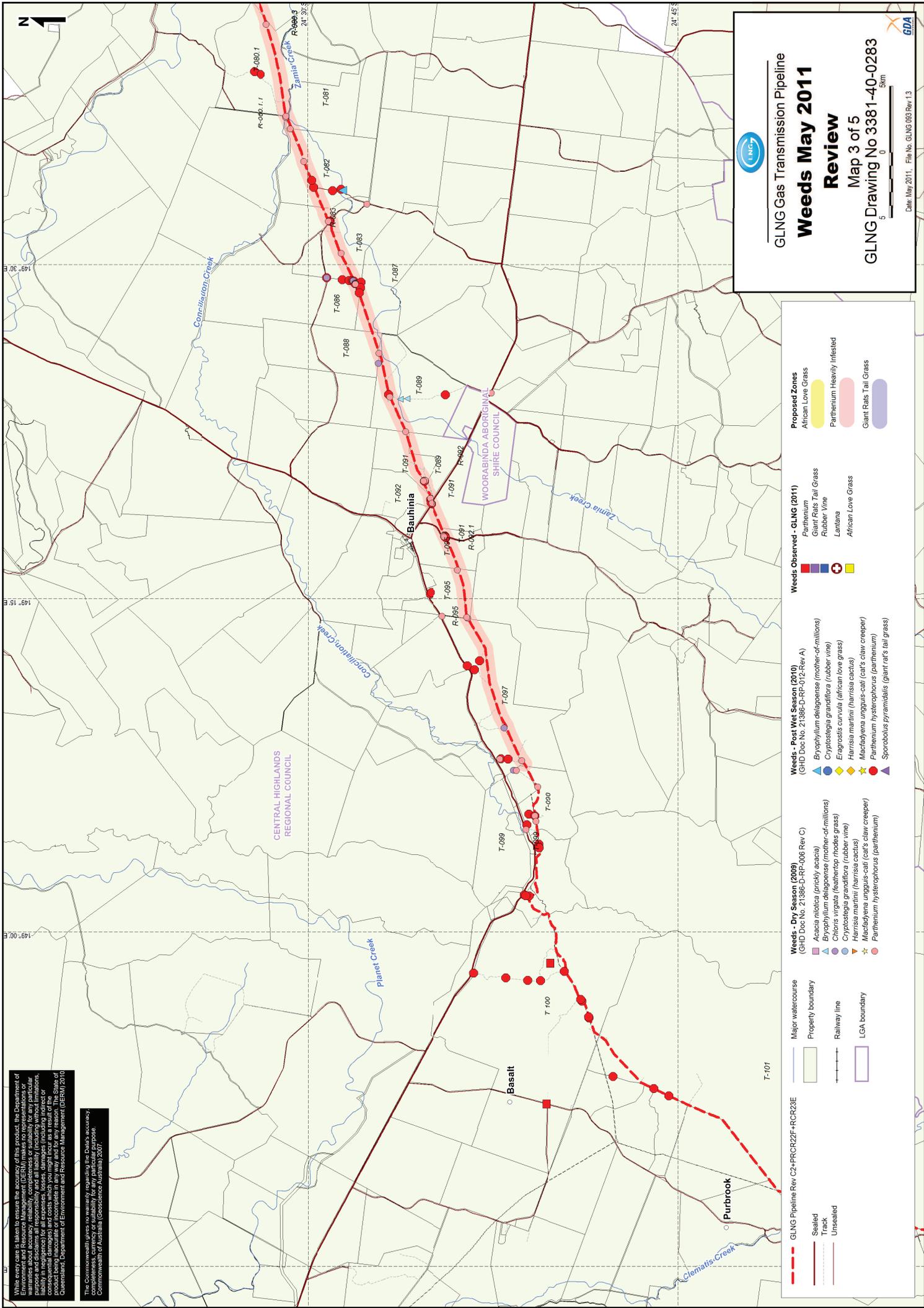
Weeds - Post Wet Season (2010)
 (GHD Doc No. 21386-D-PP-012-Rev A)
 ▲ Bryophyllum delagoense (mother-of-millions)
 ● Cryptostegia grandiflora (rubber vine)
 ● Eragrostis curvula (african love grass)
 ● Harrisia martinii (harrisia cactus)
 ☆ Macclayena unguis-cati (cat's claw creeper)
 ● Parthenium hysterophorus (parthenium)
 ▲ Sporobolus pyramidalis (giant rat's tail grass)

Weeds Observed - GLNG (2011)
 ■ Parthenium
 ■ Giant Rats Tail Grass
 ■ Rubber Vine
 ■ Lantana
 ■ African Love Grass

Proposed Zones
 ■ African Love Grass
 ■ Parthenium Heavily Infested
 ■ Giant Rats Tail Grass

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GLNG Gas Transmission Pipeline

Weeds May 2011

Review

Map 3 of 5

GLNG Drawing No 3381-40-0283

5 0 5km

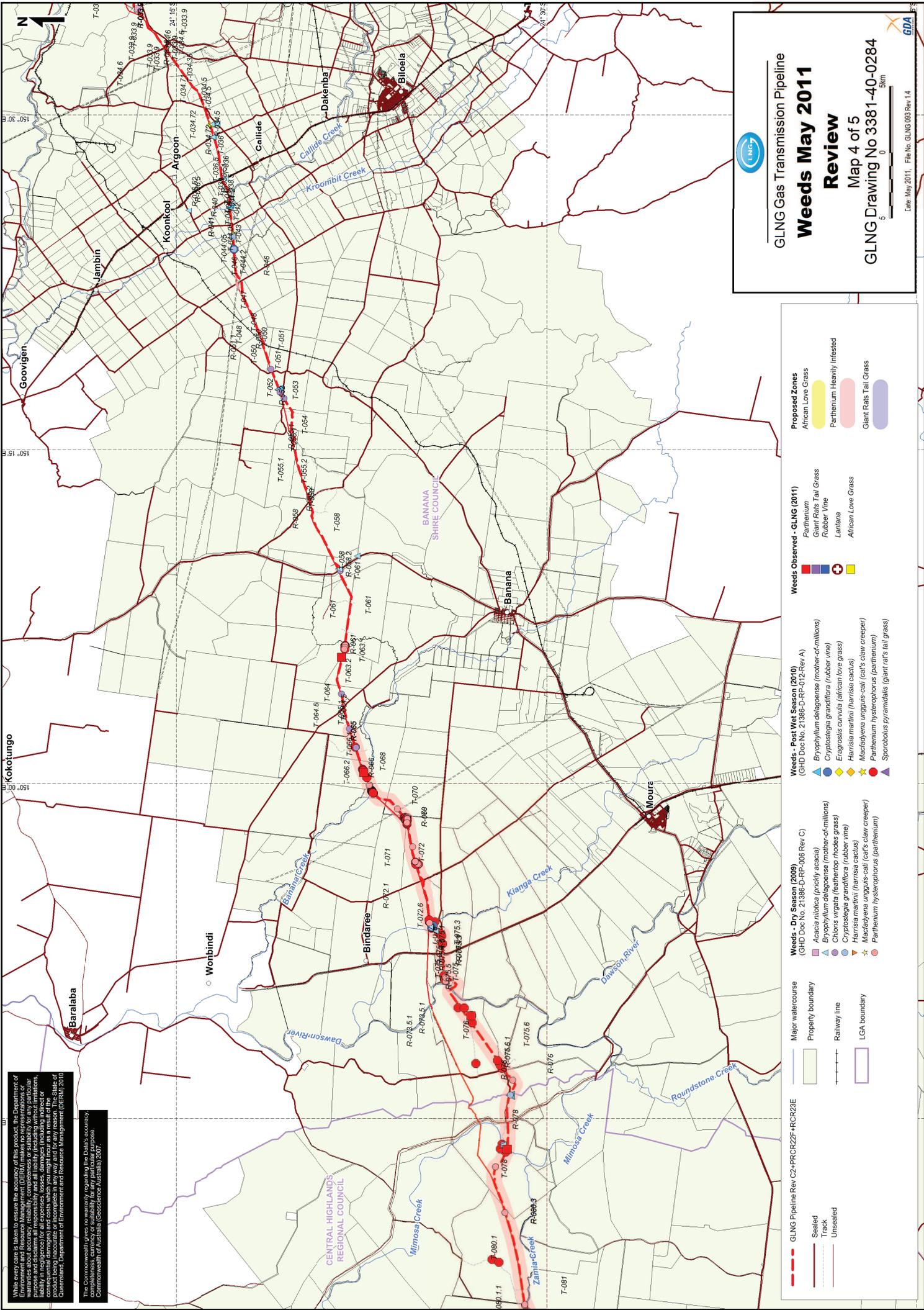
Date: May 2011, File No. GLNG 093 Rev 1.3



<p>GLNG Pipeline Rev C4+PRCR2F+RCR23E</p> <ul style="list-style-type: none"> Sealed Track Unsealed Track 	<p>Major watercourse</p> <ul style="list-style-type: none"> Property boundary Railway line LGA boundary 	<p>Weeds - Dry Season (2009) (GHD Doc No. 21386-D-PP-006 Rev C)</p> <ul style="list-style-type: none"> Acacia nilotica (prickly acacia) Bryophyllum delagoense (mother-of-millions) Choriz virgata (feathertop rhodes grass) Cryptostegia grandiflora (rubber vine) Harrisia martinii (harrisia cactus) Macleayena unguis-cati (cat's claw creeper) Parthenium hysterophorus (parthenium) 	<p>Weeds - Post Wet Season (2010) (GHD Doc No. 21386-D-PP-012 Rev A)</p> <ul style="list-style-type: none"> Bryophyllum delagoense (mother-of-millions) Cryptostegia grandiflora (rubber vine) Eragrostis curvula (african love grass) Harrisia martinii (harrisia cactus) Macleayena unguis-cati (cat's claw creeper) Parthenium hysterophorus (parthenium) Sporobolus pyramidalis (giant rat's tail grass) 	<p>Weeds Observed - GLNG (2011)</p> <ul style="list-style-type: none"> Parthenium Giant Rats Tail Grass Rubber Vine Lantana African Love Grass 	<p>Proposed Zones</p> <ul style="list-style-type: none"> African Love Grass Parthenium Heavily Infested Giant Rats Tail Grass
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GLNG Gas Transmission Pipeline
Weeds May 2011
Review
 Map 4 of 5
 GLNG Drawing No 3381-40-0284
 5 0 5 Km

GLNG Pipeline Rev. C4-PRCR2F+RCCR2E

- Major watercourse
- Sealed Track
- Unsealed Track
- Railway line
- LGA boundary

Weeds - Dry Season (2009)
(GHD Doc No. 21386-D-PP-006 Rev C)

- Acacia nilotica (prickly acacia)
- Bryophyllum delagoense (mother-of-millions)
- Choris virgata (feathertop rhodes grass)
- Cryptostegia grandiflora (rubber vine)
- Harrisia martinii (harrisia cactus)
- Maccladyena unguis-cati (cat's claw creeper)
- Parthenium hysterophorus (parthenium)

Weeds - Post Wet Season (2010)
(GHD Doc No. 21386-D-PP-072-Rev A)

- Bryophyllum delagoense (mother-of-millions)
- Cryptostegia grandiflora (rubber vine)
- Eragrostis curvula (african love grass)
- Harrisia martinii (harrisia cactus)
- Maccladyena unguis-cati (cat's claw creeper)
- Parthenium hysterophorus (parthenium)
- Sporobolus pyramidalis (giant rat's tail grass)

Weeds Observed - GLNG (2011)

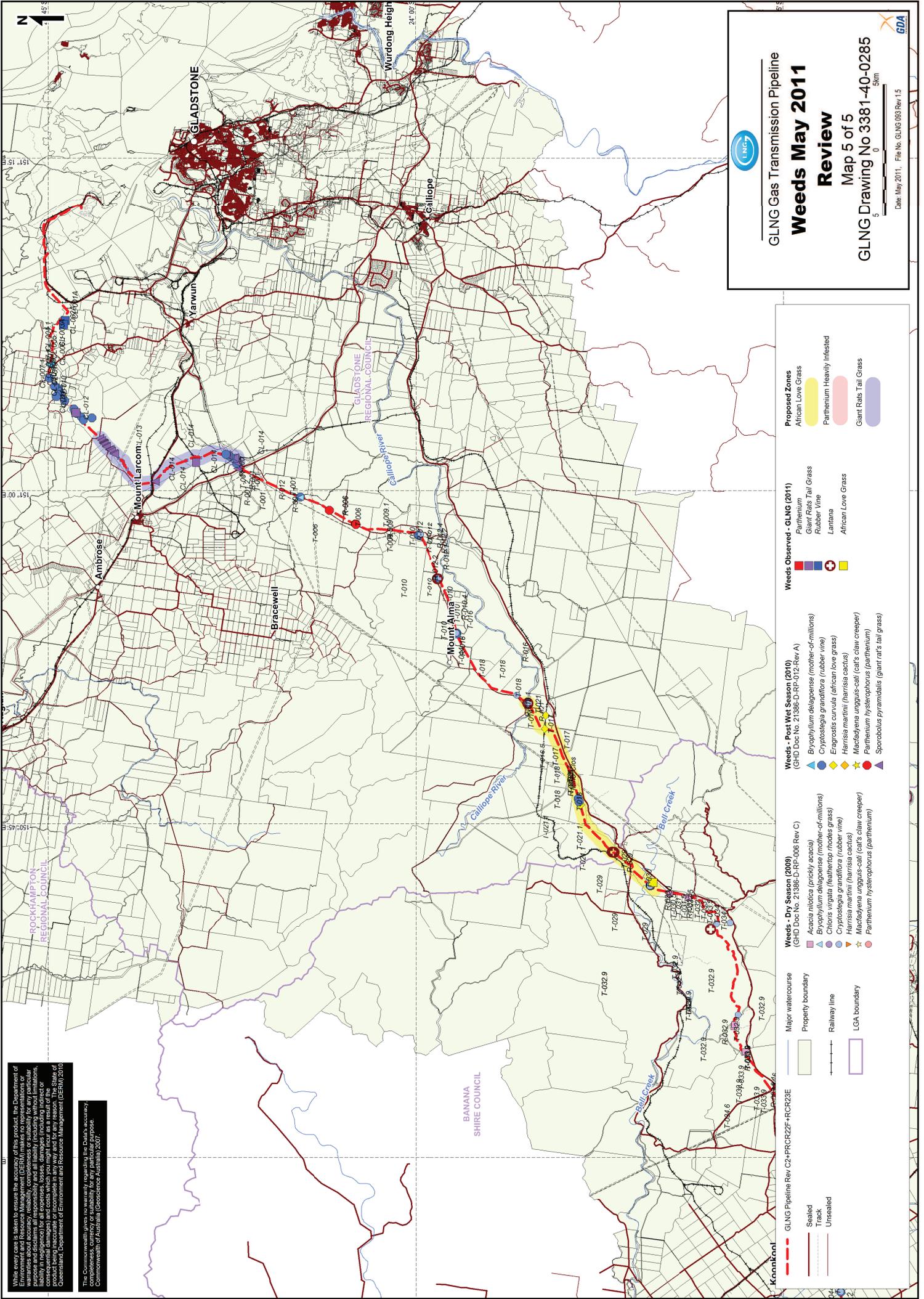
- Parthenium
- Giant Rats Tail Grass
- Rubber Vine
- Lantana
- African Love Grass

Proposed Zones

- African Love Grass
- Parthenium Heavily Infested
- Giant Rats Tail Grass

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GLNG Gas Transmission Pipeline

Weeds May 2011

Review

Map 5 of 5

GLNG Drawing No 3381-40-0285

Date: May 2011, File No. GLNG 093 Rev 1.5



Proposed Zones

- African Love Grass
- Parthenium Heavily Infested
- Giant Rats Tail Grass

Weeds Observed - GLNG (2011)

- Parthenium
- Giant Rats Tail Grass
- Rubber Vine
- Lantana
- African Love Grass

Weeds - Post Wet Season (2010)
(GHD Doc No. 21386-D-RP-012-Rev A)

- Bryophyllum delagoense (mother-of-millions)
- Cryptostegia grandiflora (rubber vine)
- Eragrostis curvula (african love grass)
- Harrisia martinii (harrisia cactus)
- Maccladyena unguis-cati (cat's claw creeper)
- Parthenium hysterophorus (parthenium)
- Sporobolus pyramidalis (giant rat's tail grass)

Weeds - Dry Season (2009)
(GHD Doc No. 21386-D-RP-006 Rev C)

- Acacia nilotica (prickly acacia)
- Bryophyllum delagoense (mother-of-millions)
- Choriz virgata (feathertop rhodes grass)
- Cryptostegia grandiflora (rubber vine)
- Harrisia martinii (harrisia cactus)
- Maccladyena unguis-cati (cat's claw creeper)
- Parthenium hysterophorus (parthenium)

Infrastructure

- GLNG Pipeline Rev C2+PRCR22+RCR23E
- Major watercourse
- Property boundary
- Railway line
- LGA boundary
- Sealed Track
- Unsealed



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Attachment E – Pest Animal Profiles

Declared Species

Species Name: *Canis lupus / Canis familiaris (Dingo / Wild dog)*

Status: Class 2 pest (LP Act)

Description: The dominant coat colours are red, ginger and sandy-yellow, although they can also be pure white, black and tan or solid black. Dingoes have a more heavily boned skull and larger teeth (especially the canine) than domestic dogs of similar size. They are naturally lean with large ears pricked, a white tip on the tail and white socks (DPIF 2007a). Adults can reach up to 60cm in height, with females weighing approximately 12kg and males 15kg (DPIF 2007a) Wild dogs refers collectively to dingoes, hybrid dingoes and domestic dogs that have escaped or been deliberately released

Distribution: Although thought to have arrived between 3,500-4000 years ago, it is not part of the ancestral fauna of Australia (DPIF 2007a)

Source: (EPA 2007a)



Dingoes/wild dogs are present in all parts of Queensland however the distribution of the wild dog in relation to purebred dingoes varies

Impact: Dingoes/wild dogs can carry diseases such as distemper and parvovirus. Their majority of their diet consists of native species such as kangaroos, wallabies, rabbits and possums (DPIF 2007a). However, wild dogs can kill, harass or maim livestock and other native fauna

Management Requirements: The operational objectives for the management of wild dogs include reducing their numbers throughout the Project Area

Monitoring Process: Report any dingo/wild dog sightings in the weekly Environmental Report

Control Actions: Fauna exclusion fencing to be utilised where necessary. If required, recommended active control methods include baiting, trapping and ground shooting

Species Name: *Felis catus* (Feral cat)

Status: Class 2 pest (LP Act)

Description: A feral cat is one that is not fed and kept by someone. The word 'kept' specifically means that is cat is housed in a domestic situation

The feral cat differs little in appearance from its domestic counterpart, however when in good condition is displays overall muscle development, particularly noticeable around the head, neck and shoulders (DPIF 2007d)

Feral cats are predominantly short-haired with coat colour range including ginger, tabby, tortoiseshell, grey and black. Males weigh between 3-6 kg and females 2-4 kg depending on condition. Feral cats are most active at night, with peak hunting activity occurring soon after sunset and in the early hours before sunrise (DPIF 2007d). During the day it will rest in any number of den sites including hollow logs, dense clumps of grass, piles of debris, rabbit burrows and hollow limbs of standing trees (DPIF 2007d)

Source: (DPIF 2008b, Invasive Animals CRC 2007b)



Distribution: The feral cat is now present Australia-wide in a variety of habitats

Impact: Feral cats are opportunistic predators of small mammals, birds, reptiles, amphibians, insects and fish (DPIF 2007d). They can be particularly harmful in island situations and have caused the extinction of a number of species. Feral cats also compete for prey with native predatory species such as quolls, eagles, hawks and reptiles

Feral cats may contain a parasite (toxoplasmosis) that can be particularly harmful to marsupials, causing blindness, respiratory disorders, paralysis and loss of offspring (DPIF 2007d)

Management Requirements: The operational objective for the management of feral cats is to reduce their numbers throughout the Project Area.

Monitoring: Reporting all cat sightings in the weekly Environmental Report

Control Actions: Fauna exclusion fencing to be utilised where necessary. If required, recommended active control methods include trapping and ground shooting

Species Name: *Vulpes vulpes* (European red fox)

Status: Class 2 pest (LP Act)

Description: Foxes have pointed muzzles, a flattened and slender skull, large ears and long bushy tails (DPIF 2007c). Adult males weigh approximately 6kg and females approximately 5 kg
 Foxes are usually active at night and rest during the day in an earth den, thicket, hollow log or stick-rake pile. However, in winter when less food is available, foxes may hunt and scavenge during the day
 Distribution: The most common and widespread of the world's fox species, the European red fox has adapted to a variety of habitats ranging from deserts to urban environments. However, they are not found in tropical areas of Australia (DPIF 2007c). Competition with dingoes, climatic preferences and food supply are thought to determine their distribution (DPIF 2007c)

Impact: Foxes are considered to be the greatest threat to the long-term survival of many small mammal species in Australia and play a major role in the decline of ground-nesting birds, critical weight mammals and reptiles such as the green turtle (DPIF 2007c). The European red fox is also thought to have caused a severe reduction in populations of many other threatened species throughout Australia

Source: (EPA 2008 and Invasive Animals CRC 2007a)



Management Requirements: The operational objective for the management of European foxes is to reduce their numbers throughout the Project Area

Monitoring: Report all fox sightings in the weekly Environmental Report

Control Actions: Fauna exclusion fencing to be utilised where necessary. If required, recommended active control methods include baiting, trapping, ground shooting and den fumigation

Species Name: *Sus scrofa* (Feral pig)

Status: Class 2 pest (LP Act)

Description: Feral pigs are predominantly black, buff-coloured or spotted black and white, while juveniles can be striped. Mature boars have a large head and shoulders and a raised and prominent back bone which slopes steeply down to small hams and short hind legs (DPIF 2007e)

Feral pigs are smaller, leaner and more muscular than domestic pigs, with well-developed shoulders and neck and smaller, shorter hindquarters (2007e). Feral pigs have sparser, longer and coarser hair than domestic pigs and have longer, larger snouts and tusks, straight tails, smaller mostly pricked ears and narrower backs (DPIF 2007e)

Feral pigs are generally nocturnal, spending daylight hours sheltered in dense cover. They are shy animals and will avoid human contact

Distribution: Feral pigs inhabit approximately 40% of Australia and are found in all habitat types in Queensland (DPIF 2007e).

Estimations of numbers range up to 24 million with the greatest concentrations of feral pigs found in the larger drainage basins and swamp areas of the coast and inland (DPIF 2007e)

Impact: Feral pigs impact the environment through predation on native animal species, consumption of native flora and damage to watercourses and wetlands. They can also carry many infectious diseases and internal and external parasites. Many of these diseases can spread to humans and livestock (DPIF 2007e)

Source: (DPIF 2008c, EPA 2006, IACRC 2007)



Management Requirements: The operational objective for the management of feral pigs is to reduce their numbers throughout the Project Area

Monitoring: Report all pig sightings in the weekly Environmental Report

Control Actions: Fauna exclusion fencing to be utilised where necessary. If required, recommended active control methods include trapping, baiting and ground shooting

Species Name: *Bufo marinus* (Cane toad)

Status: The cane toad is not a declared pest in Queensland and such there is no legal requirement to control them

Description: In comparison with the native frog and toad species, adult cane toads have a distinctive head and face and are large, heavily built creatures (DPIF 2007f). A high angular bony ridge extends from the eyes to the nose (DPIF 2007f). Adult cane toads have large glands that carry toxin on the shoulder behind the tympanum (ear opening) (DPIF 2007f). The hands and feet are relatively small and lack webbing between the fingers but is present between the toes (DPIF 2007f). In comparison to native frogs, cane toads assume an upright, rigid posture

Colouring of cane toads on the upper surface may be brown, olive-brown or reddish-brown with the underneath surface varying from white to yellow with mottled brown (DPIF 2007f). The surface of the skin is warty (DPIF 2007f)

Distribution: Cane toads currently inhabit at least four of the mainland Australian states including Queensland and generally occur wherever there is water (DPIF 2007f)

Source: (DPIF 2008d)



Impact: Cane toads produce highly toxic venom from glands in its skin that can cause death if ingested by domestic and most native animals. The Cane toad consumes a wide variety of insects, frogs, small reptiles, mammals and birds. They also compete with native frogs for breeding habitat (DPIF 2007f)

Management Requirements: It is recommended that Cane toads be managed in order to reduce their abundance across the Project Area, particularly where water and native frogs are found

Control Actions: Fencing is recommended to keep toads out of ponds intended for native fish and frogs, with a height of 50 cm being sufficient (DPIF 2007f). Freezing is considered a humane form of disposal, as a reaction to the cold causes the animal to initiate dormancy and dies while senseless (DPIF 2007f)

Monitoring Process: Report all sightings and relative abundance in the weekly Environmental Report

Species Name: *Oryctolagus cuniculus* (European rabbit)

Status: Class 2 pest (LP Act)

Description: They are usually grey-brown with a pale belly, black or ginger can also be common, with long hind legs, short front legs, long ears and large eyes (DPIF 2007b). Rabbits usually weigh between 1.3-2.3 kg

Distribution: Rabbits occur across Australia and have spread throughout Queensland with the largest populations found in the granite belt, south-western Darling Downs, Maranoa, southern Warrego and the far south-west (DPIF 2007b). Moderate populations are located in the north-western Darling Downs and North Burnett and low populations in the remainder of the state (DPIF 2007b)

Impact: Rabbits compete with native wildlife for food and shelter and increase the exposure of native wildlife to the dangers of predators such as cats and foxes (DPIF 2007b). Rabbits are implicated in the local extinction of some native species, as well as many native species, such as the Bilby (now threatened)

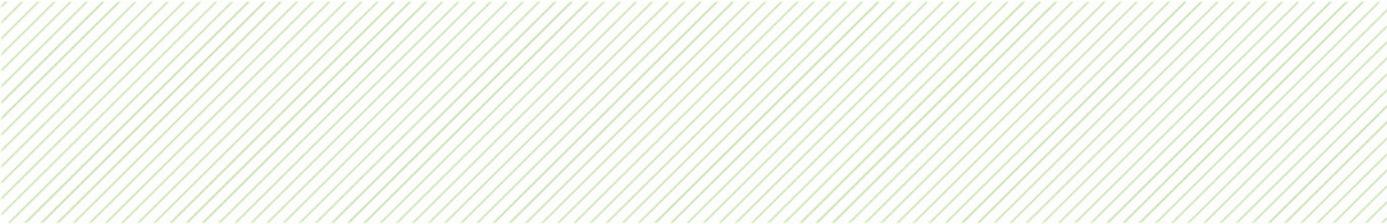
Source: (DPIF 2008a)



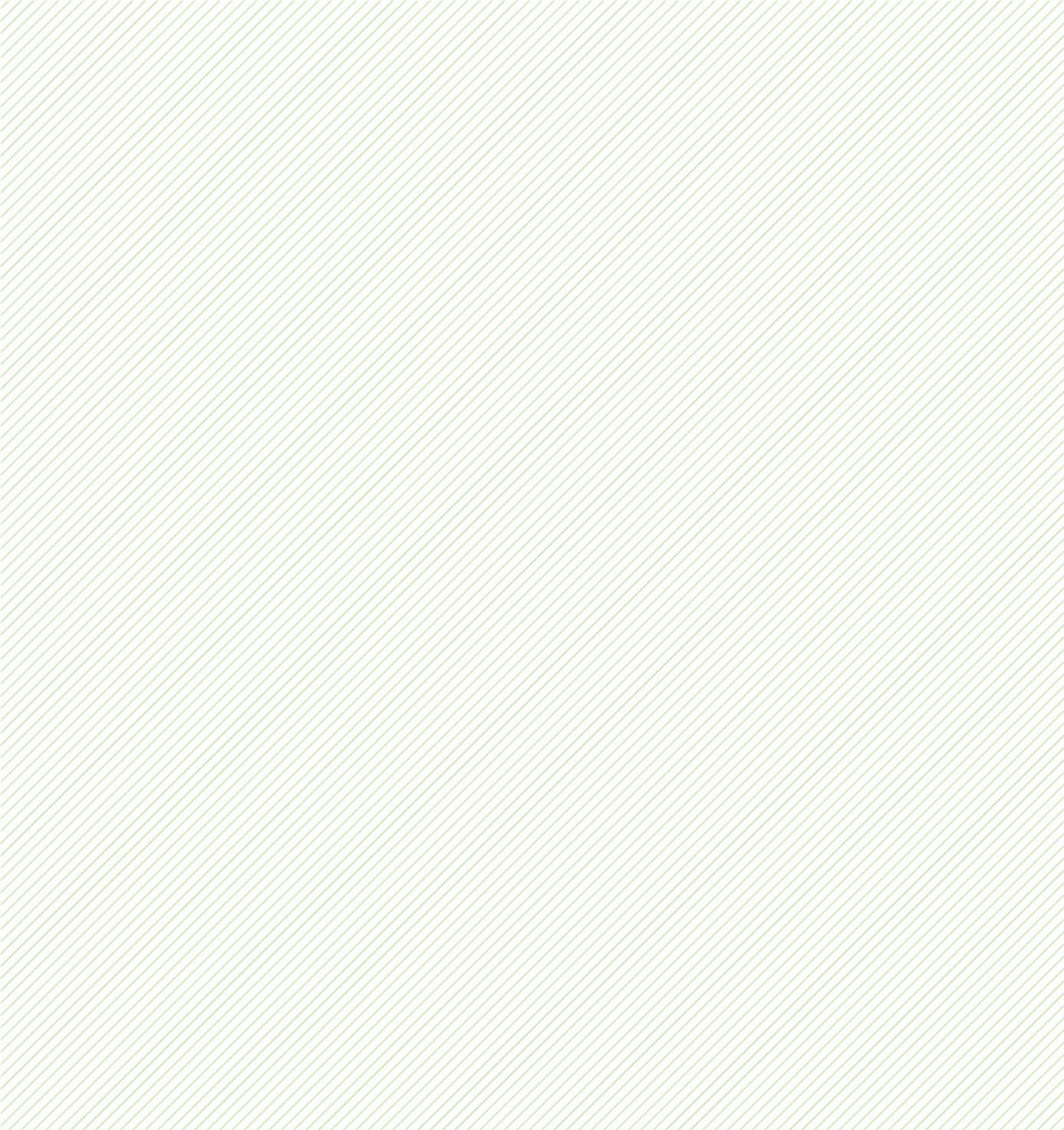
Management Requirements: The operational objectives for the management of rabbits include reducing their numbers throughout the Project Area

Monitoring: Report all rabbit sightings in the weekly Environmental Report

Control Actions: Fauna exclusion fencing to be utilised where necessary. If required, recommended active control methods include baiting, trapping, ground shooting, warren destruction and/or fumigation and biological control



Appendix E
Mosquito and Midge Management Plan





GLNG

Gas Transmission Pipeline

Mosquito and Midge Management Plan

Document Number: 3380-GLNG-4-1.3-0009

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DATE	REV	REASON FOR ISSUE	AUTHOR	ENDORSED	APPROVED
23.03.11	1	DRAFT for review and verification	CS		
30.03.11	2	Final	CS	SJM	
08.04.11	3	Amended Final	CS	CC	
15.04.11	4	Final for Legal review	CS		
30.05.11	5	LEGAL COMMENTS ADDRESSED	CC		
15.07.11	6	FOR AGENCY REVIEW	CC		

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1. Introduction

This Mosquito and Midge Management Plan (MMMP) has been developed to manage mosquitoes and midges for the purpose of public health, community well-being and for on-site workers for the Gas Transmission Pipeline (GTP) (henceforth referred to as the Project area). Mosquitoes pose a risk to human health as mosquitoes are vectors for many serious diseases, such as Ross River Virus and Barmah Forest Virus. Midges, although a nuisance, do not pose any serious risk to human health. For this reason and the fact that there are limited control measures for midges, this MMMP largely focuses on mosquito management. Therefore, midges have been removed from further discussion in the Management Plan.

This MMMP aims to meet the goal of Integrated Pest Management (IPM) by combining a variety of reasonable, practical, effective and economical pest control measures to reduce population numbers and the disease risk from mosquitoes, while having minimal impact on the environment. This MMMP provides a framework for identifying and monitoring mosquito populations as well as outlining procedures for implementing management strategies during the construction and operation phases of the Project.

2. Legal Requirements

Relevant legislation and policies associated with the management and control of mosquito and midge populations within the Project area include:

- *Public Health Act 2005 / Public Health Regulation 2005*
- *Environmental Protection Act 1994 (EP Act)*
- *Fisheries Act 1994*
- *Sustainable Planning Act 2009 (SPA)*.
- *Agricultural Chemicals Distribution Control Act 1966 (ACDC Act)*
- *Chemical Usage (Agricultural and Veterinary) Control Act 1998*
- *Nature Conservation Act 1992 (NC Act)*
- *Marine Parks Act 2004*
- *Transport Infrastructure Act 1994*

3. Mosquito and Midge initial survey and monitoring program

3.1 Initial survey

There has been no monitoring of mosquito numbers or species within the Project area. Therefore, an initial survey and monitoring programme prior to the commencement of construction will be required. The program will involve monitoring species' diversity and density of adult mosquitoes near potential breeding sites. The monitoring program will be used to identify each potential breeding site according to methodologies outlined in the Gladstone Regional Council Mosquito Management Plan (GRCMMP). The GRCMMP identifies the use of light traps conducted weekly during the main breeding period. Data obtained during this phase is to be used as baseline data that will be used to tailor the subsequent monitoring and management programs. Information that will be gathered as part of the initial survey will include:

- Average number of mosquitoes per trap per night
- Species which bite humans
- Species which are vectors of disease (female mosquitoes)

Once this initial survey monitoring program has been completed, broad baseline thresholds of mosquito numbers for each species common to the site will be established to enable the effective implementation of management strategies. Subsequent on-going surveys will use the baseline thresholds to identify significant increases in mosquito densities which will trigger management actions.

3.2 Likely midge breeding areas

Areas of mangroves and estuarine areas with sandy beaches are potential breeding grounds for midges. Midge population numbers peak monthly and are associated with tidal patterns and also peak seasonally with the summer months. However, as breeding sites for these species are generally outside of the Project area, and these species do not present a significant health risk (eg do not carry human disease causing pathogens) they will not be the subject of this MMMP. However, if significant midge breeding areas are located within, or adjacent to the Project area, notification regarding the location of these areas will be given to Gladstone Regional Council (GRC). This information may then be used by GRC to tailor management programs for these species.

3.3 Likely mosquito species and breeding areas

This MMMP outlines the mosquito species likely to be significant within the Project area based on vector capability, nuisance value and seasonal variation. While there are likely to be many mosquito species present within the greater Gladstone area, there are some species that are of greater importance because of their ability to transmit disease or to be significant pests. Mosquitoes may be broadly divided into freshwater and intertidal species. Mosquitoes within both of these categories have the potential to become disease vectors and are therefore outlined within this MMMP.

Potential on-site freshwater habitats for mosquitoes include:

- Stormwater drainage systems
- Pooled water in bunded areas, containers or other vessels
- Low lying areas temporarily flooded by high rainfall
- Areas created during construction works (trenches)

In addition, intertidal species are likely to utilise mangrove habitats as well as saltwater marshland as breeding sites.

The mosquito species likely to be significant pests within the Project area, are briefly described in the Sections 3.3.1 and 3.3.2.

3.3.1 Freshwater habitat mosquito species

A number of mosquito species are associated with breeding in freshwater pools. These species include:

- ***Aedes aegypti*** - a container breeding species. This species is a major vector for Dengue fever, Yellow fever and a potential vector of Murray Valley encephalitis and Ross River virus
- ***Culex annulirostris*** - is a vector of Ross River virus, Barmah Forest virus, Japanese Encephalitis and Kunjin virus. Preferred breeding habitats include freshwater wetlands and low lying grassy areas that are commonly inundated following rain, as well as irrigation areas having heavy organic effluent component
- ***Culex quinquefasciatus*** - utilises containers, troughs and drainage channels as breeding sites
- ***Ochlerotatus vittiger*** - the preferred breeding sites of this species consist of depressions filled by summer rain
- ***Ochlerotatus notoscriptus*** – breeds in artificial containers. This species is a suitable vector for Barmah Forest and Ross River Virus

3.3.2 Intertidal wetlands mosquito to species

Intertidal wetlands are located within and adjacent to the proposed marine GTP route. In particular the mangrove areas are likely to provide ideal grounds for breeding. Mosquito species that are associated with intertidal wetlands include:

- ***Ochlerotatus alternans*** - can reach relatively high pest levels following extended periods of rain. Breeding can occur in temporary brackish pools and marshes on the coast. This species is an aggressive biter, especially in and around mangroves and will attack throughout the day and night and can travel 5-8 km from breeding sites in search of food. This species may continue to be a pest from one to three weeks after breeding areas are inundated.
- ***Ochlerotatus vigilax*** - is the primary coastal vector of Ross River virus, Barmah Forest virus and other arboviruses in Queensland. This species will feed on humans and animals during the day or night and can travel up to 40 km from breeding sites. This species utilises a variety of saline habitats, including salt marshes, mudflats and temporary brackish pools.
- ***Culex sitiens*** – this species is a vector of Ross River virus and has the ability to travel long distances from breeding habitat. Breeding sites utilised by this species include temporary brackish pools and salt marshes filled as a result of tidal inundation.
- ***Verrallina funerea*** - may be a major pest where residential housing is in close proximity to breeding sites. This species can breed in both fresh and slightly brackish water. This species is not considered to be a major pest as it does not readily disperse from its breeding habitat.

3.4 Treatment triggers

Triggers for treatment will largely depend upon the target environment, the terrain, accessibility and location of breeding sites, the mosquito species involved, tidal flows and the weather conditions. Considerations for intertidal species may include:

- Tides
- Adult and Larval mosquito numbers.

It is difficult to predict a definitive level of rainfall that will necessitate treatment. A number of variables such as duration and amount of rainfall received, the period since the last rainfall event, barometric air pressure, wind velocity and temperature may all combine in different combinations, with different outcomes. The variability of these elements precludes the ability to consistently place definitive measurement on such elements.

This MMMP will be updated following the completion of the initial survey monitoring program outlined in Section 3.1 and will aim to specify treatment thresholds. Guidance will also be sought from Gladstone Regional Council (GRC) for evaluation of trigger conditions and when it is considered that a major mosquito event is imminent.

4. Ongoing Surveillance Program

4.1 Mosquito and midge population monitoring

To determine the on-going prevalence and distribution of mosquito and larvae and to enable timely control activities the following monitoring will be undertaken during the peak mosquito breeding season (December to March):

1. Visual inspections – visual inspection of the site for pooled water and larvae
2. Sampling of mosquito larvae - surveys of mosquito larvae will be conducted at the project sites. Mosquito larvae will be surveyed by sampling using a scoop/ladle/net.

Standardised collecting techniques of sample adult and larval mosquitoes will be undertaken at fixed sites as detailed below in Table 4.1. Sampling techniques for adult mosquitoes are to include light traps, and light traps with CO₂ lures. Sampling of mosquito larvae should be undertaken using the dip-net/scoop technique. All monitoring is to be part of standardised sampling design to ensure equal sampling effort between sites to facilitate site comparisons. This on-going monitoring program will be reviewed following the outcomes of the initial survey outlined in Section 2.1.

Table 4.1 Ongoing monitoring program during peak breeding season

Monitoring sites	Frequency
Pooled water and containers around the site	
Visual inspection	Weekly
Pooled water Visual inspection	Weekly
Sampling of mosquito larvae	Monthly
Stormwater drainage systems	
Visual inspection	Weekly
Sampling of mosquito larvae	Monthly
Areas with pooled water Visual inspection	Weekly
Thrust Pit Pads	
Visual inspection	Weekly
Sampling of mosquito larvae	Monthly
Areas with pooled water Visual inspection	Weekly
Sampling of mosquito larvae	As required
Low lying areas	
Visual inspection	Weekly following heavy rain events
Sampling of mosquito larvae	As required

In addition to this monitoring, close liaison with GRC and Queensland Health (QH) will occur to obtain results of any previous surveys undertaken within the area, and to be notified of major mosquito events within the Project area.

4.2 Notification of vector borne disease

A register will be maintained of any construction personnel member infected by the following vector borne diseases:

- Ross River Virus
- Japanese Encephalitis
- Malaria (unspecified and other)
- Malaria Falciparum
- Malaria Malariae
- Malaria Ovale
- Malaria Vivax
- Barmah Forest Virus
- Dengue Fever

Data on vector borne disease numbers for the region can be requested from QH if deemed necessary. However, these records are not always indicative of the mosquito problem as records only show those who have been diagnosed by a doctor and do not link the result to the area of transmission.

4.3 Complaint register

A complaint register will be maintained and each complaint investigated to assess mosquito and midge prevalence is to be document within this register.

5. Management Plan

To achieve environmentally sustainable outcomes, the aim of this MMMP is to focus on indirect management controls; personal protection and design controls, with the use of direct management controls, such as chemicals, habitat modification regarded as the least preferred methods.

5.1 Goals

The objectives of this MMMP are aligned with the GRC Mosquito Management Plan and include:

- Identifying triggers for treatments and types of treatment options currently available
- Complying with the Local Government Association of Queensland (LGAQ) Mosquito Management Code of Practice 2002
- Developing control measures that are environmentally sound, effective and cost efficient
- Examining environmental considerations and ensuring compliance with legislative requirements.
- Identifying suitable surveillance procedures and treatment efficacy

5.2 Performance indicators

The performance indicators for this plan are:

- No environmental harm from mosquito management controls
- No outbreaks of mosquito borne disease within the project area

5.3 Responsibility

The persons responsible for compliance with this plan during the construction period and operational phase and their responsibilities are summarised below.

5.3.1 Construction phase

During the construction period, the Construction Contractor will be responsible and will undertake the following:

- Retain a copy of the MMMP on-site for reference by appropriate personnel and provide a copy to contractors and sub-contractors
- Ensure compliance with the MMMP
- Ensure that contractors and sub-contractors engaged in the construction are advised of their responsibilities to undertake their activities in accordance with the MMMP
- Ensure that contractors and sub-contractors engaged in the construction activities within the Project area are advised of their responsibilities regarding mosquito management
- Ensure that an auditing/monitoring program is implemented
- Ensure appropriate records are kept and maintained
- Prepare incident reports and implement corrective actions
- Recommend additions or changes to the MMMP based on experience gained from implementation of the MMMP

5.3.2 Operational phase

During the operational phase and subsequent de-commissioning period, GLNG will be responsible and will undertake the following:

- Retain a copy of the MMMP



- Ensure compliance with the MMMP
- Ensure appropriate records are kept and maintained on-site
- Ensure that the monitoring program is implemented on an as needed basis
- Prepare incident reports and implement corrective actions as required

5.4 Training and awareness

All construction personnel will be made aware of the MMMP. A register of training will be maintained.

5.5 Continual improvement

This MMMP will be reviewed annually to ensure industry standards are met and make any necessary changes to improve this plan.

5.6 Management strategies

The following is a list of management strategies to be applied for the GTP during construction activities.

5.6.1 Personal protection

- Personnel will wear hats, socks, and loose fitting, light coloured clothing with long pants and long sleeves when outdoors. Head nets and gloves will also be worn, if required. Head nets with meshes are recommended. Sleeves and collars will be kept buttoned and trousers tucked into boots. In severe cases clothing may be impregnated with pyrethrum
- Where practicable, personnel will avoid peak biting times; specifically at dusk
- Personnel will be educated on the mosquito and midge problem on-site and educated in management strategies and responsibilities for their own health (through induction, regular communication and posters throughout the construction site)
- The workforce will be notified if there is a mosquito or biting midge problem and individuals will take appropriate personal protection
- When required, personnel will use tropical strength mosquito repellents

5.6.2 Design

- Yellow or red lights will be used in personnel areas, where possible, to prevent attracting midges. White lights will be used away from non-personnel areas to divert the midges.
- All on-site work offices and day accommodation for the CIGTP section will be air-conditioned and screened. Screens will be the correct mesh size, fit tightly and be in good repair. All screen doors on buildings should open outward and have automatic closing devices. Where required, Bifenthrin barrier treatments around personnel areas will be implemented to reduce adult biting midge numbers.

5.6.3 Source Reduction

Container breeding

Management actions for container and vessel breeding include:

- The creation of areas and structures in which water could be retained for more than five days will be avoided (i.e. potential mosquito breeding habitat)
- The Project area will be inspected weekly for all containers and vessels capable of holding water (including banded areas) to prevent water pooling. These areas will be drained and treated as required

Drainage systems

Drains will be constructed in a manner that does not lead to the creation of new mosquito breeding sites. The design of drainage systems will consider the following design features:

- Erosion control measures will be installed on drain batters to prevent silting
- Any plant species selected to stabilise slopes will be terrestrial and not be likely to invade water bodies and create breeding grounds for mosquitoes
- Drainage design will prevent the accumulation of silt and debris that may create pooling of water
- All maintenance of drains will be carried-out in accordance with procedures which ensure that further habitats for mosquitoes or midges are not created by wheel ruts
- Drains will be maintained free of siltation and debris
- Drains will be inspected as per the monitoring program in Table 4.1

Sewerage systems and wastewater disposal

Sewer systems and wastewater disposal will be managed in accordance with the following:

- Sewer systems and wastewater disposal will be operated in a manner to avoid ponding of water
- Wastewater will be collected on site for treatment and disposal on the mainland
- Temporarily flooded areas will be managed through filling depressions and draining pooling areas

Construction

Construction activities may create mosquito/biting midge breeding sites. In order to minimise the problem the following actions will be followed:

- Access roads will be fitted with culverts where necessary, in order to prevent water ponding upstream, and thus prevent mosquito breeding.
- Reinstated sites will be re-contoured to the original surface profiles to prevent ponding.
- Thrust pads will be installed with devices (eg soak-wells) to prevent mosquito access to excess water until such time as it can drain away.

5.6.4 Controls

Habitat modification

For the purpose of this MMMP habitat modification refers to the manipulation of wetlands to reduce breeding sites. Runnelling is the most commonly used means of modifying saltmarsh areas to reduce mosquito numbers. Runnelling is the linking of pools by shallow (less than 30 cm) spoon-shaped channels (runnels) which increase tidal flushing and access by fish and other predatory species. Because there are potential environmental consequences from runnelling (disturbances to marine plants and the increased inundation of substrates), implementation of runnelling programs for this site is not preferred. Permits are required from the DEEDI and DERM before any modification of wetland areas.

Chemical controls

If necessary, areas that cannot be managed with other management controls (eg planning methods) will be treated as required with a control agent. Relatively few chemicals can be recommended for use in wetlands, whether natural or constructed (usually flow into natural water systems), because of environmental concerns. The importance of pre-inspection activities is further reinforced when considering the selection of the most suitable treatment chemical. The effectiveness of the various 'acceptable' agents depends on appropriate formulations and local conditions and the target mosquito species is of critical concern.

Consultation will be undertaken with GRC and QH prior to the planning of and implementation of this management option.

If chemical controls are to be used the following management actions will be adhered to:

- A suitably qualified consultant will be engaged to develop a treatment program that meets the Mosquito Management Code of Practice



- A licensed and experienced operator will be engaged to undertake the chemical treatment
- Chemicals used will be registered and used in accordance with manufacturer's instruction
- Treatments will not be undertaken prior to a breeding event
- Areas identified for treatment will consider environmentally sensitive areas and buffer zones will be designated
- A treatment register will be maintained and include:
 - Areas treated
 - Date and time of treatment
 - Equipment
 - Pilot/operator
 - Insecticide dose
 - Insecticide batch measure
 - Result

Larviciding

Larviciding is the control of mosquito larvae prior to their metamorphosis into adult flying mosquitos. Several products are available for use in larvacidal applications and selection of these products will be confirmed prior to construction.

It should be noted chemicals should only be used after full assessment of potential adverse affects, consideration of the receiving environment and on-site risk/benefit analysis.

Adulticiding

Adulticiding is the control of adult, mature mosquitoes following their metamorphosis from the larval form. This stage of the lifecycle constitutes the pest stage. Several products are available for use in adulticidal applications and selection of these products will be confirmed prior to construction.

6. References

Bureau of Meteorology (BOM) 2009, *Bureau of Meteorology*, viewed 8 April 2011, <http://www.bom.gov.au/>

Department of Medical Entomology (2010a) *Saltwater Wetlands (Mangrove Swamps & Saltmarshes) Mosquito production & management*, viewed 10 September 2010, <http://medent.usyd.edu.au/fact/saltwet.htm>

Department of Medical Entomology (2010b) *Freshwater Wetlands (Natural and Constructed) Mosquitoproduction & management*, viewed 8 April 2011, <http://medent.usyd.edu.au/fact/freshwet.htm>

Gladstone Regional Council *Mosquito Management Plan*, viewed 8 April 2011, <http://www.gladstonerc.qld.gov.au/animals5Environment/docs/MosquitoControlinGladstoneRegion-FinalVersion.pdf>

Local Governmental Association of Queensland (2002) *Mosquito Management Code of Practice for Queensland*, Queensland Government

Maritime Safety Queensland (MSQ) 2009, *The Official Tide Tables and Boating Safety Guides 2009*, Maritime Safety Queensland.

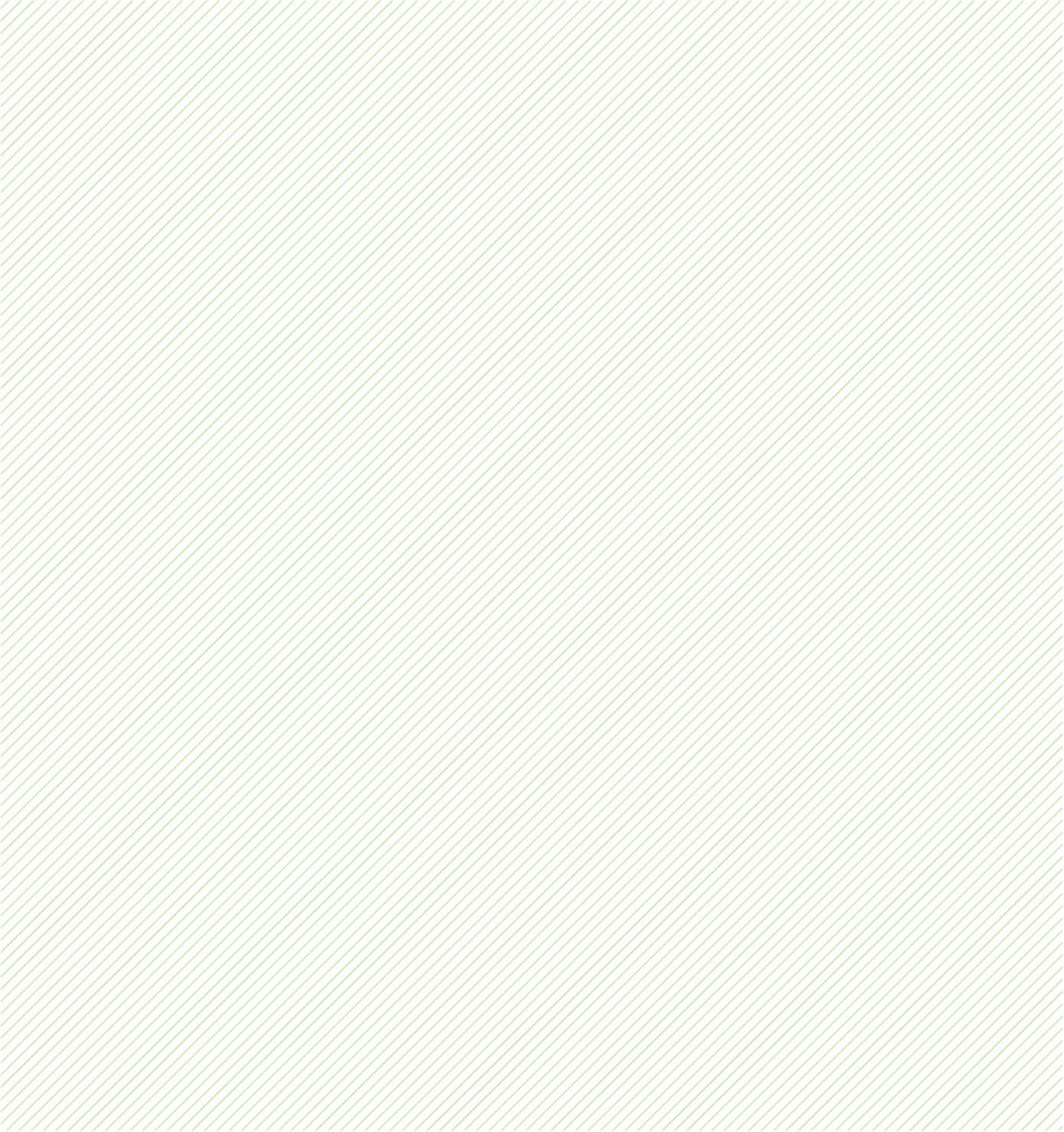
Mosquito Control Association of Australia Inc (1998) *Australian Mosquito Control Manual*

Mosquito Control Association of Australia Inc. QDPI (1999) *Native Fish as alternatives to the exotic fish, Gambusia for mosquito control*, DPI Note, Queensland Department of Primary Industries, viewed 8 April 2011, www.dpi.qld.gov.au/fishweb/2610.html

Queensland Health (2002) Guidelines to minimise mosquito and biting midge problems in new development areas. Queensland Government.



Appendix F
Waste Management Plan





**Waste Management Plan -
Gas Transmission Pipeline
(Mainland, Marine Crossing
(The Narrows) and Curtis
Island Sections)**

**Santos GLNG Pty Ltd,
Petronas Australia Pty Ltd
and Total E&P Australia**

Report ref:
214208
6 February 2012
Revision 8

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Document control						
Document ID: Appendix F Waste MP.doc						
Rev No	Date	Revision details	Typist	Author	Verifier	Approver
0	15 February 2011	Draft Waste MP Waste Quantity Estimates (Section 6) Issued to GLNG	KKF	KKF/OF	-	-
1	4 March 2011	Draft Waste MP	KKF	KKF/OF	GNC	
2	1 April 2011	Revised Draft Waste MP submitted to GLNG for review	KKF	KKF		
3	5 April 2011	Revised Draft Waste MP submitted to GLNG for legal review	KKF	KKF		
4	8 April 2011	Review by SJM	KKF	KKF		
5	15 April 2011	Final for legal review	KKF	KKF		
6	30 June 2011	Legal comments addressed	CC			
7	15 July 2011	FOR AGENCY REVIEW	KH	KKF	GNC	CC
8	6 February 2012	For SEWPaC Review	KH	KKF	GNC	AW

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Appendix A

Abbreviations

Appendix B

Figures

1. Introduction

1.1 Project overview

The Gladstone Liquid Natural Gas (GLNG) Project has the following major components:

- Coal seam gas fields
- Gas transmission pipeline (GTP)
- LNG liquefaction and export facility (LNG facility)

1.2 Scope

This Waste Management Plan (WM Plan) addresses the waste management issues relating to construction, operation and decommissioning of the GLNG GTP. It has been developed in accordance with the Environmental Protection (Waste) Policy 2000 and other relevant State and Commonwealth legislative, guidelines, standards and covers the following key areas:

- The types and amounts of waste expected to be generated during construction and operation including chemical and hazardous materials, liquid wastes and hydrotest water. It also stipulates how the wastes will be dealt with in accordance with the principles of the waste and resource management hierarchy (formerly the waste management hierarchy)
- Mitigation measures for dealing with accidents, spills and other incidents that may impact on the environment as a result of waste management during construction and operation

This WM Plan also seeks to address the specific project approval conditions and items which have been raised as a result of the Coordinator General's and Department of Infrastructure and Planning comments in relation to the GLNG EMP and EIS documents.

1.3 Objectives

The objectives of this WM Plan are:

- No contaminants or wastes are discharged to land or water on the project site
- No unauthorised discharges of contaminants or waste to land or water offsite
- Minimise the quantity of wastes generated and disposed to a landfill during construction and operation
- Maximise the amount of material recovered for reuse or recycling during construction and operation
- Dispose of all waste in accordance with all State and Commonwealth legislation and guidelines
- No complaints relating to the management of waste during construction and operation

1.4 Project description

The Project includes the construction, operation and decommissioning of a 420 km GTP network to link the coal seam gas fields near Roma, Emerald, Injune and Taroom in Queensland to the proposed LNG Facility located on Curtis Island.

This WM Plan has been prepared to address all three sections of the GTP, including the:

- Mainland section
- Marine Crossing section

- Curtis Island section

It is anticipated that the GTP will have an operational lifespan of 25 years followed by a period associated with the decommissioning of the GTP and associated infrastructure.

Mainland GTP section

The Mainland section of the GTP runs from the gas fields at Fairview to Port Curtis, traversing a distance of approximately 406 km.

Marine Crossing GTP section

The Marine Crossing GTP will connect the Mainland GTP to Curtis Island GTP section (9 km) by spanning The Narrows utilising horizontal directional drilling (HDD). This section will also encompass a section of open trenching on the Mainland section above the intertidal zone.

Curtis Island GTP section

The GTP on Curtis Island is 5 km long commencing at Laird Point and running through to the proposed LNG Facility. This section is a terrestrial section and will be constructed using open trench construction.

A detailed outline of the project description has been provided in Section 4.

1.5 Roles and responsibilities

GLNG Operation's personnel and contractors will be responsible for implementing this WM Plan in a manner which complies with relevant environmental standards, adheres to legislative requirements and ensures that environmental objectives associated with construction and operation are achieved.

Contract documents will include the necessary environmental specifications and commitments, and require compliance with the Environmental Authority (which this WM Plan is used to support), construction specifications, technical drawings and the general environmental duty.

All personnel are responsible for the environmental performance of their activities and for complying with the General Environmental Duty as outlined in the *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 practicable measures to minimise the harm*'. Specific environmental responsibilities are detailed in Table 1.1.

Table 1.1 Specific environmental responsibilities

Position	Overview
GLNG Operations Pipeline Project Manager	The GLNG Operations Pipeline Project Manager is ultimately responsible for the standard of management, including environmental management. To assist in fulfilling this responsibility, the GLNG Operations Pipeline Project Manager is supported by a series of specialised personnel
Construction Manager	The Construction Manager is responsible for all construction activities including planning, procedure's approvals and execution of works. The Construction Manager is also responsible for ensuring that adequate provision is made for compliance activities

Position	Overview
Engineering Manager	The Engineering Manager is responsible for generating the design drawings and specifications consistent with the EM Plan and AS2885 – the Australian Pipeline Standard
Pipeline Construction Superintendent	The Pipeline Construction Superintendent will direct work in a manner that complies with all relevant environmental procedures; adheres to all legislative requirements and ensures that all environmental objectives associated with the Project are achieved. The Construction Superintendent has “stop task” and “stop work” authority
Environmental Manager	The Environmental Manager is responsible for monitoring and reporting the implementation of the EM Plan and for the continual measurement of the environmental performance of personnel and equipment. The Environmental Manager has “stop task” and “stop work” authority
Construction Contractor	Ensuring compliance with the EM Plan and the development and implementation of a contractor specific EM plan. This will include training of personnel (see below), provision and maintenance of equipment, facilities and associated services and consumables, and the monitoring of compliance to the EM Plan

Source Aurecon (2011) EM Plan (Mainland)

1.6 Limitations of this WM Plan

This document provides guidance related to chemical and hazardous materials storage, spill management and clean up (containment and remediation), however it does not address health and safety aspects. This will be addressed in relevant GLNG Operations guidelines including the EHSMS and inductions process.

This WM Plan should be viewed as a living document that will be progressively updated with additional information throughout the construction and operational phases.

2. Waste Management Legislation

2.1 General legislative structure

There are a number of Queensland and Commonwealth statutory environmental requirements, policies and guidelines that affect the Project and have been taken into consideration during the preparation of this WM Plan. These statutory requirements are summarised in Table 2.1

Table 2.1 Key legislation

Waste management legislation	Key requirement of legislation
Environmental Protection Act 1994	Environmental Protection Regulation which includes licensing and approval of all Environmentally Relevant Activities (ERAs) Establishing a general environmental duty Process to prepare Environmental Management Plans (EMPs) Issuing environmental protection policies
Environmental Protection Regulation 2008	Defines regulated waste and waste disposal management
Environmental Protection (Waste Management) Policy 2000	Waste management hierarchy and principles, and environmental management decisions concerning waste
Environmental Protection (Waste Management) Regulation 2000	Waste tracking requirements
National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure as varied (2004)	Movement of Controlled Waste between States and Territories
Queensland's Waste Reduction and Recycling Strategy 2010- 2020	Sets targets to halve landfill volumes, double the recycling rate of MSW, and increase the rates for commercial and industrial building waste. Introduction of a levy on waste to landfill excluding MSW
<i>Dangerous Goods Safety Management Act 2001</i>	Storage and handling of dangerous goods and combustible liquids as well as the operation of major hazard facilities
<i>Dangerous Goods Safety Management Regulation 2001</i>	Prescription of dangerous goods location; major hazard facility or possible major hazard facility Safety obligations Flammable and combustible liquids licensing

2.1.1 Queensland legislation

The relevant legislation which will impact on the GTP includes, but is not limited to:

Environmental Protection Act 1994

The Queensland *Environmental Protection Act 1994* (EP Act) and its regulations and policies were developed to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The EP Act is administered by the Department of Environment and Resource Management (DERM) formerly Queensland Environmental Protection Agency (EPA).

The EP Act utilises a number of mechanisms to achieve its objective including:

- Environmental Protection Regulation which includes licensing and approval of all Environmentally Relevant Activities (ERAs)
- Establishing a general environmental duty
- Process to prepare Environmental Management Plans (EMPs)
- Issuing environmental protection policies

The EP Act establishes a duty of care for all persons to take reasonable and practicable measures to prevent and minimise environmental harm.

The EP Act allows for the establishment of Environmental Protection Policies (EPPs) which allow for the Queensland Government to declare and implement its aims and objectives for environmental protection. In regards to waste management; waste generators, transporters and receivers must comply with the following policy and regulations:

- Environmental Protection (Waste Management) Policy 2000 (EPP Waste)
- Environmental Protection (Waste Management) Regulation 2000 (EP Waste Regulation)

The EPP (Waste) combined with the EP Waste Regulation aim to co-ordinate and clarify waste management practices in Queensland and to provide a framework for improved environmental safeguards.

Environmental Protection (Waste Management) Policy 2000

The EPP (Waste) co-ordinates and clarify waste management practices in Queensland and provides improved environmental safeguards to achieve “ecologically sustainable development”. It does this by the adoption of the waste management hierarchy along with several management principles these include:

- “Polluter pays principle” – All costs associated with waste management should, where possible, be borne by the waste generator
- “User pay principle” – All costs associated with the use of a resource should, where possible, be included in the price of goods and services developed from the resource
- “Product stewardship principle” – The producer or importer of a product should take all reasonable steps to minimise environmental harm from the production, use and disposal of the product

The above three principles form a hierarchy and provide a basis for waste management programs under ERAs. The waste and resource management hierarchy includes the following management principles (in order of priority) (DERM 2010).

- Reduce
- Reuse
- Recycling
- Other recovery
- Treat
- Dispose

Environmental Protection Regulation 2008

This Regulation, replaces the *Environmental Protection Regulation 1998*, supports the environmental impact statement process, and identifies environmentally relevant activities (ERAs) prescribed under the Environmental Protection Act 1994.

The *Environmental Protection Regulation 2008* (EP Regulation) defines regulated waste and regulated waste disposal management. It also provides the statutory basis for implementing the National Environment Protection Measure for the National Pollutant Inventory.

Environmental Protection (Waste Management) Regulation 2000

The Environmental Protection (Waste Management) Regulation 2000 sets specific requirements for the management of regulated waste, waste disposal facilities, waste management by local government, and litter control such as:

- Offences for littering, waste dumping and unlawful activities at waste facilities
- A waste tracking system within Queensland and interstate (National Environment Protection Measure for the National Pollutant Inventory)
- Requirements for premises generating clinical and related waste
- A procedure for approval of wastes for beneficial reuse
- Approval processes for beneficial use of wastes
- Design rules for waste equipment

2.1.2 Commonwealth legislation

National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure

The *National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure* (NEPM) aims to ensure that controlled wastes which are moved between States and Territories are properly identified, transported and handled in an environmentally sound manner, and that they reach licensed or approved facilities for treatment, recycling, storage and/or disposal. The NEPM provides a framework for developing and integrating systems for the movement of controlled waste between States and Territories which includes:

- Tracking systems, which provide information to assist agencies and emergency services and ensure that controlled wastes are directed to appropriate facilities
- Prior notification systems, which provide participating States and Territories with access to information to assess the appropriateness of proposed movements of controlled wastes in terms of transportation and facility selection
- Systems for licensing transporters and the regulating of generators and facilities so that tracking and notification functions are compatible between States and Territories
- Provision for mutual recognition by States and Territories of each other's transport licences (QLD EPP 2008 legislation)

2.1.3 Waste definitions

Under the EP Act "waste" is defined as anything that is:

- Left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity
- Surplus to the industrial, commercial, domestic or other activity generating wastes

The EP Regulation defines "general waste" as waste other than regulated waste. Regulated wastes are defined in Schedule 9 of the EP Regulation as 'non-domestic' waste. A list of all defined regulated wastes is outlined in Schedule 7 of the EP Regulation. Appendix A provides a glossary of additional definitions relevant to this WM Plan.

2.1.4 Environmentally Relevant Activities (ERA's) – Environmental Protection Regulation 2008

The Project has the potential to trigger a number of Environmentally Relevant Activities (ERA's) during the construction and operation of the GTP.

The ERAs are prescribed under the *Environmental Protection Regulation 2008* and the GTP construction works may include the following ERAs:

- Environmentally Relevant Activity (ERA) 8: chemical storage
- ERA 17: Abrasive Blasting
- ERA 21: Motor Vehicle workshop operation
- ERA 38: Surface Coating
- ERA 56: Regulated waste storage
- ERA 57: Regulated waste transport
- ERA 60: Regulated waste disposal
- ERA 63: Sewage treatment
- ERA 64: Water treatment

If any GTP construction activity triggers an ERA then approval under the *Environmental Protection Act 1994* shall be sought by the Contractor prior to construction and the activity commencing.

2.1.5 License requirements

GTP license requirements regarding waste management are described within this WM Plan. All regulated wastes are to be disposed of to a licensed waste disposal facilities or recycling facilities and transported by authorised companies or personal. Designated personnel who will be required to collect, treat, transport or dispose of waste or recyclable materials will need to document their operational capacity in accordance with relevant State and Commonwealth legislation.

2.1.6 Records and data management

It is a legal requirement that records will be kept in regards to regulated waste (defined under the EP Regulation 2008). The EP Regulations require all persons or business involved with the production or transportation of trackable wastes to record detailed information about the waste as defined in the EP Waste Regulation. These include the requirement to complete a Waste Transport Certificate for all deemed trackable waste. The *Environmental Protection (Waste Management) Regulation 2000* details the regulatory procedures.

2.2 Summary of standards and guidelines

Table 2.2 is a summary of Australian Standards and guidelines which provide guidance about waste management in relation to construction and operation of the GTP.

Table 2.2 Summary of standards and guidelines

Standard/guideline	Key requirements
AS1940	The storage and handling of flammable and combustible liquids
DNRMW On-Site Sewerage Code	Technical requirements for the management, site and soil evaluation, design, installation and operation of on-site sewerage facilities
DNRMW Guidelines for Vertical and Horizontal Separation Distance	Details acceptable vertical and horizontal separation distances from buildings, watercourses, bores etc
Standards Australia AS/NZS 1547 On-Site Domestic Wastewater Management	Australian standard for on-site wastewater management
AS 3833	Australian standard for storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
AS3780	Australian standard for storage and handling of corrosive substances
AS 2187 Explosives	Australian standard for the storage and prescribed licenses and permits. (Specialist Contractor)
AS 2885.3 & APIA Code of Environmental Practice – Onshore pipeline	Code of practice for onshore pipelines - gas and liquid petroleum - operation and maintenance
Material Safety Data Sheets	Compliance with OH&S and legislative obligations related to the storage and handling of chemicals chemical registers (inventories).
Guide to the Dangerous Goods Safety Management Act 2001	This Queensland Department of Emergency services document outlines the obligations, and provides definitions and information to help explain requirements under the Dangerous Goods Safety Management Act

2.3 Regulatory approvals

In addition to the legislative requirements detailed in Section 2.1 this WM Plan has sought to address the specific project approval conditions and items, which have been raised as a result of the regulators comments in relation to the GLNG EIS. These include:

- The conditions within the Coordinator General's Report related to waste management and the storage and handling of chemicals, flammable and combustible liquids. In particular the Part 4 Environmental Authority Conditions – Gas Pipeline, Schedule D – Waste Management, Condition D8 and D9
- The Department of Infrastructure and Planning comments related to waste management as documented in *Report for Crossing of the Narrows – Review of the GLNG EMP*
- The Department of Environment and Resource Management's Guideline *Preparing an EM Plan for CSG activities* related to waste generated by the proposed petroleum activities

3. Waste Management Principles

3.1 Overview

The management of waste material generated as a result of GTP construction, operation and decommissioning will be dealt with in accordance to the principles of the waste and resource management hierarchy¹ (refer Figure 3.1) as described in the Queensland Waste Reduction and Recycling Strategy 2010 - 2020.



Source Queensland's Waste Reduction and Recycling Strategy 2010–2020 (DERM, 2010)

Figure 3.1 Waste and resource management hierarchy

The GTP waste and resource recovery hierarchy principles are outlined in Section 3.2.

3.2 Waste and resource management hierarchy principles

3.2.1 Waste avoidance

Waste avoidance will be targeted through adoption of alternative products and implementation of procurement processes which include the provision of contracts with companies which have documented sustainable waste management practices.

During delivery and transportation, the pipe sections will be protected with a coating applied during manufacture off-shore that reduces damage and subsequent wastage during the GTP construction process. All pipeline sections will be ordered and delivered to meet the detailed design requirements. This will reduce the quantities of some waste streams associated with the construction phase, including scrap steel.

¹ Prior to publishing of the Queensland Waste Reduction and Recycling Strategy 2010 – 2020, the Waste and resource management hierarchy was referred to in Queensland Legislation and other government documents as the Waste Management Hierarchy comprising waste avoidance, waste reuse, waste recycling, energy recovery and waste disposal

3.2.2 Waste reduction

Where possible, contracts will be established with companies that minimise waste through their production process, maximise recycling of waste produced and maximise recycling opportunities for the used end product and associated packaging waste. Procurement of pre-fabricated materials will be encouraged to reduce the quantity of waste generated on site.

3.2.3 Waste re-use

The re-use of waste will be achieved through identifying at the earliest opportunity materials which can be re-used during the construction period. Items such as timber skids, sand bags, timber pallets and hydrotest water are examples of materials that will be targeted for reuse.

To maximise re-use opportunities, materials will be segregated within the designated waste storage areas along the GTP RoW. The environmental protection commitments, objectives and control strategies described in Section 8 provide recommendations on how re-use could be implemented for the Project.

3.2.4 Waste recycling

The collection of waste materials for recycling will be integral to the management of waste during construction of the GTP. A proportion of the materials created as a result of construction will be recycled, an example of some of the materials are:

- Dry recyclables like paper, cardboard, plastic and glass
- Ferrous and non ferrous metals generated from the pipe welding and cutting process
- Oils generated from plant and equipment maintenance
- Timber generated from pallets, skids and off cuts (once reused)

Other potentially recyclable materials will be treated in accordance with the principles of the waste and resource management hierarchy where opportunities exist.

3.2.5 Other recovery and treatment of waste

This includes capturing the energy available in discarded products and treating the waste prior to disposal to reduce the hazardous characteristics of the waste.

Energy recovery facilities are generally not available in Central Queensland and are not likely to be an option for project waste. Some regulated waste from the Project may need to be sent to licensed treatment facilities to reduce the hazardous characteristics of the waste prior to disposal.

3.2.6 Waste disposal

The construction and operation of the GTP will adopt suitably licensed waste management and recycling contractors that will provide bins and collection/transportations services for specified waste to be hauled to licensed waste management facilities.

Disposal options for wastes generated by the construction and operation of the GTP depend on the characteristics of the waste. The following section presents the waste disposal options that have been considered for the construction and operation of the GTP.

Landfill

Although most towns in Maranoa Regional Council, Central Highlands Regional Council and Banana Shire Council have a local waste disposal facility, many facilities only accept domestic waste for disposal. The waste facilities that accept waste for disposal from commercial operators are listed in Table 3.1. No other waste disposal facilities may be used for disposal of project waste without prior approval of GLNG Operations.

Table 3.1 Waste disposal facilities closest to GLNG GTP RoW

Licensed waste facility	Allowable annual capacity as per site environmental authority	Comments
Gracemere Landfill, Allen Road, Gracemere	20,000 t per annum for disposing of general waste or limited regulated waste	Contractor to investigate if Rockhampton Regional Council will accept waste to the Gracemere Landfill from the Port Alma temporary pipe receiving area
Benaraby Landfill, Bruce Highway Benaraby (south of Gladstone)	50,000 t per annum	NIL
Trap Gully Landfill, Forestry Road, near Biloela	Less than 2,000 t per annum for disposing of general waste or limited regulated waste	Limited capacity to accept waste materials for disposal. Contractor to investigate if Banana Shire Council will accept waste at the Trap Gully Landfill from the project
Rolleston Landfill, Rolleston	Unconfirmed	Contractor to investigate if Council will accept waste at the Rolleston Landfill from the project
Roma Landfill, Short Street, Roma	Unconfirmed	Contractor to investigate if Council will accept waste at the Roma Landfill from the project
Injune Landfill, Injune	Unconfirmed	Contractor to investigate if Council will accept waste at the Injune Rolleston Landfill from the project

Sewage treatment plants

The waste contractor is to contact the relevant local authority to determine the location of suitable STPs and arrangements to receive wastewater from the construction camps.

3.3 Waste and resource management hierarchy initiatives

The Project will aim to achieve positive outcomes by targeting the source of the waste and adopting the resource management hierarchy.

Table 3.2 outlines potential opportunities for waste and recycling service for implementation in the Project.

Table 3.2 Waste and resource management hierarchy opportunities

Waste hierarchy	Opportunity	GTP initiative
Waste avoidance/ Waste reduction	Excavated material and topsoil	All excavated material and topsoil is to be used for backfill and respread along the RoW during restoration
	Hardstand material and rock	Clean hardstand material from areas to be restored to their original condition will be provided to local landowners for use on their properties ie roadways
	Temporary fencing and gates Pipe	Temporary fencing and gates constructed along the boundary of the RoW are likely to remain after completion of restoration as many of the landowners have indicated that they would like to keep this fencing Minimum length of pipe cut permitted is 2 m. These cut lengths are to be used within the pipeline
	Offsite construction	Where possible packaging materials used to deliver pipe and materials will be reusable or recyclable
Waste re-use	Green waste (felled vegetation and plant matter) Timber skids Wastewater effluent (treated wastewater) re-use Hydrotest water re-use	Green waste where possible will be reapplied during RoW restoration. Whole felled and mulched vegetation will be used in rehabilitation and soil stabilisation of RoW (refer Ecologia (2010) Landscape Rehabilitation Management Plan) Timber skids used during pipe stringing will be collected and transferred along the RoW for reuse in pipe stringing further along the corridor Explore whether treated wastewater from construction camps is suitable for use for dust suppression or use in vehicle wash down facilities Where possible hydrotesting will be reused
Waste recycling	Waste oil and hydrocarbons Steel and metal, cabling Batteries Tyres Waste paper and cardboard	A waste oil contractor would be used for recycling waste oil Waste steel and other metals will be recycled by a steel and metal merchant Batteries will be recycled with a battery recycler A licensed contractor will be engaged to transport tyres to a tyre recycler Investigate if recyclable materials can be sent to the CQ's Rockhampton MRF for recycling Banana Shire Council operates a small waste paper and cardboard bailing plant in Biloela. Contactor to investigate the opportunity to recycle source separated waste paper and cardboard at Banana Shire Council's Calvale Road facility in Biloela

Waste Management Plan - Gas Transmission Pipeline

Waste hierarchy	Opportunity	GTP initiative
Energy recovery	There are no energy recovery facilities in Central Queensland. There is a potential opportunity for some waste material to be used as a fuel for the cement kiln at Aldoga, Gladstone	Contractor to investigate if any waste materials have value and are suitable for use as a fuel/feed stock in the cement kiln at Aldoga, Gladstone

4. Project Description

4.1 Project overview

An underground 420 km GTP will feed CSG from the CSG fields at Fairview through to the proposed LNG Facility on Curtis Island. The GTP route is shown on Figure 1 – GTP Waste and Recovered Material Haulage Route. The Project activities occur in 3 phases - construction, operation and decommissioning phases. The following is an overview of the various activities which will be undertaken during each phase and a description of the project components.

During the construction phase three distinct work areas are proposed referred to as the Mainland GTP section which is approximately 406 km in length, the Marine Crossing GTP section which is 9 km long and the Curtis Island GTP section which is 5 km in length. The construction activities provided below is a summary and details for each section is provided in the each EMP.

4.2 Construction

Pipeline materials will be imported via ship to the Port of Gladstone or Port Alma, transported via road and stored in temporary locations called 'temporary pipe storage sites' along the pipeline RoW. A peak workforce of approximately 900 construction personnel are required for the pipeline construction, working 12 hours each day on a 28 days on, 9 days off roster. A summary of the construction program is as follows:

- Commences in late December 2011 with delivery of the first shipments of line pipe
- ROW clearing activities and rock exposure and blasting commence in January 2012
- Trenching, stringing and bending activities commence in April 2012
- Welding, lowering and backfilling commence in May 2012
- Clean up and RoW restoration commence in June 2012 through to February 2013

4.2.1 Mainland GTP construction activities

Construction workforce and camps

Construction personnel will be accommodated in construction camps. Four construction camp locations have been identified (Bundaleer, Bauhinia, Banana and Calliope (refer Figure 1 – GTP Waste and Recovered Material Haulage Route)). Temporary work site facilities such as vehicle refuelling facilities, waste storage area, site offices, warehouse and lay-down area, maintenance workshop, prefabrication workshop, vehicle parking area, vehicle washdown facilities and associated infrastructure such as water storage tanks, diesel generators and portable sewage treatment facilities will be located within the construction camps. These construction camps will use sectional trailers and modular structures joined together to provide the required buildings. The workshops and other facilities will be relocatable and will be moved to follow the Mainland GTP construction as it progresses along the RoW.

The construction camps will require potable and non-potable water for domestic use during construction. It is estimated that the overall usage of potable water during construction and will be approximately 200 L/person/day.

A temporary equipment maintenance workshop, which is mostly containerised, will be mobilised at each construction camp for the purpose of undertaking maintenance and repairs of construction plant and equipment.

It is proposed that fuel trucks, lubrication trucks and small maintenance vehicles with roving mechanics will be on site daily to service and perform maintenance on plant and equipment. Plant and equipment requiring major repair will be brought to the construction camp's equipment workshop.

It is proposed that emergency vehicle maintenance will be provided for the following services:

- Towing of stalled vehicle to workshop
- Tyre repair
- Changing fan belts, replacing hoses and other repairs requiring 3 hours or less

The prefabrication workshop will be provided for fabrication of main line valves and end of loops piping.

General GTP construction activities

Pipe will be imported via ships, which will be unloaded at pipe receipt areas. Approximately 11 pipe shipments will be received at Port Alma and 5 pipe shipments at Gladstone Port Central. Prior to transport from the port to the temporary pipe receiving areas, the pipe will be inspected for compliance with the specification. Many of the construction vehicles, equipment and materials which are required for the pipeline construction will be sourced from the contractor's fleet and stores located outside Australia. The contractor's fleet, equipment and materials which are imported into Australia will arrive and be unloaded either at Gladstone Port Central or the Port of Brisbane and transported via road to the construction camp or work area of the RoW.

Pipe arriving at Port Alma will be transferred to the temporary pipe receiving area located at Lot 96 on DS186 on the Toonda Port Alma Rd, Bajool. The pipe will be stored on Lot 96 until scheduled for dispatch to the temporary pipe storage sites adjacent to the GTP RoW.

Similarly, pipe arriving at Gladstone Port Central will be transferred to the temporary pipe receiving area at the Gladstone Logistic Base. The pipe will be stored at the Logistic Base until scheduled for dispatch to the temporary pipe storage sites adjacent to the Mainland RoW or transported via barge to Curtis Island. This Logistic Base is to be established to support the pipeline construction activities near Gladstone and will be operational for the duration of the Project. Vehicle refuelling facilities, waste storage area, site offices, warehouse and lay-down area, maintenance workshop, prefabrication workshop will also be located at the Gladstone Logistics Base.

Up to 11 temporary pipe storage sites (pipe laydown areas) are to be constructed at various locations adjacent to the Mainland RoW for temporary storage of pipe prior to transferring the pipe to the RoW during stringing works (Refer Figure 1 – GTP Waste and Recovered Material Haulage Route). Each temporary pipe storage site will typically be 8 ha in area to accommodate temporary storage of up to 60,000 pipes.

To prevent spread of weeds by construction vehicles, RoW access will be strictly controlled so that vehicles can not travel from a weed infested area into a weed free area without passing through a vehicle washdown facility. It is proposed to install 12 RoW access points with vehicle washdown facilities along the Mainland RoW. Weed management and control

associated with vehicle washdown and weed zones is addressed in the Weed and Pest Management Plan, which states that access routes shall be planned to achieve the following:

- Vehicles operate in such a manner as to limit crossing of weed zone boundaries
- Vehicles start in clean areas and then move into the dirty areas
- Vehicles do not drive through or contact any seeding or flowering weeds
- Vehicles are subject to washdown and certification to move between zones

It is understood that the following pipeline construction activities are likely to generate waste:

- Early works
 - Weed control along the RoW
 - Construction of platforms for pipe storage at the temporary pipe storage sites
- Contractor plant and equipment receipt in Gladstone and Brisbane ports
- Pipe receipt at temporary pipe receiving areas at Port Alma and Gladstone Logistic Base
- Mobilisation
 - Construction of temporary facilities – Temporary receiving pipe areas, 11
 - Transport and delivery of plant and equipment
 - Transport and delivery of pipe to temporary pipe storage sites
 - Progressive installation of construction camps - 4 mobile construction camps for worker accommodation, relevant to the work area of the construction workers
- Clearing and grubbing pipeline corridor and access tracks
- Erosion and sediment control maintenance
- Restoration and maintenance of existing roads, RoW access tracks and haul roads
- Trenching
- Drilling and blasting
- Pipe Installation – welding and weld checking called holiday testing
- Pipe cleaning (pigging) and testing (hydrotesting and leak detection testing)
- Infield servicing of equipment and mobile plant
- Mobile refuelling of construction equipment
- Construction of inlet station and mainline valve stations
- Rehabilitation – pipe backfilling and pipeline corridor restoration
- Decommissioning and relocation of construction camps

4.2.2 Marine Crossing section construction activities

The Marine Crossing GTP is a 9 km section that traverses the tidal area of The Narrows and wetlands to reach Curtis Island. A section of the Marine Crossing GTP will be constructed using HDD, which entails drilling a continuous borehole beneath The Narrows and then pulling the pipeline and other utility components including a fibre optic cable through the borehole, leaving the surface undisturbed. A section of marine Crossing section will be constructed by open trench. Details relating to the HDD construction process is included in the Marine Crossing EMP.

The HDD activity will generate drill cuttings which will be temporarily stored in a cuttings settlement pit (or a water tight container) located on the HDD drill pad. Drilling mud slurry (bentonitic drilling fluid) will also be stored in containment pits (or a water tight container) at the drill entry and exit points.

Drill cuttings that comply with Gladstone Port Corporation GPC's approval conditions will be disposed of within the Western Basin Reclaim Area. Drill cuttings that potentially contain Acid Sulfate Soil (ASS) will be transported to an ASS treatment area for treatment in accordance

with the Acid Sulfate Soil Management Plan (ASSMP). Treated material will then be transferred to the Western Basin Reclaim Area for disposal. Material that doesn't comply will be disposed to landfill.

At completion of drilling operations, remaining drilling fluids (bentonite slurry – mixture of water and bentonite) that comply with CGP approval conditions will be dewatered and transported to an authorised location for disposal (Benaraby Landfill or the Western Basin Reclaim Area).

Upon completion of the Marine Crossing GTP section, the HDD drill pad, access bog mats and associated pipe stringing and welding platforms will be removed and the Kangaroo Island Wetland will be rehabilitated in accordance with the Land Rehabilitation Management Plan (LRMP).

Waste and recyclable material from the Marine Crossing GTP section will be transported via barge to the Gladstone Logistic Base for aggregation and sorting in the waste storage area. A licensed waste contractor will transport waste and recyclable material to a disposal or recycling facility.

Refer Figure 2 and 3 (Appendix B).

4.2.3 Curtis Island section construction activities

The Curtis Island GTP section that joins the Marine Crossing GTP section to the proposed LNG Facility will be constructed using trenching (as described for the Mainland GTP section refer Figures 2 and 3 in Appendix B).

Waste and recyclable materials generated from the Curtis Island GTP will be transported via barge to the Gladstone Logistic Base for aggregation and sorting in the waste storage area. A licensed waste contractor will transport waste and recyclable material to a disposal or recycling facility.

4.3 Operation

The operational phase involves activities associated with:

- Structural integrity monitoring
- Maintaining and repairing the pipeline, valves and metering stations
- Cleaning the pipeline (pigging)
- Maintenance to operational access tracks such as weed control and vegetation management
- Monitoring the performance of the cathodic protection system and anti-corrosion initiatives
- Monitoring the gas transmission

Waste and recyclable materials likely to be generated from the operational phase are detailed in Section 5.2.

4.4 Decommissioning

Decommissioning will occur in accordance with regulatory requirements as set out in the EM Plans.

5. Waste Generation

Waste will be generated as a result of GTP construction activities. Three distinct construction work areas identified and outlined in Section 4 will generate waste; these include the Mainland section, the Marine Crossing section and Curtis Island section.

The estimated waste streams from the construction and operation of the GTP fall into one of the following broad categories:

- General waste
 - Recyclable waste such as paper, cardboard, plastics, glass, aluminium and timber
 - Putrescible waste
 - Medical and first-aid waste
 - Scrap metals
- Liquid waste
 - Sanitary waste
 - Hydrotest water
 - HDD fluids
- Hazardous and regulated waste

The waste materials likely to be generated from construction and operation of the GTP have been described in Section 5.1 to Section 5.3. The quantities of waste are estimates only.

5.1.1 Mainland section

Table 5.1 to Table 5.3 list the expected wastes to be generated from the construction activities from the Mainland GTP section. The waste generation lists have been compiled relative to the key activity areas:

- Temporary pipe receiving area at the Gladstone Logistic Base and at Port Alma
- Mainland RoW including temporary pipe storage sites and RoW access points
- Construction camps including plant and equipment workshops

Temporary pipe receiving areas

Table 5.1 Waste generated at temporary pipe receiving area at the Gladstone Logistic Base and Port Alma

GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Delivery of plant and equipment to site (ie light vehicles and construction vehicles, dongas, portable toilets)	Packaging (ropes and strapping, cardboard), timber skids, fibre/nylon rope spacers, pallets, drums and scrap metals	Materials treated as per waste hierarchy with general waste disposed to local licensed landfill	Negligible
Delivery of pipe at port to temporary pipe receiving area	Pipes with irreparable defects or specification non-conformity or damage Pipe will arrive with PVC or polyethylene end caps and 3 pieces of nylon rope tied around each end and in the centre. These will remain on the pipe until stringing and welding is undertaken within the RoW	All dunnage and damaged pipe sections will remain on ship	Negligible
Site office	General waste, waste paper	General waste to local licensed landfill Recyclable material to recycling facility (where available)	General waste 240 L per week
Prefabrication workshop valve assemblies, pipe supports and light structures (not applicable to Port Alma)	Waste materials such as pipe spools, various off cuts and grindings, paint containers, welding waste	Recycle metals General waste to local licensed landfill	Pipe off cuts and waste steel 0.5 t per week (approx one 12 m length of pipe per week) General industrial waste 0.5 t per week

Temporary pipe storage sites and RoW access points

Table 5.2 Waste generated from the Mainland RoW construction area and temporary pipe storage sites

Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Mobilisation activities			
Translocation of plants	Plastic pots Wooden stakes Packaging material	All existing fencing removed from the ROW during the construction phase will be offered to local landowners for reuse. Any remaining items will be removed in accordance with the principles of the waste hierarchy Recyclable material to recycling facility (where available)	10 m ³ per week of general and recyclable waste during fencing works
Weed control	Chemical containers and other consumables		
Delivery of plant, equipment and portable structures to site (ie vehicles, dongas, portable toilets, vehicle weed washdown facilities at RoW access points)	Packaging (ropes and strapping, cardboard), timber skids, wooden crates, fibre/nylon rope spacers, pallets, drums and scrap metals		

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Installation of fencing and gates (temporary and permanent) and removal of existing fencing as per Landholder agreements	Damaged fencing, fencing wire off cuts, timber post off cuts Temporary fencing that can not be reused	General waste to local licensed landfill	
Construction			
Hardstand - import of hard standing materials for roadway or hardstand construction	Hardstand materials	Surplus clean material will be offered to local landowners for reuse or removed in accordance with the principles of the waste hierarchy	No waste materials are expected to be generated
Weed washdown facilities	Wastewater and sludge	Water is filtered and reused in washdown facility. Sludge disposed at local licensed landfill or WWTP	1 m ³ sludge per week per washdown facility
Clearing and grubbing of the pipeline corridor, temporary pipe storage sites and access tracks (clear and grade)	Green waste (felled vegetation and plant matter) Topsoil and excavated material (stockpiled for backfilling and application to RoW) Installation of temporary fencing and gates Construction of access tracks as required Steel post offcuts (from signage installation)	Stockpiled/windrowed vegetation will be reapplied during restoration/rehabilitation of RoW All topsoil and excavated material reused for backfilling in RoW Any surplus fencing material will be offered to local landowners for reuse or removed in accordance with the principles of the waste hierarchy	Included in general waste in mobilisation activities
Construction of temporary pipe storage sites – grading and levelling, hardstand, berm construction, and fencing where required	Hardstand materials	Surplus clean material will be offered to local landowners for reuse or removed in accordance with the principles of the waste hierarchy	Included in general waste in pipe construction works
Erosion and sediment control installation and maintenance	Packaging material – cardboard, plastic wrapping, wooden pickets and geofabric sediment fencing Geofabrics "Bidim" A34 grade polyester filter off cuts	Sediment collected in devices stored in the ROW for respreading during rehabilitation works General waste to local licensed landfill	Quantities of waste dependent on climatic, site and topography conditions Included in general waste in mobilisation activities
Drilling and blasting	Packaging – cardboard, plastic wrapping	Specialist contractors will manage all waste associated with the handling and storage of explosives in accordance with relevant legislation and standards AS2187	No waste materials are expected be generated

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Delivery of pipe construction materials and consumables to temporary pipe storage sites	Neoprene plastic wrapping Nylon rope Rubber matting Packaging – timber dunnage, pallets and crates, plastic wrapping, metal and plastic strapping around consumables Ropes and strapping, cardboard, timber skids, fibre/nylon rope spacers, pallets, drums and scrap metals	Materials will be recycled where possible General waste to local licensed landfill	Included in general waste in pipe construction works
Pipeline construction works Pipe stringing and bending Pipe cutting and trimming Pipe welding (up to 1000 m pipe strings) Weld sandblasting Tie-ins (above ground or in-the-trench) Coating of field joints - application of rust proofing agent required to be applied when pipe is cut and a coating of epoxy-urethane over weld Holiday detection survey and weld testing Ducting for fibre optic cable River/waterway crossings	PVC or polyethylene pipe end caps (68,000 pipe end caps for pipeline) 42" mild steel pipe off cuts and defective pipe; metal filings(less than 100 m of pipe for pipeline) Timber skids and sand bags (reuse on each 30 km section) Off cuts – duct for future installation of fibre optic cable Marker tape Chemical containers (ie paint/epoxy coating cans, empty containers of rust proofing agents) Sandblasting grit (inert) Welding residue – welding rod scraps and electrode butts Polypropylene bags Waste cement and concrete Nylon rope	PVC or polyethylene pipe end caps recycled Metal recycled Timber skids and sand bags reused General waste to local licensed landfill Licensed contractor to transport regulated waste to an appropriately licensed recycling facility and residual material disposal at appropriately licensed regulated waste landfill	17.5 t per week of pipe end caps (10 kg per pipe end) 0.6 t per week of steel pipe off cuts and defective pipe 1.7 t per week of metal filings 8 t per week of general waste 100 L per week of regulated waste (spent chemicals and chemical container)
Trenching Foam trench breakers and foam pillows installation	Excavated material Excess rigid polyurethane foam (Aptane P220 / Isocyanate B900) and hose washings Spent absorbent material Drums/plastic bags (polypropylene) PPE - Protective gloves and disposable overalls PVC conduit offcuts	All excavated material reused for backfilling in RoW or offered to local landowners for reuse All materials will be managed as per the waste and resource management hierarchy with general waste disposed to the local licensed landfill	Included in general waste in pipe construction works

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Pipe cleaning and gauging Pipe testing – Hydrotesting 24 hour leak test	Pipe cleaning waste (pigging grit - scale, rust, or other foreign material) Hydrostatic test water not treated with biocides, corrosion inhibitor and oxygen scavengers (estimated 25 km tested at a time (90 kL water required), used 4 times before discharge)	Pigging grit - Licensed contractor to transport regulated waste to a licensed regulated waste landfill Hydrotest water discharge to land (assume no chemical treatment of water is required as source is potable water)	200 m ³ pigging grit total (assume 0.5 m ³ per km) 360 kL water
Infield servicing and maintenance of construction plant and equipment Fuel trucks, lubrication trucks and minor maintenance pick-ups provide on-site daily service and perform regular check ups on equipment Daily field servicing, safety checks and refuelling in the field to be undertaken in the RoW	Oily rags, spent absorbent material infield servicing and maintenance Waste oil and greases eg lube oil, hydraulic oil and engine oil Spent spill kit materials Packaging from replacement parts End of life vehicle parts (eg fan belts, hoses, other machinery parts) Tyres Batteries Used chemicals – chemicals, used tins from solvents, degreasing agents, lubricants Waste associated with diesel generator operation and maintenance	Licensed contractor to transport regulated waste to a licensed recycling facility Residual material dealt with in accordance with the principles of the waste hierarchy	All waste generated from infield servicing will be returned to the waste storage area at the at the construction camps
Site offices, crib room/s, site amenities (servicing of construction site amenities)	Office waste – paper, cardboard packaging etc Kitchen waste Rubbish bin waste in facilities (ie paper towels etc) First aid waste Wastewater	Recyclable material to recycling facility (where available) General waste to local licensed landfill Wastewater hauled via vacuum truck and disposed at construction camp's WWTP	Recycling and general waste quantities included in the construction camp per person kg per week Wastewater volumes included in construction camps quantities per person per day
Spill clean up	Hydrocarbon contaminated soil (small quantities) Contaminated absorbent material from RoW	Licensed contractor to transport regulated waste to a licensed recycling facility and residual material disposal at a licensed regulated waste landfill	Up to 160 L per week of regulated waste across Mainland GTP activities
RoW rehabilitation			
Clean up and restoration: reinstatement of the RoW, removal of foreign material	Any recyclable or general waste items listed above Useable surplus pipe will be	Clean hardstand material will be offered to local landowners or	100 t timber skids 50 t sand bags (assume timber skids and sand

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
<p>(construction material and waste), surface contouring, compaction, re-spreading topsoil, re-spreading felled vegetation(whole or mulched) and reseeded</p> <p>Removing any surplus materials, restoring services to their original condition, disposing of refuse, smoothing disturbed earth, removing temporary fills, culverts and bridges, and performing such work as may be necessary to restore RoW to original condition</p>	<p>delivered to a location designated by GLNG Operations</p>	<p>local council for reuse or removed for treatment or disposal in accordance with the principles of the waste hierarchy</p> <p>Useable surplus pipe and other reusable materials stored at location designated by GLNG Operations</p> <p>General waste to local licensed landfill</p>	<p>bags are reused approximately 15 times over the length of the pipeline ie assume reuse on each 30 km section)</p>
<p>Reinstatement of temporary pipe storage sites/pipe storage yards and other non RoW areas such as haul roads, spoil storage and other such areas requiring restoration</p>	<p>Polyethylene sheeting from pipe storage area</p>	<p>Reused or recycled where possible. Will be offered to local landowners for reuse</p> <p>General waste to local licensed landfill</p>	<p>80 t of polyethylene sheeting from temporary pipe storage sites</p>
<p>Establishment of vegetation</p>	<p>Plastic pots</p> <p>Wooden stakes</p> <p>Packaging material</p> <p>Herbicides</p>	<p>Residual material dealt with in accordance with the principles of the waste hierarchy</p> <p>Items will be recycled where possible if no option available then waste will be disposed of to a local licensed landfill</p> <p>General waste to local licensed landfill</p> <p>Licensed contractor to transport regulated waste to an appropriately licensed recycling facility and residual material disposal at appropriately licensed regulated waste landfill</p>	<p>50 kg per week during vegetation establishment activities in the RoW</p> <p>Quantity dependent upon whether herbicides for weed control are required during establishment of vegetation</p>

Construction camps

Table 5.3 Waste generated from construction camps

Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Mobilisation, construction and commissioning of construction camps	Site clearance green waste, topsoil and excavated material (stockpiled for backfilling and application to construction camps)	Stockpiled/windrowed vegetation will be reapplied during restoration/rehabilitation of RoW All topsoil and excavated material stockpiled along RoW for backfilling and spreading during site restoration	Nil
	Construction materials, concrete, scrap metal, timber, plastics, plumbing, electrical wiring etc	The construction methodology will aim to limit the amount of waste produced on the construction site and ensure that wherever possible, waste materials are re-used or recycled General waste to local licensed landfill	20 m ³ per week general and recyclable waste per construction camp during construction camp set up activities
Operation of construction camps – cleaning, catering, site offices, accommodation areas, RoW, temporary pipe storage sites, construction areas, temporary storage, and residential blocks within construction camps	General waste (including putrescible and non-hazardous waste) Recyclables (dry recyclables, cardboard, packaging materials and offices wastes)	Recyclable material to recycling facility (where available) General waste to local licensed landfill	6 kg per person per week recyclable material 13 kg per person per week general waste
	Metals - aerosol, aluminium cans, steel chemical containers, copper and aluminium (other than cans), steel drums (damaged), steel drums (good condition), scrap steel, steel chemical containers, bulk food containers		
	Food waste - Putrescible waste, metal, plastic, plastic and other associated food packaging		
	Chemicals - Cleaning and maintenance of camp buildings chemicals		
	Cardboard – Bulk food packaging and plant and equipment maintenance storage		

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
	Cooking oils – Food production activities	Waste cooking oil will be securely stored by the catering contractor and removed by the supplier for recycling where practicable	Recycling and general waste quantities included in the per person kg per week
	Wood (pallets) bulk deliveries of food	All pallets will be collected by suppliers and returned for reuse	
	Clinical, medical, sanitary waste, first-aid station waste, medical waste	Waste material dealt with in accordance with the principles of the waste hierarchy	Minimal quantities expected to be produced and have been included in the per person general waste quantities
	Wastewater treatment plant effluent	Discharge to mobile sewage treatment plants – irrigation beds/absorption beds	200 L per person per day - effluent
	Sludge from wastewater treatment plant	Licensed landfill or wastewater treatment plant	5 L sludge per person per week at 2% solids
Site mowing and vegetation maintenance	Green organic waste (woody garden waste, grass)	Stockpiled/windrowed vegetation will be reapplied during restoration / rehabilitation of construction camp	No waste expected to be generated
Office waste, construction materials and equipment store	Spent toner and printer cartridges, electronic and electrical equipment, white goods, computers, office equipment, mobile phones, batteries (dry cell)	Equipment will be reused by returning items to Brisbane	Minimal – each office will only be operational 6 to 9 months Recycling and general waste quantities included in the kg per person per week
	Spent lamps and fluorescent tubes	Recyclable material to recycling facility (where available)	
	Paper – Office paper, other sources of packaging	General waste to local licensed landfill	
	General non recyclable - synthetic material waste Fibre insulation filters (activated carbon) filters (air, dust, paper)		
	Wood (pallets) construction materials and other equipment	Pallets will be collected by suppliers during subsequent deliveries	

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Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Plant and equipment maintenance service areas / workshops			
Vehicle wash down	Wastewater and sludge	Water will be reused at the vehicle wash facilities Sludge disposed at local licensed landfill or WWTP	0.5 m ³ sludge per week per construction camp wash down facility
Delivery of bulk equipment and supplies	Packaging (ropes and strapping, cardboard), timber pallets, fibre/nylon rope, drums and scrap metals	All packaging materials such as pallets will be collected by suppliers and returned for reuse or dealt with on site as per the principles of the waste and resource management hierarchy General waste to local licensed landfill	0.5 t per week of packaging material
	Explosives	Specialist contractors will manage all waste associated with the handling and storage of explosives in accordance with relevant legislation and standards AS2187	No waste materials are expected to be generated Included in Mainland – RoW
Refuelling – diesel generators	Absorbent material	All waste will be stored in accordance with Australian Standards AS 1940 in bunded areas	No waste expected to be generated (absorbent material listed below)
Diesel refuelling area for construction vehicles - fuel storage up to three 30 kL tanks at construction camps for refuelling construction vehicles	Absorbent material	All waste will be stored in accordance with Australian Standards in bunded areas	
Plant and equipment maintenance workshop	Filters (oil) filters (air, dust, paper)	Collected and transported by a licensed contractor for recycling where possible	100 kg per week oil and air filters
	Batteries (wet lead acid)	Collected and transported by a licensed contractor for recycling where possible	Up to 50 batteries are expected for the duration of the Project
	Oils and oil contaminated waters - waste oil, oily absorbents, oily rags, oily sludges, sump oils, grease traps	Collected and transported by a licensed contractor for recycling or disposal to regulated waste landfill	Up to 3,000 L per week of waste oil 160 L per week of oily rags and absorbent material
	Rubber – tyres	Collected and transported by a licensed contractor for recycling	Up to 20 tyres per week

Mainland GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Prefabrication workshop valve assemblies, pipe supports and light structures	Waste materials such as pipe spools, various off cuts and grindings, paint containers, welding waste	Recyclable material to recycling facility (where available) General waste to local licensed landfill	Pipe off cuts and waste steel 0.5 t per week General industrial waste 0.5 t per week
Restoration and rehabilitation (decommissioning of construction camps)	Construction materials, concrete, scrap metal, timber, plastics, plumbing, electrical wiring	On decommissioning any remaining material will be offered to local landowners for reuse or removed for treatment or disposal in accordance with the principles of the waste hierarchy	Waste produced during construction of the construction camps will aim to encourage re-use or recycle wherever possible

5.1.2 Marine Crossing section

Table 5.4 lists the waste types and estimated quantities that are expected from construction activities of the Marine Crossing GTP section.

Some waste and recyclable material will be collected and transferred to the Gladstone Logistic Base waste storage area for separation into bins or containers for regulated waste, recyclable material and general waste. The material will be collected by waste contractors from the Gladstone Logistic Base and hauled to a recycling or disposal destination.

Where logistically more efficient (ie when waste quantities equate to a full hook lift or front lift bin), general waste may be hauled directly from the Marine Crossing RoW waste storage area via road to Benaraby Landfill for disposal. Likewise recyclable material may be collected and hauled from the Marine Crossing RoW waste storage area direct to the contractor's recycling yard. Figures 2 and 3 (Appendix B) show the location of the GTP, the Gladstone Logistic Base, proposed waste haulage routes and local waste and sewage disposal facilities.

Table 5.4 Waste generated from construction activity – Marine Crossing GTP section

Marine crossing GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Delivery of plant and equipment	Packaging (ropes and strapping, cardboard), timber skids, fibre/nylon rope spacers, pallets, metal and plastic drums	Local licensed landfill	Negligible
Weed washdown facilities	Wastewater Sludge	Water is filtered and reused in washdown facility Sludge disposed at local licensed landfill or WWTP	1 m ³ sludge per week per washdown facility

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Marine crossing GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Clearing and grubbing pipeline corridor and access tracks	Green waste, topsoil and excavated material (stockpiled for backfilling and application to RoW)	Stockpiled/windrowed vegetation will be reapplied during restoration/rehabilitation of RoW All topsoil and excavated material reused for backfilling in RoW	Nil
RoW, access / service roads and string area preparation	Hardstand materials	All material used including any surplus will be offered to local landowners for reuse or removed in accordance with the principles of the waste and resource management hierarchy	Nil
Erosion and sediment control installation and maintenance	Packaging material – cardboard, plastic wrapping, wooden pickets and geofabric sediment fencing Geofabrics "Bidim" A34 grade polyester filter off cuts	Sediment collected in devices stored in the RoW for respreading during rehabilitation works	Quantities of waste dependent on climatic, site and topography conditions
Trenching Foam trench breakers and foam pillows installation	Excavated material Excess Rigid Polyurethane foam (Aptane P220/Isocyanate B900) Spent absorbent material Drums/plastic bags Polypropylene PPE - Protective gloves and disposable overalls PVC conduit off cuts	Excavated material (all reused for backfilling in RoW). Surplus excavated material if suitable will be disposed to the Western Basin Reclaim Area General waste to local licensed landfill	Included in general waste in pipe construction works
HDD	Drilling spoil	Drilling spoil transported by barge for disposal at Western Basin Reclaim Area in accordance with Western Basin Reclamation Area approval	20,000 m ³
	Drilling fluids and drill cuttings (drilling fluids, muds or chemical additives)	Non-toxic drilling fluids and cuttings will be dried either in pits at the well head and remain at the site or will be contained in mud tanks on the drill rig Surplus material if suitable will be disposed to the Western Basin Reclaim Area or if not suitable, then will be disposed at Benaraby landfill	Nil

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Marine crossing GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
	Drilling fluids and drill cuttings (drilling fluids, muds with chemical additives)	Licensed contractor to transport regulated waste for disposal at a licensed landfill	Nil
	Oily rags, spent absorbent material from HDD drilling rig	Licensed contractor to transport regulated waste to a licensed recycling facility and residual material for disposal at a licensed regulated waste landfill	Up to 160 L per week of regulated waste from drilling activities
	Used chemicals and oils – eg lube oil, chemicals, used tins from solvents, rust proofing agents or primer	Licensed contractor to transport regulated waste to a licensed recycling facility and residual material disposal at a licensed regulated waste landfill	Included in general waste in pipe construction works
Delivery of pipe construction materials and consumables to Marine Crossing temporary pipe storage sites (road transport from Port Alma or Gladstone Logistic Base to the pipe lay down locations on the Marine Crossing RoW)	Neoprene plastic wrapping Nylon rope Rubber matting Packaging – timber dunnage, pallets and crates, plastic wrapping, metal and plastic strapping around consumables Ropes and strapping, cardboard, timber skids, fibre/nylon rope spacers, pallets, drums and scrap metals	All waste will be collected and transferred to the nearest construction camp for collection by waste contractors for treatment in accordance with the waste and resource management hierarchy	Included in general waste in pipe construction works
Pipeline construction works Pipe stringing and bending Pipe cutting and trimming Pipe welding (up to 1000 m pipe strings) Weld sandblasting Tie-ins (above ground or in-the-trench) Coating of field joints - application of rust proofing agent required to be applied when pipe is cut and a coating of epoxy-urethane over weld Holiday detection survey and weld testing Ducting for fibre optic cable River/waterway crossings	PVC or polyethylene pipe end caps (1,500 pipe end caps for pipeline) 42" mild steel pipe off cuts and defective pipe; metal filings (less than 5 metres of pipe for pipeline) Timber skids and sand bags Offcuts – duct for future installation of fibre optic cable Marker tape Chemical containers (ie paint/epoxy coating cans, empty containers of rust proofing agents) Sandblasting grit (inert) Welding residue – welding rod scraps and electrode butts Polypropylene bags Waste cement and concrete Nylon rope	PVC or polyethylene pipe end caps recycled Metal recycled Timber skids and sand bags reused General waste to local licensed landfill Licensed contractor to transport regulated waste to a licensed recycling facility and residual material disposal at a licensed regulated waste landfill	15 t in total of pipe end caps 1 t in total steel pipe off cuts and defective pipe 1.5 t in total of metal filings 0.5 t per week of general waste 10 L per week of regulated waste (spent chemicals and chemical container)

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Marine crossing GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Pipe cleaning and gauging Pipe testing – Hydrotesting 24 hour leak test	Pipe cleaning waste (pigging grit - scale, rust, or other foreign material) Hydrostatic test water not treated with biocides, corrosion inhibitor and oxygen scavengers (assuming whole 9 km tested (approximately 30kL water required))	Pigging grit - Licensed contractor to transport regulated waste to an licensed regulated waste landfill Hydrotest water discharge to land (assume no chemical treatment of water is required as source is potable water)	2.5 m ³ pigging grit in total over construction period (assume 0.5 m ³ per km) 30 kL water
Infield servicing and maintenance of construction vehicles and equipment Fuel trucks, lubrication trucks and minor maintenance pick-ups provide on-site daily service and perform regular maintenance on plant and equipment Daily field servicing, safety checks and refuelling in the field to be undertaken in the RoW	Oily rags, spent absorbent material infield servicing and maintenance Waste oil and greases eg lube oil, hydraulic oil and engine oil Spent spill kit materials Packaging from replacement parts End of life vehicle parts (eg fan belts, hoses, other machinery parts) Tyres Batteries Used chemicals – chemicals, used tins from solvents, degreasing agents, lubricants Waste associated with diesel generator operation and maintenance	Licensed contractor to transport regulated waste to a licensed recycling facility Residual material for disposal at a licensed landfill	All wastes generated from infield servicing at the Marine Crossing RoW be returned to the Logistic Base in Gladstone 250 kg regulated waste per week
Site offices, crib room/s, site amenities (servicing of construction site amenities)	Office waste – paper, cardboard packaging etc Kitchen waste Rubbish bin waste in facilities (ie paper towels etc) First aid waste Kitchen and amenity wastewater	Recyclable material to recycling facility (where available) General waste to local licensed landfill Wastewater from crib rooms and amenities will be hauled via vacuum truck and disposed at a local WWTP in Gladstone	Recyclable material 50 kg per week 200 kg per week of general waste 20 L wastewater per person per day
Spill clean up	Contaminated soil and absorbent material	Licensed contractor to transport regulated waste to an a licensed recycling facility and residual material for disposal at a licensed regulated waste landfill	40 L per week of regulated waste across Marine Crossing GTP activities

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Marine crossing GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
RoW rehabilitation			
Clean up and restoration: reinstatement of the RoW, removal of foreign material (construction material and waste), surface contouring, compaction, re-spreading topsoil, re-spreading felled vegetation(whole or	Recyclable or general waste items listed above Useable surplus pipe will be delivered to a location designated by GLNG Operations Hardstand material	Hardstand material will be offered to GPC for reuse or removed for treatment or disposal in accordance with the principles of the waste hierarchy Useable surplus pipe	30 t timber skids 15 t sand bags
mulched) and reseeded Removing any surplus materials, restoring services to their original condition, disposing of refuse, smoothing disturbed earth, removing temporary fills, culverts and bridges, and performing such work as may be necessary to restore RoW to original condition Reinstatement of storage areas and other off RoW areas such as haul roads, spoil storage and other such areas requiring restoration		and other reusable materials stored at location designated by GLNG Operations General waste to local licensed landfill	

5.1.3 Curtis Island section

Table 5.5 Waste generated from the Curtis Island section

Curtis Island GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Mobilisation activities			
Translocation of plants	Plastic pots Wooden stakes Packaging material	Recyclable material to recycling facility (where available) General waste to local licensed landfill	Less than 1m ³ per week of general and recyclable waste during mobilisation activities
Weed control	Chemical containers and other consumables		
Delivery of plant, equipment and portable structures to site (ie vehicles, dongas, portable toilets, vehicle weed washdown facilities at RoW access points	Packaging (ropes and strapping, cardboard), timber skids, wooden crates, fibre/nylon rope spacers, pallets, drums and scrap metals		
Installation of fencing and gates and removal of existing fencing	Damaged fencing, fencing wire off cuts, timber post off cuts Temporary fencing that can not be reused	Recyclable material to recycling facility (where available) General waste to local licensed landfill	No fences or gates to be installed or removed from the Curtis Island RoW

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Curtis Island GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
Construction			
Hard standing - import of hard standing materials for roadway or hardstand construction	Hardstand materials	Surplus clean material will be offered to local landowners for reuse or removed in accordance with the principles of the waste hierarchy	No waste materials are expected to be generated
Weed washdown facility	Wastewater Sludge	Water is filtered and reused in washdown facility Sludge disposed at local licensed landfill or WWTP	1 m ³ sludge per week per washdown facility
Clearing and grubbing of RoW, temporary pipe storage sites and access tracks (clear and grade)	Green waste (felled vegetation and plant matter) Topsoil and excavated material (stockpiled for backfilling and application to RoW) Installation of temporary fencing and gates Construction of access tracks as required Steel post off cuts (from signage installation)	Stockpiled/windrowed vegetation will be reapplied during restoration/rehabilitation of RoW All topsoil and excavated material reused for backfilling in RoW	Included in general waste in mobilisation activities
Construct of temporary pipe storage sites – grading and levelled, hardstand, berm construction, and fencing where required	Polyethylene sheeting off cuts Cardboard or plastic tubes Plastic wrapping	Minimise surplus clean material in accordance with the principles of the waste hierarchy	Included in general waste in pipe construction works
Erosion and sediment control installation and maintenance	Packaging material – cardboard, plastic wrapping, wooden pickets and geofabric sediment fencing Geofabrics "Bidim" A34 grade polyester filter off cuts	Sediment collected in devices stored in the RoW for respreading during rehabilitation works General waste to local licensed landfill	Quantities of waste dependent on climatic, site and topography conditions Included in general waste in mobilisation activities
Delivery of pipe construction materials and consumables to the Curtis Island GTP RoW	Neoprene plastic wrapping Nylon rope Rubber matting Packaging – timber dunnage, pallets and crates, plastic wrapping, metal and plastic strapping around consumables Ropes and strapping, cardboard, timber skids, fibre /nylon rope spacers, pallets, drums and scrap metals	Materials to be treated as per the waste hierarchy with general waste to local licensed landfill	Included in general waste in pipe construction works

Waste Management Plan - Gas Transmission Pipeline

Curtis Island GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
<p>Pipe construction works</p> <ul style="list-style-type: none"> • Pipe stringing and bending • Pipe cutting and trimming • Pipe welding (up to 1000 m pipe strings) • Weld sandblasting • Tie-ins (above ground or in-the-trench) • Coating of field joints - application of rust proofing agent required to be applied when pipe is cut and a coating of epoxy-urethane over weld • Holiday detection survey and weld testing • Ducting for fibre optic cable • River/waterway crossings 	<p>PVC or polyethylene pipe end caps (1,000 pipe end caps for Curtis Island GTP)</p> <p>42" mild steel pipe off cuts and defective pipe; metal filings(less than 5m of pipe for Curtis Island GTP)</p> <p>Timber skids and sand bags</p> <p>Off cuts – duct for future installation of fibre optic cable</p> <p>Marker tape</p> <p>Chemical containers (ie paint/epoxy coating cans, empty containers of rust proofing agents)</p> <p>Sandblasting grit (inert)</p> <p>Welding residue – welding rod scraps and electrode butts</p> <p>Polypropylene bags</p> <p>Waste cement and concrete</p> <p>Nylon rope</p>	<p>PVC or polyethylene pipe end caps recycled</p> <p>Metal recycled</p> <p>Timber skids and sand bags reused</p> <p>General waste to local licensed landfill</p> <p>Licensed contractor to transport regulated waste to a licensed recycling facility and residual material disposal at a licensed regulated waste landfill</p>	<p>9.2 t in total of pipe end caps (10 kg per pipe end)</p> <p>1 t in total of steel pipe off cuts and defective pipe</p> <p>1 t in total of metal filings</p> <p>General waste 0.5 t per week</p> <p>10 L per week of regulated waste (spent chemicals and chemical container)</p>
<p>Trenching</p> <p>Foam trench breakers and foam pillows installation</p>	<p>Excavated material</p> <p>Excess Rigid Polyurethane foam (Aptane P220/ Isocyanate B900) and hose washings</p> <p>Spent absorbent material</p> <p>Drums/plastic bags (polypropylene)</p> <p>PPE - protective gloves and disposable overalls</p> <p>PVC conduit off cuts</p>	<p>All excavated material reused for backfilling in RoW to be spread across RoW</p> <p>All materials will be treated as per the waste hierarchy with general waste disposed to local licensed landfill</p>	<p>Included in general waste in pipe construction works</p>
<p>Pipe cleaning and gauging</p> <p>Pipe testing – hydrotesting</p> <p>24 hour leak test</p>	<p>Pipe cleaning waste (pigging grit - scale, rust, or other foreign material)</p> <p>Hydrostatic test water not treated with biocides, corrosion inhibitor and oxygen scavengers (assuming 5 km tested at a time (20 kL water required)</p>	<p>Pigging grit - licensed contractor to transport regulated waste to a licensed regulated waste landfill</p> <p>Hydrotest water discharge to land (assume no chemical treatment of water is required as source is potable water)</p>	<p>2 m³ pigging grit in total (assume 0.5 m³ per km)</p> <p>20 kL water</p>

Waste Management Plan - Gas Transmission Pipeline

Curtis Island GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
<p>Infield servicing and maintenance of construction vehicles and equipment</p> <p>Fuel trucks, lubrication trucks and minor maintenance pick-ups provide on-site daily service and perform regular check ups on equipment</p> <p>Daily field servicing, safety checks and refuelling in the field to be undertaken in the RoW</p>	<p>Oily rags, spent absorbent material infield servicing and maintenance</p> <p>Waste oil and greases eg lube oil, hydraulic oil and engine oil</p> <p>Spent spill kit materials</p> <p>Packaging from replacement parts</p> <p>End of life vehicle parts (eg fan belts, hoses, other machinery parts)</p> <p>Tyres</p> <p>Batteries</p> <p>Used chemicals – chemicals, used tins from solvents, degreasing agents, lubricants</p> <p>Waste associated with diesel generator operation and maintenance</p>	<p>Licensed contractor to transport regulated waste to an a licensed recycling facility.</p> <p>Residual material dealt with in accordance with the principles of the waste hierarchy</p>	<p>All waste generated from infield servicing will be returned to the waste storage area at the Gladstone Logistic Base</p> <p>250 kg regulated waste per week</p>
<p>Site offices, crib room/s, site amenities (servicing of construction site amenities)</p>	<p>Office waste – paper, cardboard packaging</p> <p>Kitchen waste</p> <p>Rubbish bin waste in facilities (ie paper towels)</p> <p>First aid waste</p> <p>Kitchen and amenity wastewater</p>	<p>Recyclable material to recycling facility (where available)</p> <p>General waste to local licensed landfill</p> <p>Wastewater hauled via vacuum truck and disposed at a local WWTP in Gladstone (Calliope River STP)</p>	<p>Recyclable material 50 kg per week</p> <p>200 kg per week of general waste</p> <p>20 L wastewater per person per day</p>
<p>Spill clean up</p>	<p>Hydrocarbon contaminated soil (small quantities)</p> <p>Contaminated absorbent material from RoW</p>	<p>Licensed contractor to transport regulated waste to a licensed recycling facility and residual material disposal at a licensed regulated waste landfill</p>	<p>10 L per week of regulated waste across the Curtis Island GTP activities</p>
RoW rehabilitation			
<p>Clean up and restoration: reinstatement of the RoW, removal of foreign material (construction material and waste), surface contouring, compaction, re-spreading topsoil, re-spreading felled</p>	<p>Useable surplus pipe will be delivered to a location designated by GLNG Operations</p>	<p>Clean hardstand material will be offered to Gladstone Regional Council for reuse or removed for treatment or disposal in accordance with the</p>	<p>20 t timber skids</p> <p>10 t sand bags</p>

Curtis Island GTP construction activity	Material used/ waste generated	General management principle	Estimate of waste quantity/rate
vegetation (whole or mulched) and reseeded Removing any surplus materials, restoring services to their original condition, disposing of refuse, smoothing disturbed earth, removing temporary fills, culverts and bridges, and performing such work as may be necessary to restore RoW to original condition		principles of the waste hierarchy Useable surplus line pipe and other reusable materials stored at location designated by GLNG Operations Residual material dealt with in accordance with the principles of the waste hierarchy	
Establishment of vegetation	Plastic pots Wooden stakes Packaging material Herbicides	Residual material dealt with in accordance with the principles of the waste hierarchy General waste to local licensed landfill Licensed contractor to transport regulated waste to an appropriately licensed recycling facility and residual material disposal at appropriately licensed regulated waste landfill	10 kg per week during vegetation establishment activities in the RoW Quantity dependent upon whether herbicides for weed control are required during establishment of vegetation

5.2 Operational waste

A list of the waste types and an estimate of the waste quantities generated from operational activities is detailed in Table 5.6, Table 5.7 and Table 5.8.

Table 5.6 Waste generated from Mainland GTP section operation

GTP construction activity	Waste generated	General management principle	Estimate of waste quantity/rate
Maintenance of pipeline valves, delivery and metering stations	Filters (non-oily, oily and gas)	Collected and transported by a licensed contractor for recycling or disposal to regulated waste landfill	Less than 350 kg per year (approximately 0.8 kg/km/year based upon 30 kg per month for entire pipeline)
	Waste oils and greases	Collected and transported by a licensed contractor for recycling where possible	5 m ³ per year (estimate 10 L per km)
	Packaging	General waste for disposal at a licensed landfill	1,500 kg per year (approximately 3.6 kg/km/year based upon 30 kg per week for entire pipeline)

Waste Management Plan - Gas Transmission Pipeline

GTP construction activity	Waste generated	General management principle	Estimate of waste quantity/rate
Cleaning of pipeline - pigging (if undertaken in the future)	Pipe cleaning waste (pigging grit - scale, rust, or other foreign material)	Pigging grit - licensed contractor to transport regulated waste to a licensed regulated waste landfill	8 m ³ pigging grit per year (approximately 20 L per km)
Spills of hydrocarbon based material	Potential hydrocarbon contaminated soil from spills oils and greases	Remediation in situ for small quantities. Advice sought from DERM regarding treatment options for larger spills (eg >200 L). Removal of soil under disposal permit for remediation or disposal at suitably licensed facility	No waste materials are expected be generated
Offices, crib room/s, site amenities along pipeline	Office waste – paper, cardboard packaging etc Kitchen waste Rubbish bin waste in facilities (ie paper towels etc) First aid waste Kitchen and amenity wastewater	Recyclable material to recycling facility (where available) Residual material local licensed landfill Wastewater from crib rooms and amenities will be hauled via vacuum truck and disposed at a local WWTP	Recyclable material and general waste very small quantities – less than 30 kg per week Very small quantities of wastewater are expected. Amenities to be serviced weekly when in use

Table 5.7 Waste generated from Marine Crossing GTP section operation

GTP operation activity	Waste generated	General management principle	Estimate of waste quantity/rate
Maintenance of pipeline valves, delivery and metering stations	Filters (non-oily, oily and gas)	Collected and transported by a licensed contractor for recycling or disposal to regulated waste landfill	Less than 10 kg per year (approximately 0.8 kg/km/year based upon 30 kg per month for entire pipeline)
	Waste oils and greases	Collected and transported by a licensed contractor for recycling where possible	100 L per year (estimate 10 L per km)
	Packaging	General waste for disposal at a licensed landfill	30 kg per year (approximately 3.6 kg/km/year based upon 30 kg per week for entire pipeline)
Cleaning of pipeline - pigging (if undertaken in the future)	Pipe cleaning waste (pigging grit - scale, rust, or other foreign material)	Pigging grit - licensed contractor to transport regulated waste to a licensed regulated waste landfill	200 L of pigging grit per year (approximately 20 L per km)

Waste Management Plan - Gas Transmission Pipeline

GTP operation activity	Waste generated	General management principle	Estimate of waste quantity/rate
Spills of hydrocarbon based material	Potential hydrocarbon contaminated soil from spills oils and greases	Remediation in situ for small quantities. Advice sought from DERM regarding treatment options for larger spills (eg >200 L) Removal of soil under disposal permit for remediation or disposal at suitably licensed facility	No waste materials are expected be generated
Offices, crib room/s, site amenities along pipeline	Office waste – paper, cardboard packaging etc Kitchen waste Rubbish bin waste in facilities (ie paper towels etc) First aid waste Kitchen and amenity wastewater	Recyclable material to recycling facility (where available) Residual material local licensed landfill Wastewater from crib rooms and amenities will be hauled via vacuum truck and disposed at a local WWTP	30 kg per year recyclable material and general waste (approximately 3.6 kg/km/year based upon 30 kg per week for entire pipeline) Small quantities of wastewater are expected. Portable amenities to be serviced weekly when in use

Table 5.8 Waste generated from Curtis Island GTP section operation

GTP operation activity	Waste generated	General management principle	Estimate of waste quantity/rate
Maintenance of Curtis Island GTP section	Filters (non-oily, oily and gas)	Collected and transported by a licensed contractor for recycling or disposal to regulated waste landfill	Less than 5 kg per year (approximately 0.8 kg/km/year based upon 30 kg per month for entire pipeline)
	Waste oils and greases	Collected and transported by a licensed contractor for recycling where possible	50 L per year (estimate 10 L per km)
	Packaging	General waste for disposal at a licensed landfill	20 kg per year (approximately 3.6 kg/km/year based upon 30 kg per week for entire pipeline)
Cleaning of pipeline - pigging (if undertaken in the future)	Pipe cleaning waste (pigging grit - scale, rust, or other foreign material)	Pigging grit - licensed contractor to transport regulated waste to a licensed regulated waste landfill	100 L of pigging grit per year (approximately 20 L per km)

GTP operation activity	Waste generated	General management principle	Estimate of waste quantity/rate
Spills of hydrocarbon based material	Potential hydrocarbon contaminated soil from spills oils and greases	Remediation in situ for small quantities. Advice sought from DERM regarding treatment options for larger spills (eg >200 L) Removal of soil under disposal permit for remediation or disposal at suitably licensed facility	No waste materials are expected be generated
Offices, crib room/s, site amenities along pipeline	Office waste – paper, cardboard packaging etc Kitchen waste Rubbish bin waste in facilities (ie paper towels etc) First aid waste Kitchen and amenity wastewater	Recyclable material to recycling facility (where available) Residual material local licensed landfill Wastewater from crib rooms and amenities will be hauled via vacuum truck and disposed at a local WWTP	20 kg per year recyclable material and general waste (approximately 3.6 kg/km/year based upon 30 kg per week for entire pipeline) Small quantities of wastewater are expected. Portable amenities to be serviced weekly when in use

5.3 Decommissioning waste

The rehabilitation of the GLNG RoW and associated infrastructure is not expected to generate large volumes of waste. The GTP is expected to be operational for a period of 25 years.

Prior to final decommissioning or abandonment of any facilities associated with the GTP, GLNG Operations will investigate potential environmental issues and impacts associated with decommissioning or abandonment. Infrastructure that is no longer required for the operation of the GTP works will be decommissioned or abandoned in accordance with the regulatory requirements and accepted management environmental practice of the day.

Prior to the decommissioning of the GTP, a detailed assessment of the types and quantities of waste materials which could be expected will be conducted. Typical waste materials which would require removal from the above ground facilities would comprise metal pipework and valves and inert waste such as concrete and hard standing material from mainline valve stations.

6. Environmental Values and Potential Impacts

6.1 Environmental values

Existing environmental values that may be impacted by the generation of waste as a result of the GTP construction and operation include:

- Life, health and wellbeing of people and the community
- Diversity of ecology and associated ecosystems
- Land use capability, having regard to economic considerations
- Management of finite resources

The nature of the Project will create liquid, solid and gaseous wastes as a result of the construction, operation and decommissioning phases of the GTP. Typical wastes which will be generated include regulated, general, recyclable and inert waste.

6.2 Potential adverse or beneficial impacts associated with waste management

Table 6.1 details the major activities associated with waste management during construction and operation of the Mainland, the Marine Crossing and the Curtis Island GTP sections and the potential impacts on environmental values as result of construction and operation of the GTP.

Table 6.1 Summary of impacts on the environmental values associated with the construction of the GTP

Aspect/source/activity	Potential impacts
Construction camps wastewater disposal	Habitat degradation to wetlands or waterways. Soil, groundwater and surface water contamination, health and safety
Disposal of treated wastewater effluent, wastewater and other liquid wastes from project-related sources (eg construction camps, equipment washdown stations)	Reduced water quality (particularly suspended solids/ turbidity, nutrients and microbiological contaminants) with potential reduction in: <ul style="list-style-type: none"> • Suitability of water for drinking • Potential contamination of surface water and/or groundwater
Spillage of oil/ fuel/ chemical during transport, storage, handling or refuelling	Loss of oil/ fuel/ other hazardous material to air, surface water, groundwater, soil and/or sediment with consequent adverse impacts on associated quality and beneficial values
Spillage of hazardous materials during transport, storage, handling and use	Loss of hazardous material to air, surface water, groundwater, soil and/or sediment with consequent adverse impacts on associated quality and beneficial values
Hydrotest water discharge	Adverse impacts on local water quality, surface water, drinking water, aquatic habitat quality, temporary loss of land use for economic use, excessive erosion
Drilling fluids and cuttings from HDD at marine crossing	Soil, groundwater, marine environment and surface water contamination, health and safety
Spill during transfer of liquid and solid waste on/off barge	Release of hazardous material resulting in adverse environmental and health effects
Hydrotest water discharge	Adverse impacts on local water quality, surface water, drinking water, aquatic habitat quality, temporary loss of land use for economic use, excessive erosion

7. Activity Specific Waste Management Requirements

7.1 Temporary pipe receiving areas

A waste management area will be allocated at the Port Alma temporary pipe receiving area for storage of waste and recyclable material. On an as needs basis, waste and recyclable material will be collected by the waste contractor for off site recycling and disposal.

7.2 Temporary pipe storage sites

The temporary pipe storage sites will be primarily used for pipe and some equipment storage. Waste materials at these locations will be stored in refuse containers and this waste will be collected by a waste contractor for transfer to a construction camp waste storage area.

Portable site amenities at these sites will be provided and these will be serviced on a regular basis. Wastewater from the portable amenities will either be hauled to the nearest construction camp wastewater treatment plant for treatment or a local WWTP if approved by the relevant local authority.

7.3 RoW

A waste contractor will be responsible for collecting bulky solid waste materials from the RoW and temporary pipe storage sites on a regular basis and transporting the waste materials to the waste and recyclables storage area at the construction camps.

Refuse containers will also be provided at each worksite. At the construction camps the waste contractor will sort the waste materials into bins for recyclable materials such as metals and plastics, regulated waste or general waste.

Green waste and excavated material will be re-used within the RoW during rehabilitation. Steel pipe off-cuts, packaging and general waste will be collected by the waste contractor and transported to the nearest waste management area in the RoW for segregation and storage. On a regular basis the waste and recyclables from the waste management areas will be transported off-site by the waste contractor either for transfer to the construction camps for aggregation with other waste materials or collected by a licensed waste contractor and transported to a disposal facility in accordance with the principles of the waste and resource management hierarchy.

7.4 Vehicle wash down facilities

It is anticipated that there will be 11 access points from public roads provided to the GTP RoW. The RoW access points will be located to optimise vehicle movements and to meet the requirements of the Pest and Weed Management Plan.

A vehicle wash down facility will be located at each of these access points for the purpose of removing mud and weed seeds as part of weed management control measures. It is anticipated that on average 1 m³ of mud and silt material will be accumulated in each sump per week.

A licensed waste contractor will remove the wash down facility sludge and dispose to a licensed facility.

7.5 Hydrotesting

The water from hydrotesting testing will be reused along the length of pipeline to reduce the amount of water to be managed. Given that potable water will be used, it is considered unlikely that any additional chemicals (eg oxygen scavengers or biocides) will be added. If chemicals are used, they shall be biodegradable. Chemicals that are unsuitable for the discharge to land will not be used. Hydrotest water will be transferred from one test section to another via a break tank.

The preferred method to dispose of the hydrotest water is directly to land and away from watercourses. All hydrotesting water released to land will be tested and will comply with discharge limits as per the Environmental Authority Conditions for the Gas Pipeline – Schedule C, Table 1 (Refer Section Table 8.1). Hydrotest water will be tested and managed as described in Section 8. The hydrotest water management procedures will aim to maximise the efficiency of testing, taking into consideration the timing of construction and commissioning, and will follow good environmental practice. Disposal to land will only occur where an assessment of water quality meets relevant criteria and relevant approvals have been obtained.

Hydrotest water will be disposed of at locations in accordance with the relevant environmental authority conditions. Written consent of the administering authority must be obtained if hydrostatic test water containing chemical additives is proposed to be released to land.

7.6 Construction camps

These construction camps will generate general putrescible wastes along with recyclables, sewage, grey water and other wastes.

An area at each of the construction camps will be set aside for storage of waste materials which are to be recycled or reused. The waste storage area will receive waste and recyclable material from the:

- Accommodation and kitchen facilities
- Offices
- Vehicle workshop
- Prefabrication workshop
- Warehouse
- RoW and temporary pipe storage sites

All bins will be serviced by the waste contractor. Separate bins will be provided for general waste, waste metal, oily waste (rags and absorbent material), batteries, tyres, regulated waste and for recycling. Likewise an area will be set aside for a bunded waste oil tank.

7.6.1 Wastewater treatment plants in construction camps

Each construction camp will have a wastewater treatment system installed capable of treating the maximum amount of effluent generated from the construction camp and associated workshops and offices.

Emphasis will be placed on the reduction and reuse of effluent on site. Each construction camp will adopt the principles of the waste and resource management hierarchy to minimise the wastewater quantities generated (where possible) through education and adoption of water efficient equipment and machinery.

Wastewater collection systems will segregate the wastes. Sanitary waste from various sources will be directed to a wastewater treatment plant. Once the wastewater has been treated to the relevant effluent standard, it will be used for irrigation or disposed of to a licensed facility. If the effluent is to be irrigated to land a disposal system will consist of a fenced (sediment fencing and bund), vegetated area, where treated effluent will be irrigated above-ground. Sludge from wastewater treatment facilities will be removed as required to a licensed facility.

7.7 Horizontal directional drilling

HDD produces waste associated with operation of the drilling rig such as oily wastes, drill cuttings and drilling muds. A waste storage area at the HDD drilling pad will be provided for storage of general waste and any regulated waste.

A HDD cuttings settlement pit and drilling mud containment pit will be located at the HDD drilling pad. No discharge of water or drill cuttings to surface water will be allowed during stockpiling, drying and transportation. Drill cuttings generated from the drilling operations will be stockpiled in a water-tight pit in a manner that prevents their release into the water or surrounding area.

The HDD cuttings will be temporarily stored in a cuttings settlement pit located in the HDD drill pad and periodically transported by barge for disposal at Western Basin Reclaim Area (WBRA) in accordance with WBRA approval. Prior to transfer to the WBRA, samples of HDD cuttings will be collected and submitted for laboratory analysis to confirm whether the cuttings comply with the WBRA approval conditions.

7.8 Transport of project related waste

Traffic movements associated with waste contractor vehicles have been addressed in the Transport and Traffic Management Plan.

Waste and recyclable materials will be moved on a daily basis from all areas along the RoW during construction and operation. Waste materials will be collected from the point of generation and transported to the closest waste storage areas located within the construction camps.

From there the waste material will be consolidated prior to collection for recycling or disposal. The existing network of state and regional council controlled roads, as well as the RoW will be used by waste collection vehicles to collect and transport the waste and recyclables.

The waste management contractor shall identify the proposed haulage routes and potential issues associated the collection and haulage of waste and recyclable materials. A haulage route and site access plan will be prepared in order to minimise impacts, this will be developed with regard to the project's Transport and Traffic Management Plan. This plan will also detail the proposed destination for the disposal of waste and recyclable materials. All waste vehicles travelling to and from the project sites will follow dedicated heavy vehicle routes to avoid built-up areas. The waste contractor where practicable will limit vehicle movements to daytime working hours.

Waste deemed as regulated or dangerous will be transported along preferred routes in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail*, and in accordance with the *Queensland Transport Operations (Road Use Management – Dangerous Goods) Regulation 1998* and the *Transport Infrastructure Act 1994* and the *Environmental Protection (Waste Management) Regulations 2008*.

7.8.1 Waste tracking

Regulated waste which is transported by road and water is required to be accompanied by a Waste Transport Certificate stating the nature of the waste and any associated hazard in accordance with the *Environmental Protection (Waste Management) Regulations 2000*. A licensed waste contractor will collect and transport the project waste. The following requirements will be implemented for the project waste-tracking system:

- Provide tracking of wastes of environmental concern from production to disposal, with the aim of ensuring that the waste is disposed in an environmentally appropriate manner
- Ensure that only those facilities that have adequate treatment and disposal methods receive wastes
- Promote responsibility to reduce the risk of illegal dumping and establish a system of accountability

The types of trackable wastes and instructions for completing the Waste Transport Certificate are outlined in *Environmental Protection (Waste Management) Regulation 2000*.

7.8.2 Non-trackable waste

Non-trackable waste associated with GTP construction activities will be identified and basic waste shipment information will be recorded for the purpose of recording project waste quantities and monitoring compliance with this WM Plan.

This information will be stored by the waste contractor for the purposes of recording project waste quantities and monitoring compliance with this WM Plan. Table 7.1 provides an example of basic information to be collected for non-regulated/non-trackable waste shipments.

Table 7.1 Example of waste shipment record

Information to be recorded on each waste shipment	
Type of waste	
Date waste collected	
Quantity of waste (litres, kg, number of bags, size of container)	
Waste transportation certificate number (only if trackable waste)	
Waste collection contractor name	
Vehicle driver name	
Vehicle transporting waste from project site	
Destination of waste	
Recipient names (company or site)	
Other details or comments	
Transporters signature	

7.9 Waste inductions and training

All construction personnel associated with GTP construction will be required to complete an induction. The induction training should incorporate relevant aspects of this WM Plan and

cover an individual's personal obligations with regard to the management procedures for all waste items and materials. This training will outline the importance of managing waste materials in accordance the principle of the waste and resource management hierarchy.

7.10 Waste chemical and hazardous materials management

The construction and operation of the GTP will require the use of chemicals and hazardous materials and will therefore generate waste chemicals and hazardous waste.

Chemical and hazardous wastes associated with the construction and operation of the GTP will be handled and stored in accordance with the State and Commonwealth legislation (refer Table 2.1) and Australian standards and guidelines (refer Table 2.2). This will include the separate storage of waste chemicals in containers at designated storage areas. Table 7.2 provides a list of likely chemicals and hazardous materials to be used during the GTP construction including relevant activity and likely storage location.

Table 7.2 Likely chemical and hazardous materials during construction

Chemical/hazardous material	Activity	Likely storage location
Diesel	Fuel for construction vehicles and machinery and diesel generators at construction camps and offices	Storage tanks located at construction camps Up to a total storage capacity 90,000 L at each construction camp (3 x T30 fuel tanks (30,000 L each))
Fuel dispenser pump and storage (unleaded) Fuel dispenser pump and storage (diesel)	Fuelling facilities for vehicles at the Marine Crossing GTP section and the Curtis Island GTP section	Gladstone Logistic Base at Gladstone Port Central 30 000 L fuel tank for generators 50 000 L fuel tank for fuel filling station
Diesel	Fuel for HDD rig generator and associated equipment	HDD drilling pad
Fertiliser	Translocation of plants and restoration of the RoW	Construction camps storage area and Gladstone Logistic Base
Herbicides (chemicals registered for the specific weed to be controlled)	Chemical spraying of weeds	Construction camps storage area and Gladstone Logistic Base
Rigid Polyurethane foam (Aptane P220/Isocyanate B900)	Foam trench breakers and foam pillows installation – to hold the pipe off the trench invert (alternative material - sand bags)	Specialist subcontractors will mobilise foam components to site in storage containers on vehicles. Subcontractors to provide documentation regarding storage, handling and disposal arrangements prior to bringing to site
Oils and greases	In field vehicle servicing and maintenance of construction vehicles and equipment Major repair and maintenance of construction equipment at the temporary maintenance workshop at each of the construction camps. HDD	Construction camp and Gladstone Logistic Base storage area in suitably sized tanks within appropriately banded compounds as per Australian Standards HDD drilling pad

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Chemical/hazardous material	Activity	Likely storage location
Waste oil	Minor repairs and maintenance of construction equipment at the maintenance workshop within construction camps and Gladstone Logistic Base	Waste oils will be collected and stored within bunded storage containers within the workshops
Emulite (bottom charge)	Blasting	Specialist subcontractors mobilise blasting materials to site. Handling, storage requirements and disposal methods to be documented by the blasting contractor ie Australian Standards 2187
Prillite (column charge)		
Nonel U175 or U500 detonators, Nonel UB,42 UB17, UB25		
Paint	Painting welds and pipe coating defects	Storage area at construction camps/Gladstone Logistic Base
Fusion bond epoxy powder	Coating for welded field joints	Storage area at construction camps/Gladstone Logistic Base
Polyurethane-tar coating compound	Field joint coating	Storage area at construction camps/Gladstone Logistic Base
Oxygen scavenger	Chemical dosing during Hydrotesting	Storage area at construction camps/Gladstone Logistic Base
Biocide	Hydrotesting	Storage area at construction camps/Gladstone Logistic Base
Radioactive isotope/ material/ element within weld inspection device (pipe crawler)	Weld inspection activities	Contained in pipe crawler machine. Pipe crawler located (RoW) or parked in equipment storage area at the construction camp/Gladstone Logistic Base Specialist subcontractor will maintain documentation and certificates to transport these materials to site and be responsible for handling, storage requirements and identification of disposal methods
	Non-destructive testing (NDT) X-ray films development for weld quality assurance	Darkroom, containing the necessary film processing equipment, will be located at the construction camps/Gladstone Logistic Base Specialist subcontractor will maintain documentation and certificates to transport these materials to site and be responsible for handling, storage requirements and identification of disposal methods
Drilling additives - polymers	HDD	HDD drilling pad in secure containers as per Australian Standards
Wastewater treatment plant chemicals	Construction camp wastewater treatment	Storage area at construction camps as per Australian Standards

Table 7.3 provides a list of likely chemicals and hazardous materials to be used during the GTP operation including relevant activity and likely storage location.

Table 7.3 Likely chemical and hazardous materials during operation

Chemical/hazardous material	Activity	Likely storage location
Lubricants	Maintenance of mainline valve stations	GLNG GTP operations facility in Gladstone
Solvents	Cleaning pigging equipment and sumps	GLNG GTP operations facility in Gladstone
Oils and greases	Maintenance of equipment for pipeline maintenance	GLNG GTP operations facility in Gladstone

7.11 Specialist pipe weld inspections

The Contractor will be responsible for the inspecting the weld integrity of each pipe weld prior to operation. The Contractor will use specialised Ultrasonic or X-ray equipment that involves the use of radioactive isotopes for inspection of each weld. The Contractor will be licensed to handle, store and use the weld inspection equipment. If isotopes are to be used then they will be stored in specially constructed and secure containers. Depleted isotopes will be disposed of in accordance with regulatory waste disposal requirements.

8. Proposed environmental protection commitments, objectives and control strategies

8.1 Waste management control strategies

Table 8.1 to Table 8.3 identify the control strategies and performance indicators for the waste management objectives detailed in Section 6 above.

General waste

Table 8.1 Environmental protection commitments, objectives and control strategies for general waste

Item	Detail
Environmental protection objective	<ul style="list-style-type: none"> To ensure that the transmission pipeline construction adheres to the waste management hierarchy of avoid, reuse, re-use and recycle. Where this is not possible, to dispose of waste in the most appropriate manner
Specific objectives	<ul style="list-style-type: none"> No inappropriate disposal or management of waste No contamination of soil, air or water as a result of waste handling Petroleum activities do not result in the release or likely release of contaminants to the environment from the storage, conditioning, treatment and disposal of regulated waste materials
Control strategies	<p>General</p> <ul style="list-style-type: none"> Prior to commencement of works, the appropriate methods for disposal of waste will be determined by consultation with the relevant local governments and the Department of Environment and Resource Management A waste management plan in accordance with the Environmental Protection (Waste) Policy 2000 on the following will be developed and implemented including: <ul style="list-style-type: none"> The types and amounts of waste generated How the waste will be dealt with, including a description of the types and amounts of waste that will be dealt with under each of the waste management practices mentioned in the waste management hierarchy (section 10 of the Environmental Protection (Waste Management) Policy 2000) Procedures for dealing with accidents, spills and other incidents that may impact on waste management How often the performance of the waste management practices will be assessed (ie at least annually) The indicators or other criteria on which the performance of the waste management practices will be assessed On completion of each section of pipeline, all waste material will be removed from the workplace. No wastes will be buried or disposed of on-site without local government and/or DERM approval The Construction Contractor will advise designated disposal areas for each section of the RoW All welding waste will be managed appropriately and removed from the RoW on a daily basis General waste will be collected and transported generally to local council approved disposal sites Food wastes will be collected, where practicable, considering health and hygiene issues, for disposal off-site All waste/rubbish will be correctly disposed of and will not pose a risk to marine fauna. Plastic bags will be banned from all site offices and project areas within the coastal zone (intertidal and marine zones) Refuse containers will be located at each worksite Where practical, wastes will be segregated and reused / recycled (eg scrap metal) All personnel will be instructed in project waste management practices and

Item	Detail																																								
	<p>procedures as a component of the environmental induction process</p> <ul style="list-style-type: none"> Suppliers will be requested to minimise packaging where practicable Emphasis will be placed on housekeeping and all work areas will be maintained in a neat and orderly manner All equipment and facilities will be maintained in a clean and safe condition <p>Liquid waste</p> <ul style="list-style-type: none"> Wastewater from construction, cleaning and testing operations will be treated and managed in accordance with the relevant environmental authorities Sewage or grey water will either be collected for treatment and disposal off-site or treated via an on-site treatment system and disposed of to effluent absorption beds or irrigation fields, with treated sewage effluent generally to be disposed of by irrigation The treatment method will be selected in consultation with a relevant local authority and DERM and the relevant environmental authority obtained Prior to commencement of works, the Contractor must determine from all relevant local governments, any additional upgrades of sewerage or waste disposal facilities required as a result of this project's requirements for workers' accommodation and meet any costs associated with these upgrades Prior to discharge of wastewater to land, the Contractor must submit a copy of the WIMP to GLNG Operations within a sufficient timeframe to obtain approval from the administering authority allowing for review and comment and having due regard to that comment in the finalisation of the plan The release of contaminants from the sewage treatment plant to land must comply, at the sampling and in situ monitoring point(s) with each of the limits specified in Table 1 for each quality characteristic <p>Table 1 Release quality characteristics for discharge to land</p> <table border="1"> <thead> <tr> <th>Quality characteristics</th> <th>Release limit</th> <th>Limit type</th> <th>Monitoring frequency</th> </tr> </thead> <tbody> <tr> <td>Total-N</td> <td>3 mg/l</td> <td>50 percentile Compliance</td> <td>Weekly</td> </tr> <tr> <td>Total-N</td> <td>10 mg/l</td> <td>Maximum</td> <td>Weekly</td> </tr> <tr> <td>Total-P</td> <td>0.1 mg/l</td> <td>50 percentile Compliance</td> <td>Weekly</td> </tr> <tr> <td>Total-P</td> <td>1 mg/l</td> <td>Maximum</td> <td>Weekly</td> </tr> <tr> <td>Ammonia-N</td> <td>1 mg/l</td> <td>50 percentile Compliance</td> <td>Weekly</td> </tr> <tr> <td>5-day Biochemical Oxygen Demand</td> <td><5 mg/l</td> <td>80 percentile Compliance</td> <td>Weekly</td> </tr> <tr> <td>Suspended Solids</td> <td><5 mg/l</td> <td>80 percentile Compliance</td> <td>Weekly</td> </tr> <tr> <td>pH</td> <td>6.5 – 8.0</td> <td>Range</td> <td>Daily</td> </tr> <tr> <td>Faecal Coliforms</td> <td>5 colonies per 100ml sample</td> <td>Geometric Mean</td> <td>Weekly</td> </tr> </tbody> </table> <ul style="list-style-type: none"> The effluent released must not have any properties nor contain any organisms or contaminants in concentrations which are capable of causing environmental harm or an environmental nuisance Signage must be placed around the land irrigation area and irrigation equipment 	Quality characteristics	Release limit	Limit type	Monitoring frequency	Total-N	3 mg/l	50 percentile Compliance	Weekly	Total-N	10 mg/l	Maximum	Weekly	Total-P	0.1 mg/l	50 percentile Compliance	Weekly	Total-P	1 mg/l	Maximum	Weekly	Ammonia-N	1 mg/l	50 percentile Compliance	Weekly	5-day Biochemical Oxygen Demand	<5 mg/l	80 percentile Compliance	Weekly	Suspended Solids	<5 mg/l	80 percentile Compliance	Weekly	pH	6.5 – 8.0	Range	Daily	Faecal Coliforms	5 colonies per 100ml sample	Geometric Mean	Weekly
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Item	Detail
	<p>warning the public that the area and equipment has been set aside for irrigation by treated effluent, which is not to be used for drinking purposes. The signs must be maintained in a visible and legible condition</p> <ul style="list-style-type: none"> • Any treated effluent irrigation area must not be used for: <ul style="list-style-type: none"> – Recreational activities or as a traffic thoroughfare during irrigation – Any activity which may involve members of the public or employees without appropriate personal protective equipment coming in contact with treated wastewater during irrigation periods and for at least four hours after irrigation has ceased or until irrigated vegetation has dried • Sufficient wet weather storage should be provided for a 3 month period • When weather conditions or soil conditions preclude the irrigation of treated effluent, the treated effluent must only be discharged at nomination locations as per environmental authority • Treated sewage effluent must not be irrigated when weather or soil conditions would cause run-off or ponding of any irrigated wastewater • The amount of treated sewage effluent irrigated must be matched to the water requirements of the vegetation irrigated, without exceeding a reasonable estimation of the field capacity of the soil, in the root zone, in the irrigation area • The rate of application of treated sewage effluent to the release area must not exceed the capacity of the soil in the contaminant release area to absorb it • The irrigation of treated effluent must be carried out with a sufficient buffer distance to comply with all environmental conditions and requirements (eg contaminants release, Air quality) • Treated effluent will not be released to other parties for irrigation without written permission from GLNG Operations. The quality of the treated effluent released to other parties for the purpose of irrigation must comply, at the sampling point specified, with each of the release limits specified in Table 2 • Copies of agreements to supply treated sewage effluent from the Sewage Treatment Plant for the purpose of irrigation must be forwarded to GLNG Operations in a sufficient timeframe to be approved by administering authority • The Contractor must prepare a Wastewater Irrigation Management Plan (WIMP) as part of the EMP. The WIMP is to be developed in accordance with the “Interim Guidelines for the Reuse of Reclaimed Wastewater in Queensland, 1996” produced by the Department of Natural Resources or the “Draft National Guidelines for Sewerage Systems: Reclaimed Water” endorsed by NH and MRC in 2000. The WIMP should address at least, but not be limited to, the following matters: <ul style="list-style-type: none"> – The measurement of the quantity and quality of treated effluent produced by the activity – An assessment of the suitability of the area of land available for wastewater irrigation – The definition and clear identification of areas to be used for wastewater irrigation – Carrying out daily time step modelling (using MEDLI or similar) to estimate at least wastewater irrigation application rates, the wastewater irrigation area required and the volume of wet weather storage required, taking into account at local tropical climatic conditions, soils in the wastewater irrigation area and the vegetation grown in the wastewater irrigation area – An assessment of surface waters, including stormwater, that may be affected – An assessment of the characteristics of the soils in the wastewater irrigation area including assessment of nutrient and salt levels of the soils in the disposal area and how soils will be managed – An assessment of the potential impacts of odour resulting from wastewater irrigation – Management of human and fauna health issues associated with the irrigation of wastewater • Sewage treatment plants associated with temporary workers’ accommodation must be located above Q50 flood levels • The plant and equipment used for sewage treatment or disposal will be installed, maintained and operated in a proper and efficient manner by a suitably qualified

Item	Detail
	<p>and experienced person</p> <ul style="list-style-type: none"> • Sewage effluent absorption beds and/or irrigation fields will be selected and designed to ensure that: <ul style="list-style-type: none"> – Sensitive areas are avoided – Soil erosion and soil structure damage is avoided to the extent possible – There is no ponding or runoff of effluent – The receiving environment has the capacity to assimilate the contaminants – There will be no discharge of treated effluent from wet weather storage to any waters • Flammable and combustible liquids (including petroleum products and associated piping and infrastructure), must be stored, handled and maintained in accordance with the latest edition of Australian Standard 1940 - the Storage and Handling of Flammable and Combustible Liquids • Any liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land. Where no relevant Australian Standard is available, the following must be applied: <ul style="list-style-type: none"> – Storage tanks must be banded so that the capacity and construction of the bund is sufficient to contain at least 110 per cent of a single storage tank or 100 per cent of the largest storage tank plus 10 per cent of the second largest storage tank in multiple storage areas; and – Drum storages must be banded so that the capacity and construction of the bund is sufficient to contain at least 25 per cent of the maximum design storage volume within the bund <p>Hazardous waste</p> <ul style="list-style-type: none"> • Chemical wastes will be collected in 200 litre drums (or similar sealed container) and appropriately labelled for safe transport to an approved chemical waste depot or collection by a liquid waste treatment service • Storage, transport and handling of all chemicals will be conducted in accordance with all legislative requirements • Containment bunds and/or sumps will be drained periodically to prevent overflow and subsequent pollution of the surrounding land and/or water body • All hazardous wastes will be appropriately stored in banded areas away from watercourses and in accordance with legislative requirements • Where no Australian Standard is available, any liquid with potential to harm the environment must be: <ul style="list-style-type: none"> – Stored in impervious banded tanks with banded capacity at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas – Impervious drum storage must have a banded capacity to contain at least 25% of the maximum design storage volume within the bund • Hazardous wastes, such as solvents, rust proofing agents and primers will be managed in accordance with the requirements of relevant legislation and industry standards • A hazardous materials inventory will be prepared • Material Safety Data Sheets (MSDS) for hazardous materials will be available at all work sites • Hydrocarbon wastes, including lube oils, will be collected for safe transport off-site for reuse, recycling, treatment or disposal at approved locations • As soon as practicable remove and dispose of all regulated waste to a licensed waste disposal facility or recycling facility • All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the Environmental Protection Act 1994 and sent to a facility licensed to accept such

Item	Detail
	<p>waste</p> <ul style="list-style-type: none"> • When regulated waste is removed from within the boundary of the petroleum tenure and transported by the holder of this authority, a record must be kept of the following: <ul style="list-style-type: none"> – Date of waste transport – Quantity of waste removed and transported – Type of waste removed and transported – Route selected for transport of waste – Quantity of waste delivered – Any incidents (e.g. spillage) that may have occurred on route • If a person removes regulated waste associated with activities within the operational land and disposes of such waste in a manner which is not authorised or is improper or unlawful then, as soon as practicable, the administering authority will be notified of all relevant facts, matters and circumstances known concerning the disposal • If a hazardous contaminant is released to waters or land the following steps must be taken: <ul style="list-style-type: none"> – Take immediate action to stop any further release and make sure that the area is safe – Take immediate action to contain the hazardous contaminant to the affected area, taking particular care to protect environmentally sensitive areas – Restore or rehabilitate the environment to its condition before the release occurred; and take necessary action to prevent a recurrence of the release – Ensure that all health risks associated with the disposal and reuse of treated sewerage is mitigated through appropriate primary and secondary treatment
<p>Performance indicators</p>	<ul style="list-style-type: none"> • No inappropriate disposal or management of waste • No contamination of soil, air or water as a result of waste handling

Hydrotest water

Table 8.2 Environmental protection commitments, objectives and control strategies for hydrotesting

Item	Detail
Environmental protection objective	<ul style="list-style-type: none"> To protect the quality of local land and water resources during pipeline hydrotesting
Specific objectives	<ul style="list-style-type: none"> Appropriate permits obtained prior to drawing water No existing water sources unsustainably depleted to provide hydrotesting water No adverse impacts on soil or surface water as the result of discharging hydrotesting water
Control strategies	<ul style="list-style-type: none"> Relevant permits to draw water obtained Hydrotest water will be re-used on multiple and adjacent pipeline sections as much as possible to reduce actual volumes used Pipe sections crossing water bodies will be tested prior to installation Inspection of all pipeline section welds, or hydrotesting of pipeline sections before installation under water bodies, will be performed in accordance with construction specifications/procedures Biocides, where required, will be biodegradable Where biocides are added, discharge water will be aerated Prior to discharge, the Contractor shall provide a Hydrotest Water Management Plan (HWMP) prior to commencement of construction works for the Project. The HWMP will include: <ul style="list-style-type: none"> A detailed assessment of impacts from hydrostatic test water along the pipeline route including source water quality data and characteristics of additives, particularly biocides Proposed storage, treatment and disposal methods of hydrotest water Site specific mitigation measures for management of hydrotest water including monitoring and reporting Determination of whether testing of the hydrotest water is necessary and submit a plan for review to GLNG Operations. Where the water source and water quality is known, and no chemicals have been added, water quality testing may not be required Hydrostatic test water, including a detailed assessment of impacts from hydrostatic test water along the pipeline route, will be provided. Source water quality data and characteristics of additives, (particularly biocides) will be provided along with the proposed storage, treatment and disposal methods. The information will be used to determine the site specific mitigation measures including monitoring and reporting Hydrotest water will be treated as necessary and then disposed of such that it does not enter into any watercourses or run in an uncontrolled manner onto open land. Where water cannot be discharged to ground, other options will be considered to ensure compliance with all regulations Hydrotest water will be released at least 100 m from any watercourse such that vegetation and soil structure are not damaged or eroded and the quality of groundwater is not adversely impacted Discharge of hydrotesting water will comply with all regulatory and landholder requirements Where hydrostatic test water is proposed to be released to land, it will not exceed the water quality limits specified in Table 1: Water Quality Limits. Hydrostatic test water containing chemical additives must not be released to land without written consent from GLNG Operations and the administering authority

Item	Detail																										
	Table 1 Water quality limits																										
	<table border="1"> <thead> <tr> <th>Parameter</th> <th>Maximum value</th> </tr> </thead> <tbody> <tr> <td>pH</td> <td>6.5-8.5 (Range)</td> </tr> <tr> <td>Arsenic (mg/L)</td> <td>2.0</td> </tr> <tr> <td>Cadmium (mg/L)</td> <td>0.05</td> </tr> <tr> <td>Chromium (mg/L)</td> <td>1</td> </tr> <tr> <td>Copper (mg/L)</td> <td>5</td> </tr> <tr> <td>Iron (mg/L)</td> <td>10</td> </tr> <tr> <td>Lead (mg/L)</td> <td>5</td> </tr> <tr> <td>Manganese</td> <td>10</td> </tr> <tr> <td>Zinc (mg/L)</td> <td>5</td> </tr> <tr> <td>Nitrogen (mg/L)</td> <td>35</td> </tr> <tr> <td>Phosphorus (mg/L)</td> <td>10</td> </tr> <tr> <td>Electrical Conductivity (uS/cm)</td> <td>2000</td> </tr> </tbody> </table>	Parameter	Maximum value	pH	6.5-8.5 (Range)	Arsenic (mg/L)	2.0	Cadmium (mg/L)	0.05	Chromium (mg/L)	1	Copper (mg/L)	5	Iron (mg/L)	10	Lead (mg/L)	5	Manganese	10	Zinc (mg/L)	5	Nitrogen (mg/L)	35	Phosphorus (mg/L)	10	Electrical Conductivity (uS/cm)	2000
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Electrical Conductivity (uS/cm)	2000																										
Performance indicators	<ul style="list-style-type: none"> • Appropriate permits are obtained prior to drawing water • No existing water sources unsustainably depleted to provide hydrotesting water • No adverse impacts on soil or surface water as the result of discharging hydrotesting water 																										

Chemical and hazardous materials

Table 8.3 Environmental protection commitments, objectives and control strategies for chemical and hazardous materials management

Item	Detail
Operational policy or management objective	<ul style="list-style-type: none"> • To ensure that storage and handling of chemicals and dangerous goods does not cause environmental harm or harm to persons
Performance criteria	<ul style="list-style-type: none"> • Petroleum activities do not result in the release or likely release of a hazardous contaminant to the environment • Storage and handling procedures correct and appropriate • Chemicals stored in secure areas • All containment systems must be designed to minimise rainfall collection within the system
Control strategies	<ul style="list-style-type: none"> • Spill control procedures will be prepared and personnel trained • Dangerous goods will be stored and handled as per the requirements of relevant Australian Standards • Areas where contaminants or wastes are stored or handled will be minimised or roofed • Dangerous goods will, where appropriate (eg outside locations), be stored in bunded areas away from watercourses • Stormwater will be diverted around disturbed areas and areas where contaminants or wastes are stored or handled • All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard • Explosives will be stored in magazines constructed and located as prescribed in AS 2187

Item	Detail
	<ul style="list-style-type: none"> • Where no Australian Standard is available, any liquid with potential to harm the environment must be <ul style="list-style-type: none"> – Stored in impervious bunded tanks with bunded capacity at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas – Impervious drum storage must have a bunded capacity to contain at least 25% of the maximum design storage volume within the bund • Stormwater runoff and rainfall events will be collected, treated, reused or released in accordance with environmental and legal requirements • Material safety data sheets for chemicals and dangerous goods will be available on-site • Waste dangerous goods, which cannot be recycled, will be transported to a designated disposal site as approved by the local authority • Any spillage of hazardous waste or other contaminants that may cause environmental harm, will be effectively contained and cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise thereby releasing such waste or contaminants to any land or waters • Spillages must be cleaned up using dry methods that minimise the release of wastes, contaminants or materials to any stormwater drainage system, roadside gutter or waters • Spills of dangerous goods will be rendered harmless and collected for treatment and disposal at a designated site, including cleaning materials, absorbents and contaminated soils • Hydrocarbon spillage from storage areas, diesel and chemical spills from construction equipment, and industrial waste spill will be contained, reported, and treated/remediated in accordance with appropriate legislative and regulatory agency requirements. Drainage will be reinstated • Absorbent and containment material (eg absorbent matting) will be available where hazardous materials are used and stored and personnel trained in their correct use • Protective clothing, appropriate to the materials in use, will be provided • Relevant permits will be held and conditions of permits met • Servicing of equipment/machinery will not be permitted on the RoW without prior authorisation from GLNG Operations. All planned services for all equipment is to occur in an approved workshop
<p>Performance indicators</p>	<ul style="list-style-type: none"> • No hazardous goods contamination of the environment • Storage and handling procedures are correct and appropriate • Chemicals are stored in secure areas • All containment systems are designed to minimise rainfall collection within the system

8.2 Waste management record keeping, auditing and monitoring

This section addresses the recording and monitoring requirements which will be undertaken as part of this WM Plan. Waste streams, quantities and management practices (including chemical and hazardous materials) will be monitored during the construction and operational phases to ensure compliance with State and Commonwealth legislation, approval conditions and Australian Standards.

The key objectives of auditing the waste management and chemical management activities are to:

- Monitor and review wastes and chemical handling, usage, storage and disposal
- Monitor and review transportation records
- Monitor and review compliance with legislation, approval conditions and standards
- Assess the wastes quantities and streams compared to the predicted levels
- Recommend and implement actions to improve waste management practices
- Monitoring performance against the key performance indicators

8.2.1 Record keeping

Information generated from auditing and monitoring will be stored by the Waste Contractor to enable corrective actions identified during the inspection / auditing process to be recorded, tracked and finalised. The information will be made available to the relevant regulatory authorities as required. The Waste Contractor will keep the following key records:

- Regulated waste records
- Waste register including hazardous and dangerous materials
- Other records prescribed by DERM or government agencies through the licensing and permitting of these activities
- Copies of relevant waste management licences
- Environmental training and induction
- Complaints and incidents
- Inspection and audit details including findings
- Corrective actions

8.2.2 Auditing

The Waste Contractor to will be required to comply with the following auditing requirements:

- During construction the Waste Contractor will be required to report on environmental compliance on a weekly and monthly basis
- During construction undertake internal audits to verify that all work is proceeding in accordance with this WM Plan
- A post-construction audit of the RoW and other related infrastructure will be conducted annually for two years following construction to ensure all waste materials have been removed from the RoW
- The audit report will identify the segment of the Project being audited, the conditions that were activated during the period, and a compliance/non-compliance table. A description of the evidence to support the compliance table will be provided. The audit report shall also contain recommendations on any non-compliance or other matter to improve compliance. The third party auditor must certify the findings of the audit report

- The Waste Contractor will immediately act upon any recommendations arising from the audit report and investigate any non-compliance issues identified
- As soon as practicable, implement measures or take necessary action to ensure compliance
- When first becoming aware of a non-compliance, the Waste Contractor will:
 - Undertake action to bring the matter into compliance within an effective time frame
 - Report the non-compliance and remedial action to GLNG Operations within the specified timeframe

8.2.3 Monitoring

Table 8.4 to Table 8.8 outline the recommended auditing requirements along with the monitoring activities and inspection frequencies.

Table 8.4 WM Plan auditing and monitoring activities – general waste

Inspection and monitoring activity*	Frequency
Inspect waste handling activities and storage areas to check processes effectively handle, store and securely contain wastes as per the project WM Plan ie lids are closed, no spillages or leaks from liquid or solid waste tanks or containers that could cause nuisance or harm to water or the environment.	Weekly
Review waste disposal records/transport receipts to confirm use of licensed waste management facilities and transport contractors to ensure wastes are appropriately collected, transported and disposed of	Weekly
Check all waste contractors have correct and up to date licenses and permits as required to conduct the waste transport and disposal activity	Weekly / monthly/ annually
Check MSDS and a dangerous goods register is available and easily accessible and contains MSDS for each stored chemical	Weekly
Check that spill containment and remediation process equipment is in place and unused Check construction personnel effectively implement the required procedures for spill response and the storage, handling and disposal of hazardous waste	Weekly
Check the training and induction/awareness program records to check all personnel have undertaken awareness training in their responsibilities with regard to waste management.	Weekly
Any findings where a breach of license conditions has been identified, are to be reported to the designated GTP Management group or relevant external stakeholders ie DERM	Monthly / annually
Review waste handling, storage and sorting practices to ensure all materials are being dealt with in accordance with the Waste and Resource Management Hierarchy	Weekly / monthly/ annually
Conduct a post-construction audit of the construction camp and RoW and other related infrastructure to check all waste materials have been removed from the RoW	Annually for two years following construction

*Note These suggested monitoring actions and frequencies are not comprehensive, detailed monitoring and auditing schedules should be developed by the Waste Contractor

Table 8.5 WM Plan auditing and monitoring activities – liquid waste

Inspection and monitoring activity*	Frequency
Record the quantity of effluent treated on a daily basis as required in the approval conditions	Daily
Conduct treated effluent quality monitoring as required in the approval conditions	Weekly

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Check that any environmental incidents or accidents that have occurred are reported in accordance with EHSMS	As required
Inspect the construction camp wastewater storage/s and irrigation area in accordance with Wastewater Irrigation Management Plan (WIMP)	Weekly
Inspect the hydrotest water discharge areas in accordance with HWMP	Weekly / monthly/ annually
Inspect waste handling activities and storage areas to check processes effectively handle, store and securely contain wastes as per the project Waste MP and relevant Australian Standards ie lids are closed, no spillages or leaks from liquid or solid waste tanks or containers that could cause nuisance or harm to water or the environment	As required
Check MSDS and a dangerous goods register is available and easily accessible and contains MSDS for each stored chemical	As required
Review liquid waste disposal records/transport receipts to confirm use of licensed waste management facilities and transport contractors to ensure liquid wastes are correctly collected, transported and disposed of	Weekly
Review the waste auditing and monitoring process to ensure the process is effectively achieving objectives	As required
Check that spill containment and remediation process equipment is in place and unused	As required
Check project workers effectively implement the required procedures for spill response and associated storage, handling and disposal of hazardous waste	
Check the training and induction/awareness program records to check all personnel have undertaken awareness training in their responsibilities with regard to waste management	As required
Check copies of agreements (if any) to supply treated sewage effluent from the wastewater treatment plant for the purpose of irrigation have been forwarded to administering authority	Monthly/ annually
Review waste handling, storage and sorting practices to ensure all materials are being dealt with in accordance with the Waste and Resource Management Hierarchy	Weekly / monthly/ annually
Check WIMP against its objectives such as discharge quality, rates or application area and erosion	Monthly
Conduct a post-construction audit of the construction camp and RoW and other related infrastructure to check all waste materials have been removed from the RoW	Annually for two years following construction

*Note These suggested monitoring actions and frequencies are not comprehensive, detailed monitoring and auditing schedules should be developed by the contractor

Table 8.6 WM Plan auditing and monitoring activities – vehicles and machinery

Inspection and monitoring activity*	Frequency
Check vehicles, plant and equipment are maintained as per maintenance schedules to ensure no leaks or damage which could result in spills or leaks	Daily
Inspect waste handling and storage processes to check waste is effectively handled, stored and securely contained as per this WM Plan and Australian Standards ie no spillages, leaks from liquid or solid waste tanks or containers that could cause damage to water or the environment.	As required
Check the training and induction/awareness program records to check all personnel have undertaken awareness training in their responsibilities with regard to waste management.	As required

Waste Management Plan - Gas Transmission Pipeline

Check all waste contractors have appropriate and up to date licenses and permits as required to conduct the waste transport and disposal activity	Weekly / monthly/ annually
Review waste handling, storage and sorting practices to check all materials are being dealt with in accordance with the Waste and Resource Management Hierarchy	Weekly / monthly/ annually
*Note These suggested monitoring actions and frequencies are not comprehensive, detailed monitoring and auditing schedules should be developed by the contractor	

Table 8.7 WM Plan auditing and monitoring activities – hazardous waste and chemical storages monitoring

Inspection and monitoring activity*	Frequency
Inspect hazardous wastes handling activities and storage areas to check hazardous waste is stored in sealed containers, banded areas, correctly labelled as per the WM Plan and Australian Standards and Legislation ie lids are closed, no spillages, leaks from liquid or solid waste tanks or containers that could cause nuisance or harm to water or the environment	As required
Inspect containment bunds and/or sumps to check integrity of bund and to maintain storage capacity to reduce risk of overflow and subsequent pollution of the surrounding land and/or water body (ie captured sump liquid to extracted periodically when required – noting that extracted liquid will need to be handled and disposed correctly)	As required
Review waste disposal records/transport receipts to confirm use of licensed waste management facilities and transport contractors to ensure wastes are correctly collected, transported and disposed of	Weekly
Check regulated waste tracking paperwork to ensure the process accurately records all necessary details with regard to waste	Weekly / monthly/ annually
Check all waste contractors have correct and up to date licenses and permits as required to conduct the waste transport and disposal activity	Weekly / monthly/ annually
Review hazardous materials inventory with stored items to check all items are recorded, stored and treated correctly	Weekly / monthly/ annually
Check MSDS and a dangerous goods register is available and easily accessible and contains MSDS for each stored chemical	Weekly
Check that spill containment and remediation process equipment is in place and unused Check project workers effectively implement the required procedures for spill response and associated storage, handling and disposal of hazardous waste	Weekly
Check the training and induction/awareness program records to check all personnel have undertaken awareness training in their responsibilities with regard to waste management	As required
Review waste handling, storage and sorting practices to ensure all materials are being dealt with in accordance with the Waste and Resource Management Hierarchy (Review waste and recyclable quantities and check dispatched to correct destination)	Weekly / monthly/ annually
Any findings of auditing and monitoring where a breach of license conditions has been identified, are to be reported to the designated GTP Management group or relevant external stakeholders ie DERM	As required
*Note These suggested monitoring actions and frequencies are not comprehensive, detailed monitoring and auditing schedules should be developed by the contractor	

Table 8.8 Waste MP auditing and monitoring activities – HDD

Inspection and monitoring activity*	Frequency
-------------------------------------	-----------

Review drill cutting laboratory results to check cuttings comply with WBRA approval requirements	As required
Review waste disposal records/transport receipts to confirm use of a licensed waste management facilities and licensed transport contractors to check wastes are correctly collected, transported and disposed of	As required
Check HDD equipment is maintained as per maintenance schedules to check for leaks or damage which could result in spills or leaks	Daily
Inspect waste handling and storage processes to check appropriate and effective handling, storage and secure containment of HDD wastes as per project WM Plan and Australian Standards ie no spillages, leaks from liquid or solid waste tanks or containments (ie drill cuttings or drill fluids pits) that could cause nuisance or harm to water or the environment	Daily
Check MSDS and a dangerous goods register is available and easily accessible and contains MSDS for each stored chemical	As required
Check the training and induction/awareness program records to check all personnel have undertaken awareness training in their responsibilities with regard to waste management	As required
Check all waste contractors have appropriate and up to date licenses and permits as required to conduct the waste transport and disposal activity	As required
Review waste handling, storage and sorting practices to check all materials are being dealt with in accordance with the Waste and Resource Management Hierarchy	As required
Conduct a post-construction audit of the Marine Crossing RoW and other related infrastructure to ensure all waste materials have been removed from the RoW	Annually for two years following construction

*Note These suggested monitoring actions and frequencies are not comprehensive, detailed monitoring and auditing schedules should be developed by the contractor

8.2.4 Continuous improvement

GLNG Operations will work closely with the Contractor to rectify any issues identified as a result of WM Plan monitoring and auditing activities.

GLNG Operations will continue to investigate and implement actions to reduce impacts and deliver positive outcomes through the operation of the GTP in relation to waste management.

The results of inspections, audits and incident reports will be used to drive continuous improvement along with other associated internal environmental performance reviews conducted by the GTP management team.

Following any significant changes to the GTP design or operational processes the WM Plan will be reviewed to determine if it should be updated to reflect the changes.

Following any environmental incidents resulting in environmental harm, this WM Plan will be reviewed and mitigation measures updated and improved to reduce the risk of incidents.

This WM Plan will be subject to annual review by GLNG Operations and its effectiveness in managing the waste streams associated with the GTP operations reported internally and to any relevant stakeholder.

8.2.5 Complaints response

Complaints which are received from internal or external stakeholders should be recorded and investigated in accordance with the Complaints Response Procedures.

Refer to the proposed management objectives and strategies as detailed in Section 8 for more details on the complaints procedure.

9. Emergency Response Management

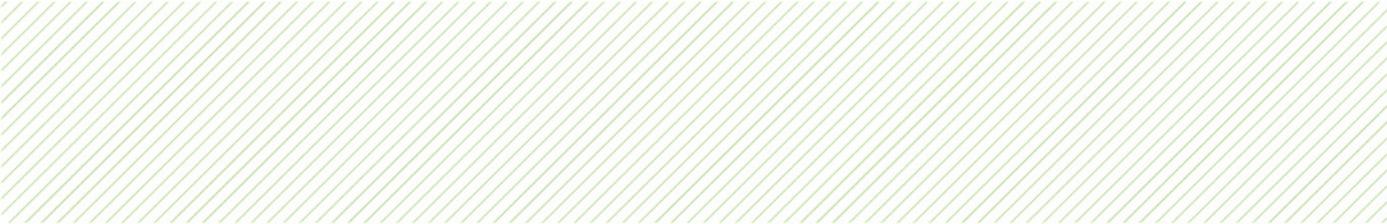
Emergency response management for spills and incident involving waste and hazardous materials will be undertaken in accordance with the requirements stipulated in Chapter 3 of the EMP.

10. References

- Australian Standard 2885.3-2001: Pipelines – Gas and liquid petroleum Part 3: Operation and Maintenance
- Aurecon (2011) GLNG Gas Transmission Pipeline Environmental Management Plan in Support of an Environmental Authority for Mainland
- Aurecon (2011) GLNG Gas Transmission Pipeline Environmental Management Plan in Support of an Environmental Authority for Marine Crossing
- Aurecon (2011) GLNG Gas Transmission Pipeline Environmental Management Plan in Support of an Environmental Authority for Curtis Island
- Canadian Association of Petroleum Producers (2004) Guideline Planning Horizontal Directional Drilling for Pipeline Construction
- Department of Infrastructure and Planning (2010) Report for Crossing of The Narrows, Review of GLNG Environmental Management Plan
- Ecologica Consulting (2010) Landscape Rehabilitation Management Plan for the GLNG Gas Transportation Pipeline Corridor, Brisbane.
- Department of Environment and Resource Management (2010) Queensland's Waste Reduction and Recycling Strategy 2010-2020
- GTP (no date) O&M Procedures – Pipeline Abandoning Document
- GLNG (no date) Pipeline – GLNG Project Environmental Management Plan (3380-GLNG-3-1.3-0007)
- GLNG (no date) Gas Transmission Pipeline Operations and Maintenance Procedures
- International Erosion Control Association (IECA) (2008) Best Practice Erosion and Sediment Control
- MAE Mid-Atlantic Express, LLC (2007) Mid-Atlantic Express Pipeline Project HDD Monitoring and Contingency Plan. Available at <http://www.docstoc.com/docs/23405017/Formal-Report>
- Queensland Government (May 2010) Coordinator-General's evaluation report for an environmental impact statement, Gladstone Liquefied Natural Gas-GLNG project
- Queensland Government, Environmental Protection Agency (December 2005) Queensland Water Recycling Guidelines
- Santos (2007) Environment, Health and Safety Management Guide Accessed [online] February 2011, Available at http://www.glng.com.au/library/EIS/Appendices/BB3_Health%20and%20Safety%20FINAL%20PUBLIC.pdf
- Santos Petronas (2010) GLNG Gas Transmission Pipeline Weed Management Plan (Document Number: 3380-GLNG-3-1.3-0006-DOC)
- URS (2009) Final Report GLNG Environmental Impact Statement – Waste Management Plan (Ref 42626220)

URS (2009) GLNG Project – Environmental Impact Statement

The Australian Pipeline Industry Association (APIA): Code of Environmental Practice – Onshore Pipelines, March 2009



Appendix A

Abbreviations



Appendix A

Abbreviation	Description
AIM	Audit and Inspection Manager
APIA Code	Australian Pipeline Industry Association Code of Environmental Practice for Onshore Pipelines
APLNG	Australia Pacific Liquefied Natural Gas
AS	Australian Standard
AS/NZS	Australian Standard/New Zealand Standard
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soils Management Plan
CEMP	Construction Environmental Management Plan
CG	Coordinator General
CMP	Construction Management Plan
CSG	Coal Seam Gas
C&I	Construction and Industrial
DERM	Department of Environment and Resource Management
DMP	Dredge Management Plan
DNRMW	Department of Natural Resources, Mines and Water
EA	Environmental Authority
EHSMS	Environment Health and Safety Management System
EHS&S	Environmental, Health, Safety & Security
EIS	Environmental Impact Statement
EM Plan	Environmental Management Plan
EP Act	<i>Environmental Protection Act 1994</i>
EPP Waste	Environmental Protection (Waste Management) Policy 2000
EP Waste Regulation	Environmental Protection (Waste Management) Regulations 2008
ERA	Environmentally Relevant Activity
ERP	Emergency Response Plan
FEED	Front End Engineering Design
GLB	Gladstone Logistics Base
GLNG	Gladstone Liquefied Natural Gas
GPC	Gladstone Port Corporation
GTP	Gas Transmission Pipeline
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
HWMP	Hydrotest Water Management Plan
IECA	International Erosion Control Australasia
IMS	Incident Monitoring System
LNG Facility	Liquefied Natural Gas Facility

Waste Management Plan - Gas Transmission Pipeline

Abbreviation	Description
MEDLI	Model for effluent disposal using land irrigation
MRF	Material Recovery Facility
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
Mtpa	Million Tonnes per Annum
NEPM	National Environment Protection Measures
NPI	National Pollution Inventory
N/A	Not Applicable
Pigging	Pipe Cleaning Activities
PPE	Personal Protective Equipment
PVM	Preventative Vehicle Maintenance
PVMW	Preventative Vehicle Maintenance Workshops
PWMP	Pest and Weed Management Plan
QCLNG	Queensland Curtis Liquefied Natural Gas
Qld	Queensland
RMP	Road use Management Plan
RoW	Right-of-Way
SSMP	Significant Species Management Plan
STP	Sewage Treatment Plant
TPRA	Temporary Pipe Receiving Area
TPSA	Temporary Pipe Storage Area
WBRA	Western Basin Reclaim Area
Waste MP	Waste Management Plan
WIMP	Wastewater Irrigation Management Plan
WWTP	Wastewater Treatment Plant
Weed MP	Weed Management Plan



Appendix B Figures





Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 50km
- 10km

Road Haulage Route

- Waste to Landfill; regulated waste and recyclables via approved route to SE Qld
- Other GLNG haulage route

- Port Alma Temporary Pipe Receiving Area
- Landfill
- Sewage Treatment Plant
- Temporary Pipe Storage Site
- Construction Camp
- Vehicle Washdown and RoW Access Point (Indicative Location Only)

Barge Haulage Route

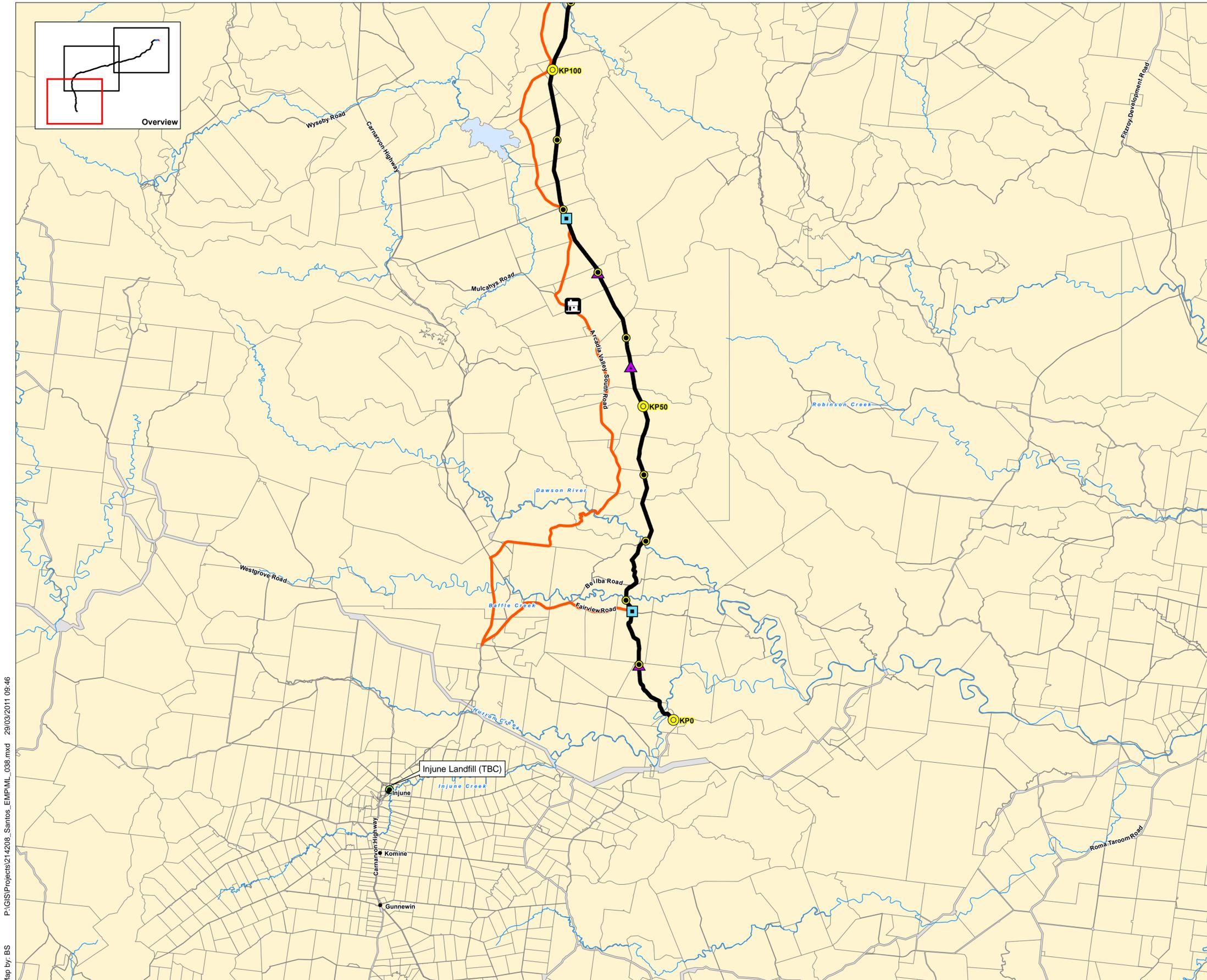
- Cadastre
- Rail
- Watercourse
- Major Road

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Fishermans Landing and Western Basin Reclamation Area, Aurecon, Feb 2011.
 Protected Areas: Department of Environment and Resource Management, Feb 2011.
 Cadastre: Department of Environment and Resource Management, Feb 2011.
 Temporary Pipe Storage Site: GLNG Pipeline Logistics Study, GHD, Nov 2009.
 Vehicle Washdown Points: Aurecon, Feb 2011.
 Construction Camps: GLNG Pipeline Logistics Study, GHD, Nov 2009.

Waste and Recovered Material Haulage Route Appendix A Figure 1 (Page 1 of 3)

Date: 29/03/2011

Version: b



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Map by: BS



A1 scale: 1:275,000
 0 5 10 15 20 25km

GLNG No: 3381-40-0425
 Coordinate system: GCS GDA 1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 50km
- 10km

Road Haulage Route

- Waste to Landfill; regulated waste and recyclables via approved route to SE Qld
- Other GLNG haulage route

- Port Alma Temporary Pipe Receiving Area
- Landfill
- Sewage Treatment Plant
- Temporary Pipe Storage Site
- Construction Camp
- Vehicle Washdown and RoW Access Point (Indicative Location Only)

Barge Haulage Route

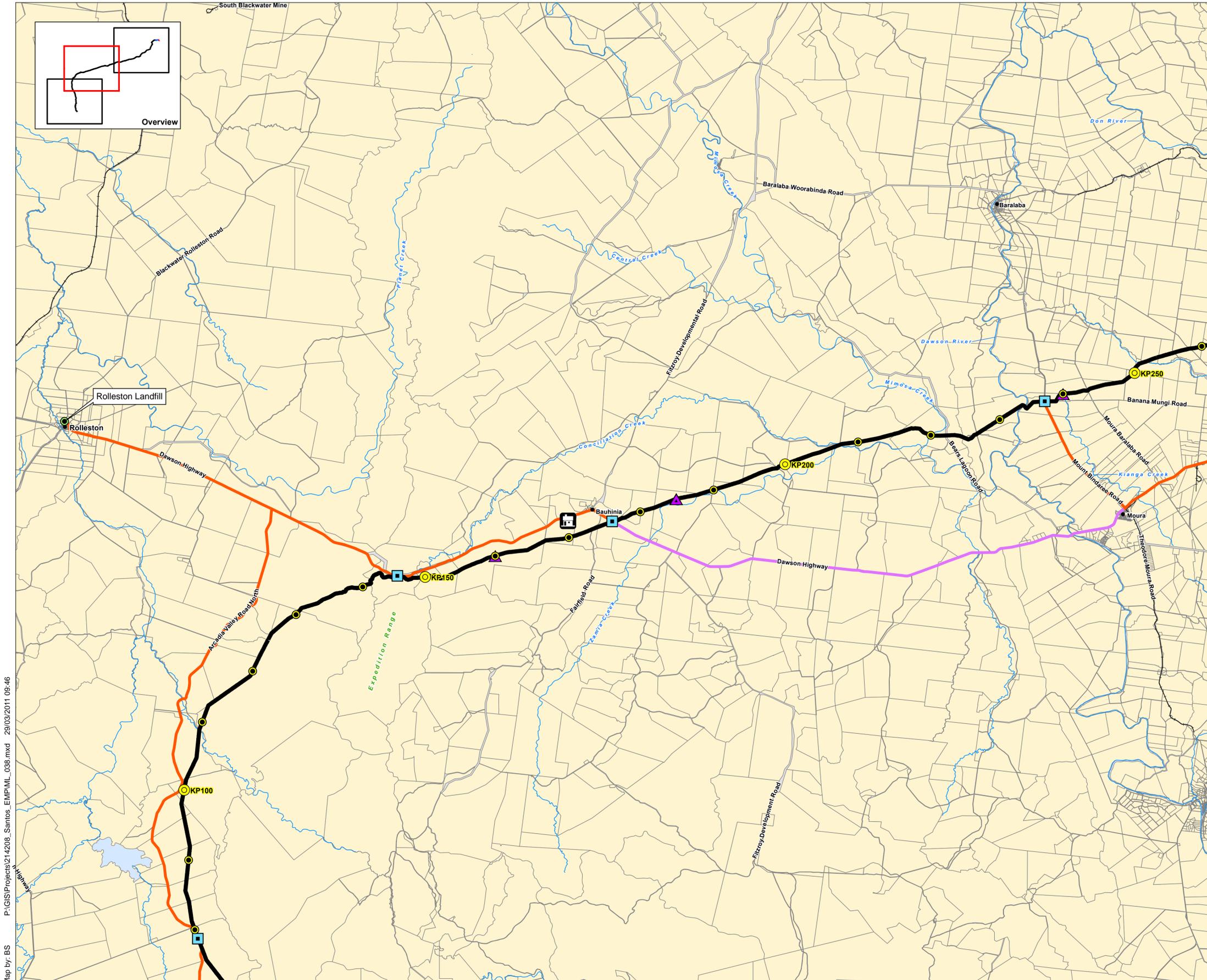
- Cadastre
- Rail
- Watercourse
- Major Road

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Fishermans Landing and Western Basin Reclamation Area, Aurecon, Feb 2011.
 Protected Areas: Department of Environment and Resource Management, Feb 2011.
 Cadastre: Department of Environment and Resource Management, Feb 2011.
 Temporary Pipe Storage Site: GLNG Pipeline Logistics Study, GHD, Nov 2009.
 Vehicle Washdown Points: Aurecon, Feb 2011.
 Construction Camps: GLNG Pipeline Logistics Study, GHD, Nov 2009.

Waste and Recovered Material Haulage Route Appendix A Figure 1 (Page 2 of 3)

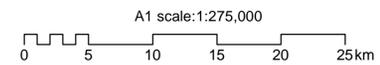
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Map by: BS



GLNG No: 3381-40-0425
 Coordinate system: GCS GDA 1994



Mainland GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

Kilometre Post Distance Marker

- 50km
- 10km

Road Haulage Route

- Waste to Landfill; regulated waste and recyclables via approved route to SE Qld
- Other GLNG haulage route

Port Alma Temporary Pipe Receiving Area

Landfill

Sewage Treatment Plant

Temporary Pipe Storage Site

Construction Camp

Vehicle Washdown and RoW Access Point (Indicative Location Only)

Barge Haulage Route

Cadastre

Rail

Watercourse

Major Road

Recovered Materials to SE Queensland

Benaraby Landfill

Calliope Range

Calliope River

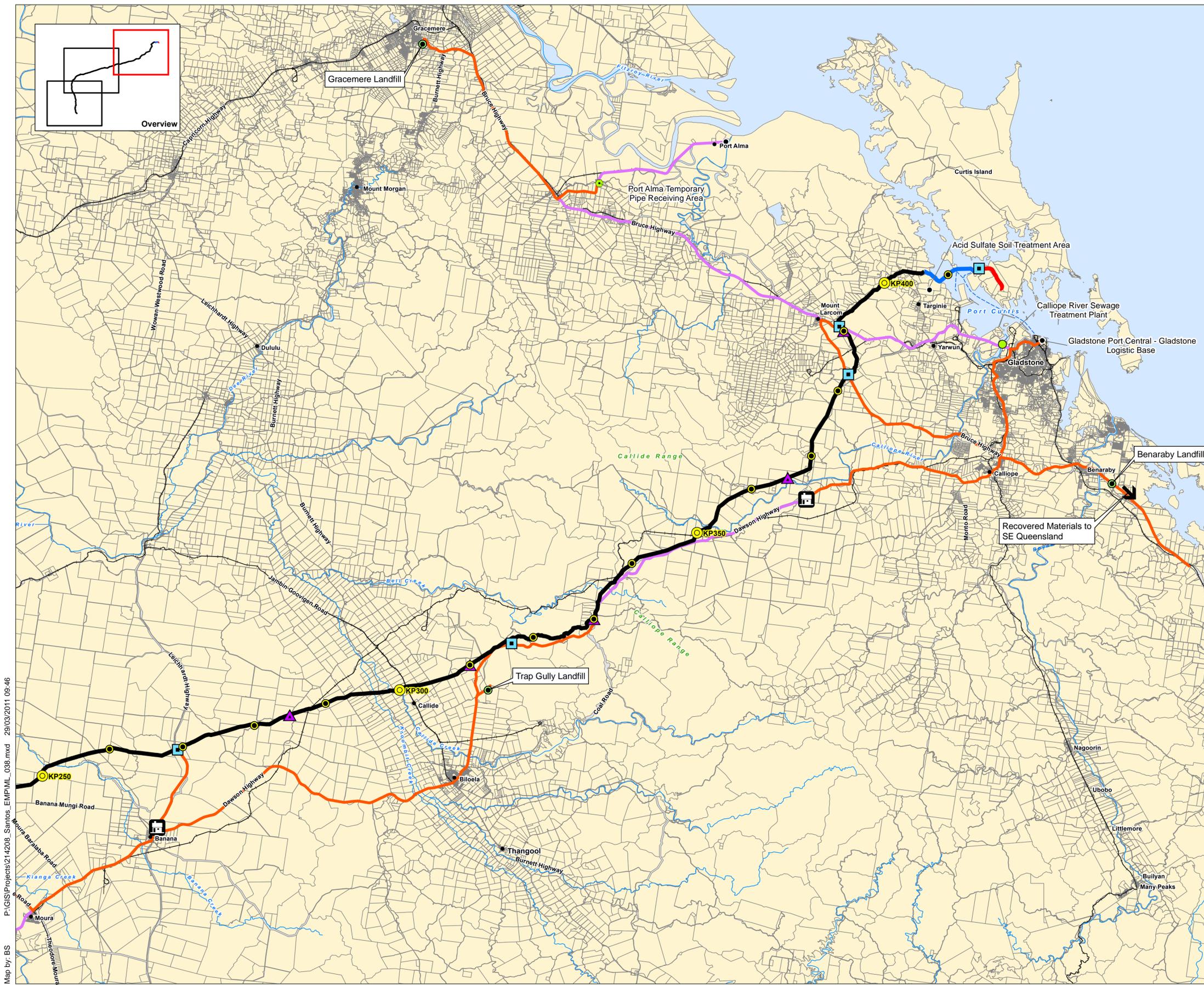
Calliope Range

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Fishermans Landing and Western Basin Reclamation Area, Aurecon, Feb 2011.
 Protected Areas: Department of Environment and Resource Management, Feb 2011.
 Cadastre: Department of Environment and Resource Management, Feb 2011.
 Temporary Pipe Storage Site: GLNG Pipeline Logistics Study, GHD, Nov 2009.
 Vehicle Washdown Points: Aurecon, Feb 2011.
 Construction Camps: GLNG Pipeline Logistics Study, GHD, Nov 2009.

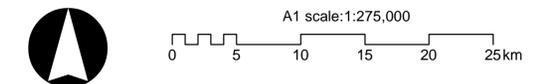
Waste and Recovered Material Haulage Route Appendix A Figure 1 (Page 3 of 3)

Date: 29/03/2011

Version: b



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Map by: BS



GLNG No: 3381-40-0425
Coordinate system: GCS GDA 1994



Marine Crossing GTP EM Plan

- Gas Transmission Pipeline (GTP)
 - Mainland GTP EM Plan
 - Marine Crossing GTP EM Plan
 - Curtis Island GTP EM Plan
- Kilometre Post Distance Marker
 - 5km
 - 1km
- Road Haulage Route
 - Waste to Benaraby Landfill; regulated waste and recyclables to SE Qld
 - Other GLNG haulage route
- Barge Haulage Route
 - All waste and materials
 - Drill cuttings
- Barge Landing (Indicative Location Only)
- Vehicle Washdown and RoW Access Point (Indicative Location Only)
- Temporary Pipe Storage Site
- Fishermans Landing and Western Basin Reclamation Area
- Protected Area
- Cadastre
- Rail

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Aerial: Santos, 2011.
 Fishermans Landing and Western Basin Reclamation Area, Aurecon, Feb 2011.
 Protected Areas: Department of Environment and Resource Management, Feb 2011.
 Cadastre: Department of Environment and Resource Management, Feb 2011.
 Temporary Pipe Storage Site: GLNG Pipeline Logistics Study, GHD, Nov 2009.
 Vehicle Washdown Point: Aurecon, Feb 2011.

Note:
 Barge landing and routes are approximate only.

Waste and Recovered Material Haulage Route: Overview Figure 2

Date: 11/04/2011

Version: b

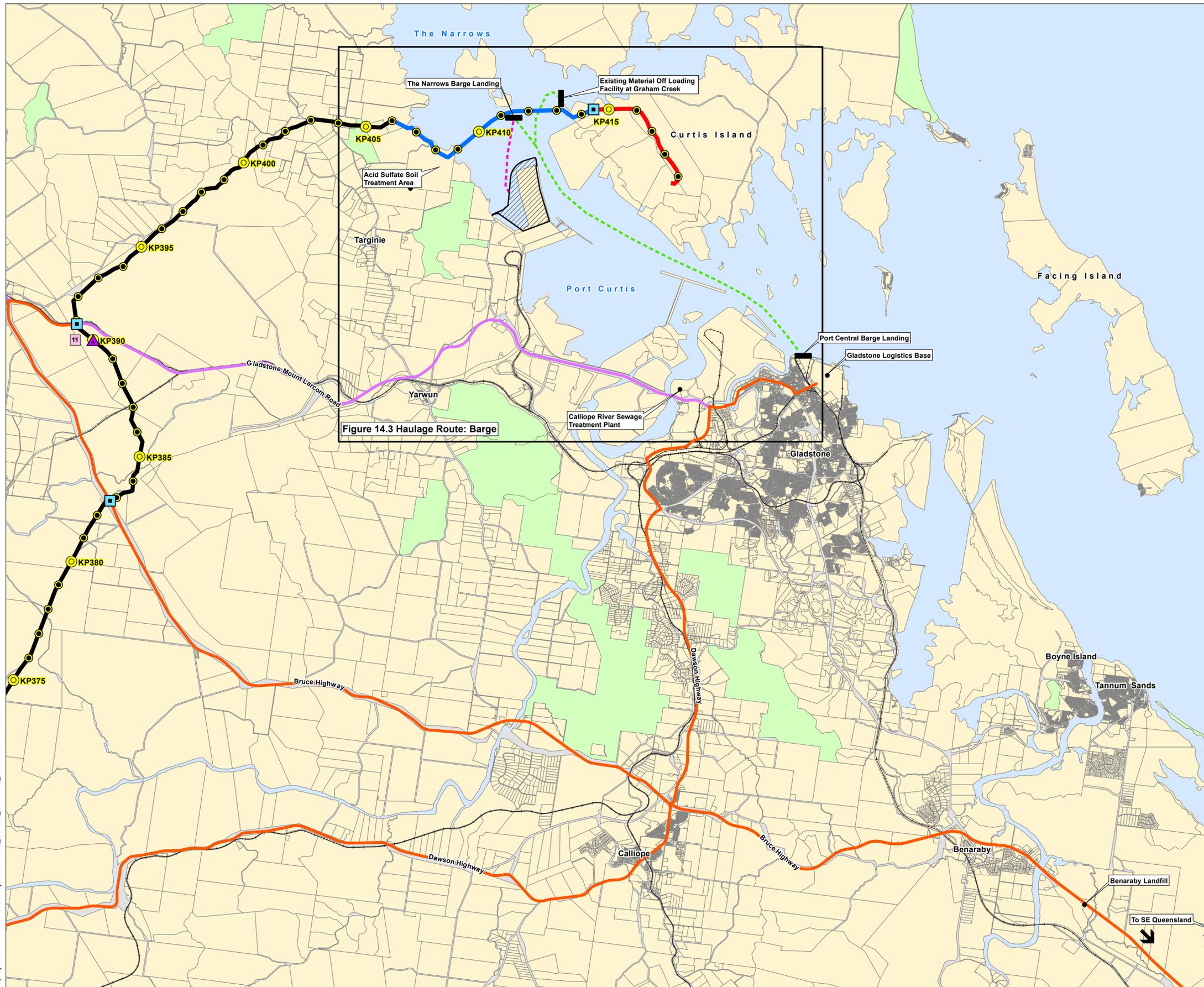
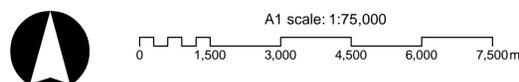


Figure 14.3 Haulage Route: Barge

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Map by: BS



GLNG No: 3381-40-0458
 Coordinate system: GCS_GDA_1994



Reference Point	KP (km)
A	406
B	406.5
B1	408.5
C	409
D	410.5
E	411
F	411.5
G	413
G1	413.5
H	414.5

Reference Points and Associated KPs



Marine Crossing GTP EM Plan

Gas Transmission Pipeline (GTP)

- Mainland GTP EM Plan
- Marine Crossing GTP EM Plan
- Curtis Island GTP EM Plan

GTP Marine Crossing Reference Point

+

Road Haulage Route

- Waste to Benaraby Landfill; regulated waste and recyclables to SE Qld
- Other GLNG haulage route

Barge Haulage Route

- - - All waste and materials
- - - Drill cuttings

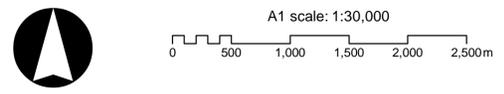
- Barge Landing (Indicative Location Only)
- Vehicle Washdown and RoW Access Point (Indicative Location Only)
- Fishermans Landing and Western Basin Reclamation Area
- +— Rail

Source:
 Gas Transmission Pipeline (GTP): Santos, Jan 2011.
 Aerial: Santos, 2011.
 Fishermans Landing and Western Basin Reclamation Area, Aurecon, Feb 2011.
 Vehicle Washdown Point: Aurecon, Feb 2011.

Note:
 Barge landing and routes are approximate only.

**Waste and Recovered Material
Haulage Route: Barge
Figure 3**

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Map by: RB



GLNG No: 3381-40-0459
 Coordinate system: GCS_GDA_1994



Appendix G
Landscape Rehabilitation Management Plan



GLNG Project

Landscape Rehabilitation Management Plan for the GLNG Gas Transmission Pipeline Corridor

Document Number: 3380-GLNG-3-1.3-0037

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DATE	REV	REASON FOR ISSUE	AUTHOR	ENDORSED	APPROVED
Jun 2010	1	Draft	AW	BF	
Nov 2010	2	Revised Draft	AW	BF	
Mar 2012	3	Revised Draft for SEWPac Review	AW	IB	AB
May 2012	4	Revised Draft for SEWPac Second Review	AW	IB	AB

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1. Introduction

1.1 Background and context

The GLNG project involves the development of coal seam gas resources in the Bowen and Surat Basins around Roma, construction of a pipeline from the gas fields to the coast, and construction of up to three processing trains at a liquefied natural gas (LNG) plant and export facility on Curtis Island, off Gladstone.

On 16 July 2007, the Coordinator-General declared the Project to be a 'significant project' for which an environmental impact statement (EIS) is required in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971* (Qld).

Following the preparation of the EIS and the SEIS, the CG Report for the GLNG Project was issued in May 2010, and the approvals of the four relevant referred components were granted under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cth) in October 2010.

This Landscape Rehabilitation Management Plan (LRMP) has been prepared in accordance with the following conditions outlined in the CG Report, the EPBC Act approval and the DERM Environmental Authority.

CG Report conditions

- Appendix 3 - Gas Pipeline, Part 2 – General Conditions
 - Condition 3
 - Condition 17
- Appendix 3 – Gas Pipeline, Part 3 & 4 – Environmental Conditions
 - Condition 1(d)
 - Condition 3(d)
 - Condition 4(f-g)
 - Condition 5(a & e)
 - Schedule E14.7, E30-E36
 - Schedule J

EPBC Act approval conditions

- Condition 3a
- Condition 3d
- Condition 8(e)i

DERM Environmental Authority No.: PEN102664411

- Schedule E30 – E36
- Schedule H
- Schedule J22-J24

1.2 Purpose of this plan

This LRMP is applicable to the Gas Transmission Pipeline (GTP) component of the Project which commences approximately 40km east of Injune, then travels north along the eastern side of Arcadia Valley. The GTP will approach Gladstone from the south-west through the Callide Infrastructure Corridor State Development Area (CICSDA) and the Gladstone State Development Area (GSDA) before crossing Port Curtis between Friend Point and Laird Point to Curtis Island and the proposed LNG Facility. A number of associated ancillary sites comprising accommodation camps and stockpile facilities, in addition to access tracks and roads will be constructed and are also addressed within this LRMP.

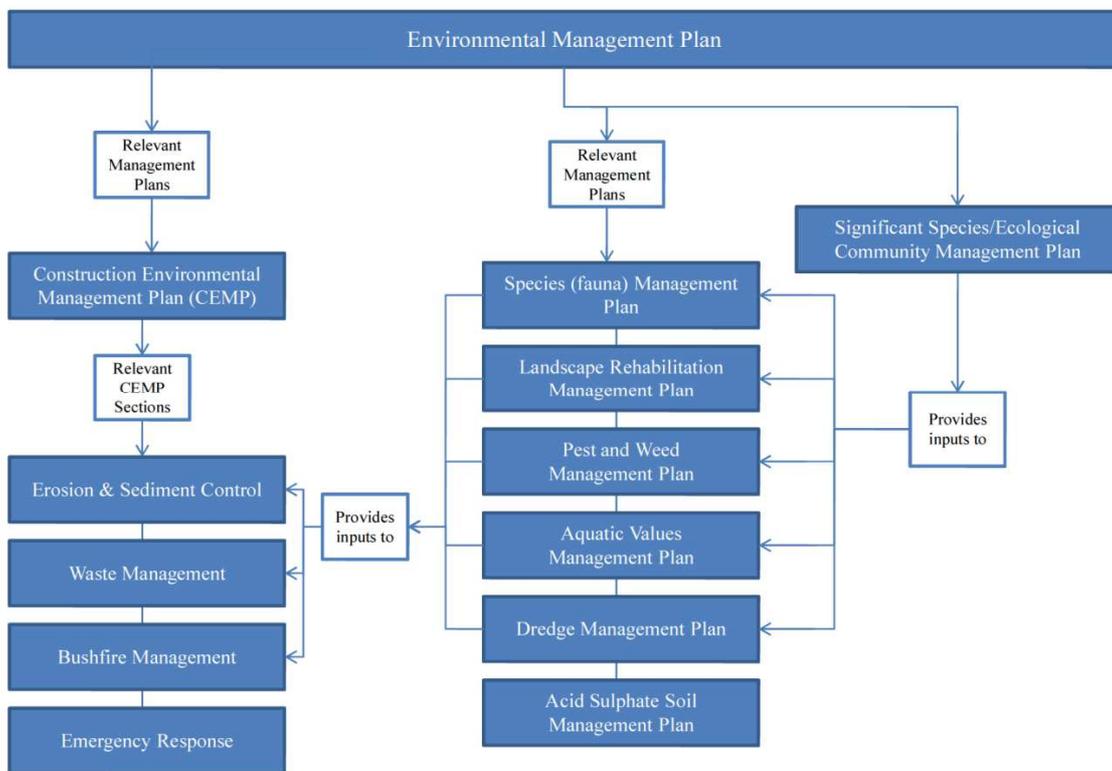
The purpose of this LRMP is to provide management measures to be implemented during and post construction of the GTP Corridor to rehabilitate the GTP Right of Way (ROW) to meet relevant approval conditions.

The LRMP will act as a tool to assist both the proponent and the Principal Contractor in determining the extent of compliance required by Principal Contractor's staff and sub-contractors with regards to the regulations and guidelines applicable to the GLNG pipeline project.

The LRMP is a live document and will be updated as required during construction of the Project. It is designed to:

- Minimise area of overall disturbance;
- Create a safe, stable and non-polluting landform;
- Undertake a comprehensive revegetation and rehabilitation program of all disturbed areas;
- Revegetation and rehabilitation undertaken in a timely manner;
- Preservation of downstream receiving environments;
- Ensure compliance with relevant approval conditions specified by the Coordinator-General, the Department of Environment and Resource Management (DERM), Queensland Primary Industries and Fisheries (QPIF) and DSEWPC; and
- Ensure compliance with commitments under the EIS and SEIS.

1.2.1 Relationship between this plan and other GTP Corridor Management Plans



2. Legislative and Regulatory Framework

It should be noted that the information provided in this plan regarding relevant legislation, policies, regulations, standards and guidelines might not be a complete representation of all statutory requirements relevant to landscaping and rehabilitation practices. It is the responsibility of Contractors to determine all statutory and other requirements relevant to their package of works.

2.1 Applicable Legislation

The rehabilitation and landscaping of disturbed areas are not legislated under any one specific Act. However, it is enforced by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)¹, Department of Environment and Resource Management (DERM)² and the Department of Employment, Economic Development and Innovation (DEEDI)³, often as a condition outlined in approvals for the disturbance and/or clearing of native vegetation.

Key environmental legislation relating to the LRMP includes the following:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Nature Conservation Act 1992*
- *Nature Conservation (Wildlife) Regulation 2006*
- *Nature Conservation (Protected Plants) Conservation Plan 2000*
- *Nature Conservation (Protected Areas) Regulation 1994*
- *Nature Conservation (Koala) Conservation Plan 2005*
- *Nature Conservation (Forest Reserves) Regulation 2000*
- *Fisheries Act 1994*
- *Fisheries Regulation 2008*
- *Land Protection (Pest and Stock Route Management) Regulation 2003*
- *Great Barrier Reef Marine Park Act 1975*
- *Great Barrier Reef Marine Park Amendment Act 2007*
- *Animal Care and Protection Act 2001*
- *Coastal Protection and Management Act 1995*
- *Environmental Protection Act 1994*
- *Marine Parks Act 1982*
- *Water Act 2000*
- *Vegetation Management Act 1999*
- *Petroleum and Gas (Production and Safety) Act 2004*
- *Land Protection (Pest and Stock Route Management) Act 2002*

2.1.1 Policies, Standards and Guidelines

Activities will be undertaken in consideration of the relevant components of the following industry Codes of Practice:

- Australian Petroleum Production and Exploration Association's (APPEA) Code of Environmental Practice (2008); and
- Australian Pipeline Industry Association's (APIA) Code of Environmental Practice (Operations) (2005).

Relevant standards include:

- Australian Standard 4801:2000 Occupational Health and Safety Management Systems – Specification with guidance for use, and AS/NZS ISO 14001:1996 Environmental Management Systems;
- AS2885.1-1997 Gas and Liquid Petroleum - Design and Construction;
- Road Landscape Manual (Department of Main Roads (DMR), 2004) available for download from <http://www.mainroads.qld.gov.au/>. Consultation with the Project civil engineers and landscape architects is recommended when referring to this document;
- Ergon Energy has requirements pertaining to the amount of clearance required both under and directly adjacent to existing powerlines. This information is available for download at <http://www.ergon.com.au/>;
- These guidelines will be followed as a minimum around all powerlines regardless of ownership;
- Riparian Land Management Technical Guidelines Volumes 1 and 2 (Lovett & Price 2002);
- A Rehabilitation Manual for Australian Streams Volumes 1 And 2 (Rutherford *et al.* 2000);
- Guidelines for Protecting Australian Waterways (Bennett *et al.* 2002);
- Principles of Riparian lands Management (Lovett & Price 2007); and
- Code of Environmental Practice – Onshore Pipelines (APIA 2005).

¹ Formerly the Department of Environment, Water, Heritage and the Arts.

² Formerly the Environmental Protection Agency and the Department of Natural Resources and Water.

³ Formerly the Department of Primary Industries and Fisheries.

- Soil Erosion and Sediment Control - Engineering Guidelines for Queensland Construction Sites (Institution of Engineers Australia 1996)
- Saltwater Wetland Rehabilitation Manual (Department of Environment and Climate Change 2008)
- Wetland Rehabilitation Guidelines for the Great Barrier Reef catchment (WetlandCare Australia 2008)
- Santos EHSMS Standards as per the CEMP.

2.2 EIS Commitments and Approval Conditions

In addition to the commitments outlined within the EIS and SEIS, this Plan will need to adopt any relevant statutory approval conditions. As of November 2010, this Plan has addressed all commitments within the EIS/SEIS and all relevant approval conditions determined by the Co-ordinator General.

2.2.1 Approvals, Licenses and Permits

A Coordinator-General's Report was provided for the Project in May 2010. Additional approvals/permits applicable to LRMP are as follows:

- Permit to collect seed / cuttings from a threatened species outside the corridor (NC Act);
- Permit to clear native vegetation (NC Act);
- Permit to clear marine plants (Fisheries Act);
- Licence to construct a waterway barrier within a defined watercourse;
- Environment Authority for the Pipeline Licence; and
- EPBC Act Approval.

2.3 Offsets Package

An Environmental Offset proposal for the GLNG Project has been developed by Ecofund Queensland on behalf of the Proponent. The proposal outlines the environmental offset requirements for each component of the Project under both Queensland and Australian Government offset policies. The extent of offsets was based on information contained in the EIS and SEIS. The Package also included options for offset delivery and examples of properties that may be suitable to meet the identified offset requirements.

3. Environmental Management Framework

3.1 Santos Environment Health, Safety and Management System (EHSMS)

This section provides an introduction to the EHSMS for operations. An overview of the Santos EHSMS is provided together with further information on key components of the system considered to be specifically relevant to the construction of the pipeline.

The framework has been developed to ensure compliance with Australian Standard 4801:2000 Occupational Health and Safety Management Systems – Specification with guidance for use, and AS/NZS ISO 14001:1996 Environmental Management Systems – Specification with guidance for use. The Santos EHSMS applies to all Santos operations.

3.2 Overall EHSMS Structure

The EHSMS framework consists of multiple layers, the key components being management and hazard standards.

The documents that make up each level of the EHSMS are maintained in electronic form on a central server (The Well) that is accessible to all GLNG employees.

3.3 EHSMS Management Standards

Management Standards are documents which define the requirements necessary to ensure that environmental, health and safety risk is systematically managed. Management standards have been developed as part of the EHSMS.

3.4 EHSMS Hazard Standards

Hazard Standards detail the controls required to manage the risks of specific hazards to acceptable levels. These apply to all Santos operations. They contain specific requirements for planning and undertaking activities and include checklists and references to internal and external approvals and controls.

4. Existing Environment

4.1 Flora

The design of the GTP RoW has considered the ecological values of the vegetation communities and habitat within and adjacent to the footprint. This has been achieved by positioning the GTP in areas which have already been historically cleared for agricultural activities or, where possible, co-positioning the GTP adjacent to existing linear infrastructure, such as the existing Jemena Gas Pipeline where it traverses remnant vegetation communities.

State Forests and Timber Reserves directly impacted by the GTP include the Expedition State Forest, Callide Timber Reserve and Targinie State Forest (refer to mapping provided within the SSMP for specific locations).

4.1.1 Species

As part of the GLNG EIS process, flora assessments of the mainland component of the GTP RoW were undertaken in 2008. The surveys identified the presence of approximately 320 flora species within the GTP RoW.

Additional surveys undertaken in 2010 targeted significant flora species (EPBC Act and *Nature Conservation Act 1992* [NC Act] listed Endangered, Vulnerable, Near Threatened [EVNT]; and NC Act Type A Restricted Plants) and ecological communities (including *Vegetation Management Act 1999* [VM Act] listed Endangered and Of Concern Regional Ecosystems [REs] and EPBC listed Threatened Ecological Communities [TECs]). These surveys resulted in the detection of an additional 14 significant plant species.

The majority of the species identified from the GTP RoW during the 2008/2010 survey periods are listed as Least Concern under the provisions of the NC Act and are not listed under the provisions of the EPBC Act. However, a number of conservation significant flora (ie Type A restricted plants and EVNT species), including *Cycas megacarpa* (Cycad), *Gonocarpus urceolatus* (Raspweed), *Acacia gittinsii* (Gittin's wattle) and *Solanum johnsonianum* (NCN) are known to occur within the Project footprint.

The EIS and SEIS surveys also noted a number of introduced weed species, of which 10 are declared species under the *Queensland Land Protection (Pest and Stock Route Management) Act 2002* (LP Act). Three of the species observed (*Cryptostegia grandiflora* [Rubber vine], *Lantana camara* [Lantana] and *Parthenium hysterophorus* [Parthenium weed]) are also listed as Weeds of National Significance (WONS) under the provisions of the EPBC Act.

A summary of the vegetation communities, associated habitats and identified flora present within the GTP RoW is available in the EIS, SEIS, SSMP and the Weed Management Plan (WMP).

4.1.2 Regional Ecosystems

The majority of the Project area (approximately 80%) has been historically cleared for agriculture, and as such, a large portion of the GTP is considered pastoral grazing land (Fairview, Arcadia Valley and Calliope) or irrigated cropping (Zamia, Mimosa and Dawson catchments).

However, the GTP RoW also intercepts areas mapped as remnant vegetation under DERM's RE Mapping (approximately 60 RE communities). This includes REs which are also listed as TECs under the provisions of the EPBC Act. Table 1 outlines RE communities present within the GTP RoW.

Table 4.1 Regional Ecosystems within the GTP ROW

RE Code	RE Description
11.1.2	Very sparse samphire forbland on marine clay plains.
11.1.4	Mid-dense mangrove forest/woodland on marine clay plains.
11.3.1/11.3.2	Mid-dense <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains and sparse <i>Eucalyptus populnea</i> woodland on alluvial plains.
11.3.2	Sparse <i>Eucalyptus populnea</i> woodland on alluvial plains.
11.3.2/11.3.4/11.3.25	Sparse <i>Eucalyptus populnea</i> woodland on alluvial plains, sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains and mid-dense <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.
11.3.2/11.3.25	Sparse <i>Eucalyptus populnea</i> woodland on alluvial plains and mid-dense <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.
11.3.2/11.3.39	Sparse <i>Eucalyptus populnea</i> woodland on alluvial plains and sparse <i>E.melanophloia</i> +/- <i>E. chloroclada</i> open-woodland on undulating plains and valleys with sandy soils.
11.3.3/11.3.4	Sparse <i>E.coolabah</i> woodland on alluvial plains and sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains.
11.3.4/11.3.25	Sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains and mid-dense <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.
11.3.4/11.3.26	Sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains and mid-dense <i>E.moluccana</i> or <i>E.microcarpa</i> woodland to open forest on margins of alluvial plains.
11.3.4/11.3.26/11.11.15	Sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains, mid-dense <i>E.moluccana</i> or <i>E.microcarpa</i> woodland to open forest on margins of alluvial plains and sparse <i>E.crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics.
11.3.4/11.8.4	Sparse <i>E.tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains and sparse <i>E.melanophloia</i> woodland on Cainozoic igneous rocks (hillsides).
11.3.17	Sparse <i>E.populnea</i> woodland with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> on alluvial plains.
11.3.25	Mid-dense <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines.
11.3.25/11.11.4/11.11.15	Mid-dense <i>E. tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines, sparse <i>E.crebra</i> woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges and sparse <i>E.crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics.
11.3.26	Mid-dense <i>E.moluccana</i> or <i>E.microcarpa</i> woodland to open forest on margins of alluvial plains.
11.4.8	Mid-dense <i>E.cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>Acacia argyrodendron</i> on Cainozoic clay plains.
11.4.9	Mid-dense <i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains.
11.5.2	Sparse <i>E.crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces.
11.5.2/11.9.1	Sparse <i>E.crebra</i> , <i>Corymbia</i> spp., with <i>E. moluccana</i> on lower slopes of Cainozoic sand plains/remnant surfaces and mid-dense <i>Acacia harpophylla</i> - <i>E.cambageana</i> open forest to woodland on fine-grained sedimentary rocks.
11.5.5	Sparse <i>E.melanophloia</i> , <i>Callitris glaucophylla</i> woodland on Cainozoic sand plains/remnant surfaces (deep red sands).
11.8.4	Sparse <i>E.melanophloia</i> woodland on Cainozoic igneous rocks (hillsides).
11.8.4/11.10.1	Sparse <i>E.melanophloia</i> woodland on Cainozoic igneous rocks (hillsides) and mid-dense <i>Corymbia citriodora</i> open forest on coarse-grained sedimentary

RE Code	RE Description
	rocks.
11.9.1/11.9.5	Mid-dense <i>Acacia harpophylla</i> - <i>E.cambageana</i> open forest to woodland on fine-grained sedimentary rocks and mid-dense <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks.
11.9.5/11.10.1	Mid-dense <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks and mid-dense <i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks.
11.9.5	Mid-dense <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks.
11.10.1	Mid-dense <i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks.
11.10.1/11.10.13	Mid-dense <i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks and mid-dense <i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. open forest on scarps and sandstone tablelands.
11.10.13	Mid-dense <i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. open forest on scarps and sandstone tablelands.
11.11.3/11.11.15/11.11.18	Mid-dense <i>Corymbia citriodora</i> , <i>E.crebra</i> , <i>E.acmenoides</i> open forest on old sedimentary rocks with varying degrees of metamorphism and folding (coastal ranges), sparse <i>E.crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics and dense semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding.
11.11.4/11.11.15	Sparse <i>E.crebra</i> woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges and sparse <i>E.crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics.
11.11.15/11.11.18	Sparse <i>E.crebra</i> woodland on deformed and metamorphosed sediments and interbedded volcanics and dense semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding.
11.12.1/11.12.6	Sparse <i>E.crebra</i> woodland on igneous rocks and mid-dense <i>Corymbia citriodora</i> open forest on igneous rocks (granite).
12.1.3	Dense mangrove shrubland to low closed forest on marine clay plains and estuaries.
12.3.3/12.3.7	Mid-dense <i>E.tereticornis</i> woodland to open forest on alluvial plains and mid-dense <i>E.tereticornis</i> , <i>Melaleuca viminalis</i> , <i>Casuarina cunninghamiana</i> fringing forest.
12.3.7/12.3.11	Mid-dense <i>E.tereticornis</i> , <i>Melaleuca viminalis</i> , <i>Casuarina cunninghamiana</i> fringing forest and mid-dense <i>E. tereticornis</i> , <i>E.siderophloia</i> , <i>Corymbia intermedia</i> open forest on alluvial plains near coast.
12.11.6	Mid-dense <i>Corymbia citriodora</i> , <i>E.crebra</i> open forest on metamorphics +/- interbedded volcanics.
12.11.6/12.11.14	Mid-dense <i>Corymbia citriodora</i> , <i>E.crebra</i> open forest on metamorphics +/- interbedded volcanics and sparse <i>E.crebra</i> , <i>E. tereticornis</i> woodland on metamorphics +/- interbedded volcanics.

Refer to the SSMP for detailed information on significant ecological communities present within the GTP ROW as well as mapping highlighting the location of each RE and its status within the GTP ROW.

4.2 Fauna

As part of the EIS process, fauna assessments of the mainland component of the GTP RoW were undertaken in 2008. During the survey periods, a total of 98 native and 8 introduced fauna species were identified from the GTP RoW. Additional surveys undertaken in 2010 detected an additional 220 native and 4 introduced fauna species within, and adjacent to, the GTP RoW.

The majority of the fauna species identified from the GTP RoW are listed as Least Concern under the provisions of the NC Act, and are not listed under the provisions of the EPBC Act. However, there are a number of EVNT fauna species known within the Project footprint, including the Powerful owl (*Ninox strenua*), Squatter pigeon

(*Geophaps scripta scripta*), Golden-tailed gecko (*Strophurus taenicauda*) and Brigalow scaly-foot (*Paradelma orientalis*).

Further detail regarding the EVNT species known or likely to occur within the GTP RoW is provided in the EIS, SEIS, SMP and SSMP.

4.3 Watercourse and wetlands

The project area encompasses the catchment areas of Dawson, Comet and Calliope Rivers, and extends into tidal creeks and wetlands of Port Curtis.

Within these three catchments, the proposed corridor traverses 183 watercourses. DERM has assigned each watercourse a Stream Order (SO) number from 1 to 8, based on its position within the catchment. The major watercourses intersected include the Dawson River (SO 8 and 5) and Calliope River (SO 5) and Hutton (SO 6), Clematis (SO 5), Callide (SO 5), Baffle (SO 4) and Larcom (SO 3 and 4) Creeks.

The GTP RoW also intersects the estuarine environs of Targinie and Humpy Creek and the intertidal wetlands (including seagrass, mangrove and saltmarsh communities) of Port Curtis (e.g. Kangaroo Island and Curtis Island).

4.3.1 Environmentally sensitive areas

To assist in minimising the impacts on the existing environmental values of the area, the Environmentally Sensitive Areas (ESAs) have been mapped. The ESAs within and adjacent to the GTP RoW include:

- TECs under the EPBC Act;
- Areas known to support EVNT species under the provisions of the EPBC Act and/or NC Act;
- Areas mapped as Endangered or Of concern REs under the provisions of the VM Act;
- Areas mapped as Essential Habitat under the provisions of the VM Act;
- Areas protected under the provisions of the NC Act and/or Forestry Act; and
- Riparian zones of watercourses with a Stream Order equal to or greater than 3.

Where possible, these areas will be avoided, or measures will be implemented, prior to and during construction, to minimise potential impacts (e.g. a maximum clearing footprint of 30 m).

Specific management measures for ESAs are outlined in the SSMP.

4.3.2 Agricultural Land Use

An assessment of the agricultural land capability of the area was conducted during the EIS (URS, 2009) to provide a benchmark of existing/potential agricultural land use. Land within the study area was identified in accordance with State Planning Policy 1/92: Development and the Conservation of Agricultural Land. The assessment was based on the four class system for defining Good Quality Agricultural Land (GQAL) as detailed in the Planning Guidelines - Department of Primary Industries (DPI) and the Department of Housing Local Government and Planning (DPI/DHLGP - 1993).

All Class A land is considered to be GQAL. In some areas, Class B land (where agricultural land is scarce) and better quality Class C land (C1) (where pastoral industries predominate), are also considered to be GQAL. For the Mainland GTP RoW, Classes A, B and C1 are considered to be GQAL.

The Mainland GTP RoW traverses GQAL land classes A through to D. Significant lengths of Class A and B land is traversed in the Arcadia Valley and East of the Dawson Highway to North of Burnett Highway. The majority of land intercepted by the Mainland GTP RoW is classified as Class C.

It has been calculated that approximately 7.4% of the GTP RoW will pass through Class A land; approximately 9.6% will pass through Class B land; and approximately 77.6% will pass through Class C land (with 34.9% of that being Class C1). The remaining mainland GTP RoW will pass through Class D non-agricultural land.

5. Impacts

The construction of the GTP ROW will create a linear disturbance across several landscape types. The GLNG EIS and SEIS identify the adverse and beneficial impacts associated with the construction and operation of the GTP ROW. Key examples of the short and long term impacts pertaining to landscaping and rehabilitation within and adjacent the GTP ROW are summarised in table 2 below.

Table 5.1 Impacts

Aspect	Impacts
Negative Impacts	
Vegetation clearing as a result of bulk earthworks (e.g. excavation, clearing quarrying etc.).	<ul style="list-style-type: none"> • Potential to alter the biodiversity, distribution and dynamics of the existing environment through: <ul style="list-style-type: none"> - Fragmentation of vegetation communities - Loss of habitat and microhabitats (flora and fauna) - Loss of local faunal and floral populations, including threatened and significant species - Loss of riparian vegetation - Establishment of pest and weed species in sensitive environs (increase in weed proliferation) - Loss of topsoil and increased erosion - Sedimentation into waterways resulting in a decrease in water quality - Subsequent salinity issues or a rise in the watertable - Increase in likelihood of disturbing acid sulphate soils - Reduction in buffering capacity particularly in or adjacent sensitive areas.
Topsoil removal and/or loss as a result of bulk earthworks (e.g. excavation, clearing etc.).	<ul style="list-style-type: none"> • Loss of soil seed bank. • Sedimentation into waterways resulting in a decrease in water quality. • Increase in likelihood of disturbing acid sulphate soils.
Chemical use	<ul style="list-style-type: none"> • An increase in chemical use (i.e. pesticides) may reduce food sources for some fauna species (i.e. moth/insects and other invertebrates). • Potential for bioaccumulation within the food chain. • Impact on local pollinators which are required to help maintain ecosystem function.
Positive Impacts	
Propagation of endemic species for rehabilitation activities (e.g. revegetation, seeding, weeding etc.)	<ul style="list-style-type: none"> • Potential to enhance the local biodiversity of the area through: <ul style="list-style-type: none"> - Strategic revegetation of and provision of artificial fauna furniture, such as glider poles, bat boxes and nests in potential corridors (to re-create linkages) - Recreating vegetation communities lost as a result of construction clearing - The enhancement of habitat and associated foraging resources for native fauna.
General landscape works (revegetation, seeding, weeding etc.)	<ul style="list-style-type: none"> • The use of locally native plant species to minimise the risk of introducing 'problem' species. <ul style="list-style-type: none"> - Enhance soil stability and structure - Enhance water retention in soils to encourage water table stability - Improve aesthetic/visual value to the area - Improve air quality.

6. Pipeline operational and decommissioning phase rehabilitation objectives

Australian Standard AS2885, Part 3: Vegetation on or near the pipeline states:

Unless approved, vegetation shall be restricted to allow free passage along the pipeline route. Vegetation, whose roots may damage the anti-corrosion coating of the pipeline, shall not be permitted in the vicinity of the pipeline.

The APIA Code of Environmental Practice – Onshore Pipelines states: *Vegetation management – Environmental management; Management Measures: Regrowth vegetation on the pipeline easement shall be maintained to ensure root systems do not create a safety risk to the pipeline. The width of vegetation removal (i.e. the distance cleared on either side of the pipeline centreline) should be the minimum extent reasonable necessary to ensure the safe operation of the pipeline.*

In line with the Australian Standard and APIA Code of Environmental Practice requirements stated above, rehabilitation following construction of the pipeline must allow for the protection of the pipeline integrity and ensure permanent access to the pipeline for monitoring and maintenance purposes whilst it is in operation. Subsequently rehabilitation objectives for the operational phase will restrict vegetation growth to allow for understorey species and mid-level species to return within 10m of the pipeline.

On decommissioning of the pipeline, rehabilitation to pre-clearance conditions will be undertaken within all previously restricted vegetation growth areas, in accordance with EPBC Act Approval Condition 3d.

7. Implementation and Management Strategy

A rehabilitation strategy has been developed and is detailed below. The strategy ensures that rehabilitation objectives are met for the range of land uses and disturbance levels for the lifespan of the pipeline.

7.1 Pre-clearance Survey

Prior to construction, a pre-clearance survey will be undertaken in accordance with EPBC Act Approval Condition 3(a). During the pre-clearance survey, information to document the condition and value of a site prior to disturbance, including habitat resources, species composition and level of disturbance will be collected.

7.2 Benchmark Guidelines

A range of benchmarks will be selected to guide rehabilitation for broad ecosystems, including pasture grasses, identified in the RoW. Benchmark guidelines provide a summary of the key condition indicators of a range of vegetation and grazing communities.

Benchmarks provide information on the best condition on offer for each broad ecosystem, and are considered to be the minimum target for rehabilitation. This information is designed to be supplemented by the pre-clearance survey, and provide a means to rehabilitate disturbance areas to better than pre-clearance condition.

The pre-clearance survey includes methods to select the appropriate benchmark guideline.

7.3 Operational Safety requirements

In accordance with Australian Standard AS25884, Part 3 and The APIA Code of Environmental Practice – Onshore Pipelines (Refer to Section 6) operation safety requirements must be considered when determining rehabilitation criteria. Trees with large root balls (such as *Ficus sp.*) pose a risk to the structural integrity of buried infrastructure. To ensure compliance with AS2885 (Part 3, Section 6.4.4), vegetation will be restricted to allow free passage along the pipeline route. Vegetation whose roots may damage the anti-corrosion coating of the pipeline shall not be permitted in the vicinity of the pipeline during the operational phase of the pipeline.

In order to ensure operational safety, vegetation species used to rehabilitate the RoW will be limited to species less than 10 to 12 m in height. In areas where RE communities are to be rehabilitated, understorey species and mid level species of pre-disturbance RE communities will be returned to the RoW.

To ensure compliance with EPBC Act Approval Condition 3d, pre-clearance conditions will be rehabilitated within these restricted areas on decommissioning of the pipeline.

7.4 Landholder Rehabilitation requirements

A Construction Line List (CLL) has been prepared detailing a number of commitments which GLNG has made to Landholders whose property is intersected by the GTP RoW (and/or ancillary sites). A number of the CLL commitments relate to specific site rehabilitation actions, which fall in to the following broad groups:

- Vegetation: Re-seeding (seed mix type); arrangements for relocation of cycads, grass trees and orchids, weed prevention;
- Disturbed soils: Restoration of land condition; prevention of soil erosion; soil compaction; soil inversion; soil subsidence; sink holes; surface disruption; provision of contour banks/whoo boys;
- Infrastructure: Fencing and gates; installation of Cathodic Protector posts; construction of water tank pad, relocation of dam) and
- Stockpiling of materials: Excess excavated materials and timber for reuse by landowner.

All CLL commitments must be actioned within the relevant land tenures prior to transferring decommissioned areas to Landholders. Where landholders have not specified additional rehabilitation requirements, land will be restored to its pre-disturbance land use.

7.5 Rehabilitation Schedules

Rehabilitation schedules will be developed based on benchmark guidelines for each disturbance type and broad land use (vegetation or agriculture), and include specific objectives and performance criteria to ensure disturbed sites are rehabilitated to a pre-disturbed condition.

The rehabilitation schedules will include performance measures and related monitoring actions to assess site rehabilitation, as well as provisions for reporting on the implementation of the LRMP including monitoring and performance to a standard which can be independently audited.

Rehabilitation schedules will include site remediation measures by stage of development (e.g. pre-construction, construction, post-construction, and decommissioning), as well as the inclusion of timeframes and standards for conducting rehabilitation activities.

The schedules will provide practical rehabilitation measures to support recovery of EVNT species habitat and recovery of TEC, in line with the SSMP, as well as recovery plans provided by SEWPaC and DERM.

7.5.1 Performance criteria

Performance criteria will be developed for each rehabilitation schedule in order to meet the overarching rehabilitation objectives of providing a safe, stable and non-polluting landform.

In order to comply with the EPBC Act Approval, CG Conditions and EA Conditions, standard performance criteria for vegetated sites (including TEC, RE and HVR vegetation) include the representativeness of species richness and diversity for the appropriate benchmark. Specific criteria to support the recovery of TEC, RE and significant species habitat will also be included within each rehabilitation schedule.

Standard performance criteria within agricultural sites across the Project area include:

- Plant survival, height, recruitment and richness;
- Stability of landform;
- No declared weeds occurring;
- Pasture species richness representative of pre-disturbed condition;

- The preservation of inherent GQAL agricultural land use classes; and
- Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks.

8. Management Requirements

While the rehabilitation schedules will determine the detailed management measures, the following general measures will be incorporated to the guidelines:

Table 7.1 Mitigation and Management Measures relevant to Landscape and Rehabilitation Works

Actions	Timing
• All landscaping and rehabilitation works will comply with relevant statutory conditions and guidelines (e.g. EPBC and NC Act approval).	At all times
• Where applicable, all landscaping and rehabilitation works will be consistent with measures outlined in the SSMP and SMP.	At all times
• Landscaping and rehabilitation personnel will be suitably qualified and experienced to undertake the works.	At all times
• Landscaping rehabilitation personnel will be educated on potential risks to native wildlife which may inhabit the area as per the SMP and SSMP.	Prior to and during works
• A pre-clearing survey of the GTP ROW will be undertaken to document the existing condition of the vegetation communities to be impacted as a result of clearing works. The survey will document (including photologging) all environments relevant to the landscape and rehabilitation works, including: <ul style="list-style-type: none"> - Topsoil and landforms - Drainage - Vegetation - Environmentally Sensitive Areas • The survey will also include undertaking cross sections to record existing surface level and contours.	Prior to works commencing
• Development of any Special Area plans will be undertaken in consultation with Councils, landowners, DERM, DTMR, DEEDI as necessary.	Prior to works commencing
• Consultation with the design civil engineers and landscape architects prior to finalising planting design will be undertaken where applicable.	Prior to works commencing
• Where applicable, compliance with the Road Landscaping Guidelines (DMR, 2004) will be undertaken within rehabilitation works within a road reserve.	At all times
• Where applicable, compliance with other stakeholder requirements including local government authorities (local government controlled roads), Energex and/or Powerlink and QR National (rail corridors) will be undertaken.	At all times
• The Principal shall organise for Type A flora pursuant to the NC Act to be translocated or salvaged. This may involve the relocation of specimens to an interim area (e.g. for orchids a bushhouse facility) until rehabilitation works are mature enough to accommodate translocated individuals.	Prior to works commencing
• The Principal Contractor will be responsible for organising the collection of any seeds and/or propagules from locally native flora (least concern) within the project area for use in the rehabilitation works. This includes flora associated with threatened ecological communities present within the GTP ROW. The Proponent will be responsible for the collection of any significant flora seeds and/or propagules for any translocation, offset and management works (those protected under the NC Act). Seed collection will be undertaken in accordance with seed collection guideline document: Model Code of Practice, Florabank Guideline 6: Native Seed Collection Methods.	Prior to works commencing
• All growing facilities must adhere to Australian phytosanitary standards and guidelines.	At all times
• Where enhancement plantings are required, a planting and/or seeding plan	Prior to works commencing

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Actions	Timing
will be developed based on the geology, soil description, pre-existing and existing floristic composition and vegetation characteristics and landholder preferences.	
<ul style="list-style-type: none"> Monitoring points will be strategically located and set up prior to rehabilitation works commencing. This will include but not be limited to the establishment of permanent photologging points for monitoring purposes. Monitoring and photologging stations will be set up at locations that include the locations where photos and data were collected prior to disturbance. 	Prior to works commencing
<ul style="list-style-type: none"> Clearing is a last resort. The retention of vegetation, selective clearing, trimming and fauna spotting is the first priority. 	Construction Phase
Stockpiling of topsoil for reuse during rehabilitation works is to be undertaken. Ensure that stockpiles are separated from subsoils and covered as appropriate, or that appropriate erosion and sediment controls are in place to avoid erosion and sediment runoff.	Construction Phase
<ul style="list-style-type: none"> Topsoil stockpiles shall preferably be no more than 2 m high and 50 m wide. Variation to this standard is subject to approval by the Environment Manager. 	Construction Phase
<ul style="list-style-type: none"> Topsoil that is stockpiled for greater than Six (6) months must be managed to minimise erosion. 	Construction Phase
<ul style="list-style-type: none"> Topsoil stockpiles shall be seeded if left for more than 12 months. 	Construction & Operational Phases
<ul style="list-style-type: none"> Relocate tree hollows and other microhabitats (e.g. rocky outcrops) to suitable sites outside the clearing footprint. This is to be determined in consultation with an ecologist and where necessary, landholders. 	Prior to and during works
<ul style="list-style-type: none"> Weather permitting, rehabilitation and reconsolidation of impacted watercourses shall commence immediately after the pipeline has been lowered in and backfilled. This will include early rehabilitation of riparian buffers will occur in order to restore natural stream functions and aquatic habitats 	Construction & Operational Phases
<ul style="list-style-type: none"> Where appropriate, rehabilitation of the bed and bank structure such that original dimensions and shape of the creek or spring are achieved. Bank re-contouring should include stabilisation methods (crib walls or soil wraps). 	Construction & Operational Phases
<ul style="list-style-type: none"> Where possible, promote a heterogeneous substrate in watercourse crossings, including : <ul style="list-style-type: none"> - Replace large woody debris to stabilise banks and also to provide in-stream complexity; and - Use a combination of rocks, gravel and/or cobbles, etc. in the stream bed. The use of large rocks and logs to moderate flows. 	Construction & Operational Phases
<ul style="list-style-type: none"> Salvaging of existing bed material prior to the construction and placing it back into the creek or spring at completion of construction. If the existing bed material is unable to be salvaged, a comparable sediment sized material is recommended to cover the bed and should be approximately 10 cm thick. If the sediment is fine (mud/silt), it is recommended that the bed material be replaced with sand to prevent future erosion. If the sediment is coarser (gravel, cobble, pebbles), new material must be washed prior to placing in the creek (as usually, new coarse substrate is covered in a fine dust, which will become suspended in the water). 	Construction & Operational Phases
<ul style="list-style-type: none"> Soils will be graded away from the watercourses, not towards it. Graded soil shall not be stockpiled where it has the potential to result in sedimentation or acidification of land or surface water (e.g. on slopes which drain immediately to a watercourse). 	Construction & Operational Phases
<ul style="list-style-type: none"> Weather permitting, rehabilitation of the GTP ROW shall commence within 3 months from the completion of the pipeline construction. Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the 	Construction & Operational Phases

Actions	Timing
natural re-establishment of significant species and ecological communities into the disturbed areas.	
<ul style="list-style-type: none"> The GTP ROW will be re-profiled to original or stable contours, including re-establishing watercourses, wetlands, overland flow paths and other topographic features, immediately after the pipeline has been lowered in and backfilled. 	Construction & Operational Phases
<ul style="list-style-type: none"> Erosion and sediment control measures will be implemented in accordance with the Erosion and Sediment Control Plan. 	At all times
<ul style="list-style-type: none"> Activities will be conducted in accordance with EHS04 (<i>Waste Management</i>) to ensure appropriate mitigation measures are implemented in the management of waste. 	At all times
<ul style="list-style-type: none"> Areas of the GTP ROW may be deep ripped prior to reapplying topsoil. 	Construction & Operational Phases
<ul style="list-style-type: none"> Subsoil will be respread over the GTP ROW and compacted over the trench, including contouring works, immediately after the pipeline has been lowered in and backfilled. 	Construction & Operational Phases
<ul style="list-style-type: none"> After subsoil respreading and compaction, topsoil will be respread over the GTP ROW and left with a slightly rough surface. 	Construction & Operational Phases
<ul style="list-style-type: none"> Cleared native vegetation will be respread over the GTP ROW to assist in seed stock distribution. This action will be undertaken in a manner which does not promote erosion or subsidence. 	Construction & Operational Phases
<ul style="list-style-type: none"> Native woody debris, which is not to be used in habitat rehabilitation works, will be mulched and respread across the GTP ROW. The mulch material will be used to filter out sediments and also in planting works. 	Construction & Operational Phases
<ul style="list-style-type: none"> Where necessary imported topsoil, which is of appropriate quality and weed and fire ant free, will only be used with landholder approval. 	Construction & Operational Phases
<ul style="list-style-type: none"> Where necessary, fertilisers and soil supplements will be only be used with approval from local landholders and authorities. 	Construction & Operational Phases
<ul style="list-style-type: none"> A maximum of 10 m will be maintained along the GTP ROW for access. No planting of deep-rooted trees within 3 m of the pipe will occur to maintain pipe integrity (Refer to Section 6 & 7). Within 10m of the pipeline, rehabilitation objectives for the operational phase will allow vegetation growth of understorey species and mid-level species to return. 	Operational Phase
<ul style="list-style-type: none"> Re-establish or enhance the habitat of a significant species known or likely to occur within the GTP ROW prior to clearing activities (especially where the construction clearing activities have affected such habitat (Refer SSMP)). 	Construction & Operational Phases
<ul style="list-style-type: none"> Preserve specific European and indigenous heritage that has been registered for the site (note that these values are managed under other legislation). 	Construction & Operational Phases
<ul style="list-style-type: none"> The natural regeneration of native species will be encouraged (in particular, groundcover and shrub species). However, seeding will be utilised in areas where rapid restoration is required (e.g. watercourse crossings and areas of high erosion potential). 	Construction & Operational Phases
<ul style="list-style-type: none"> Reseeding will be undertaken using native species only for areas of high value regrowth and regional ecosystems. Reseeding using non-native species may be used on pastoral grasslands and cropping land only and within these areas reseeded will be undertaken as per the landholder's requirements. 	Construction & Operational Phases
<ul style="list-style-type: none"> Where natural regeneration is not successful, establish vegetation communities to a condition at least equivalent to the ROW condition prior to commencement (especially where native vegetation is the proposed land use), taking into consideration the constraints. 	Construction & Operational Phases
<ul style="list-style-type: none"> Maintain a mosaic vegetation structure, including planting of different aged plants. 	Operational Phase

Actions	Timing
<ul style="list-style-type: none"> Any 'temporary'⁴ vegetation is to be locally native. If this is not achievable, other native plants from the bioregion are to be used. Any proposed species substitutes are to be approved by the Principal prior to planting. 	Construction & Operational Phases
<ul style="list-style-type: none"> Vegetated buffers are to be established at sufficient height and width to provide a wind break and visual screening along the boundaries between stockpiles and sensitive receptors. 	Construction & Operational Phases
<ul style="list-style-type: none"> Use foraging and habitat tree species in planting works for fauna such as koalas, gliders and Glossy-black cockatoos. 	Operational Phase
<ul style="list-style-type: none"> Place artificial nest and/or bat boxes in suitable sites outside the clearing footprint and within rehabilitated areas. 	Construction & Operational Phases
<ul style="list-style-type: none"> In consultation with an ecologist, erect glider poles and other measures (e.g. timber poles to allow semi-arboreal and arboreal species to escape predators) in the GTP ROW (especially in areas of remnant vegetation adjoining the Jemena Pipeline) to facilitate fauna movement (e.g. Expedition Range). 	Construction & Operational Phases
<ul style="list-style-type: none"> Re-establish large woody debris and rocky outcrops within rehabilitated areas to create stepping stones for fauna and also microhabitats. 	Construction & Operational Phases
<ul style="list-style-type: none"> Planting of frangible species, where required, to comply with safety requirements will be undertaken. 	At all times
<ul style="list-style-type: none"> Where applicable, maintain adjacent high tide banks with intertidal species. 	At all times
<ul style="list-style-type: none"> It is considered that the most appropriate method to regenerate large areas of intertidal wetlands is through natural regeneration. This should be achieved through regular weed control, maintaining existing tidal regimes, and mitigating issues with ASS. 	Construction & Operational Phases
<ul style="list-style-type: none"> If natural re-colonisation of intertidal communities does not occur within 12 months, manual planting may be required. This will be subject to consultation from DEEDI. 	Operational Phase
<ul style="list-style-type: none"> Watering of revegetated areas shall be carried out to maintain soil moisture content to no less than PAW⁵ during the establishment period. 	Construction & Operational Phases
<ul style="list-style-type: none"> Weed species will be managed as per the Weed and Pest Management Plan. However, as a general rule, weed management should occur prior to and during the rehabilitation planting to encourage rehabilitation success. 	At all times
<ul style="list-style-type: none"> All waste materials and equipment will be removed from the GTP ROW and associated laydown areas once construction is completed. This includes disused sediment fences. 	Construction & Operational Phases
<ul style="list-style-type: none"> Rehabilitated areas shall be clearly marked with appropriate signage, "Revegetation Area No Unauthorised Access". 	Construction & Operational Phases
<ul style="list-style-type: none"> Vehicles will be confined to designated maintenance access tracks within GTP ROW. 	At all times
<ul style="list-style-type: none"> Where appropriate, rehabilitation areas will be fenced to exclude cattle and other threatening processes. Fencing will only be undertaken with landholder approval. 	Construction & Operational Phases
<ul style="list-style-type: none"> Avoid the use of barb wire when erecting any Project related fencing. Where barb wire fencing is unavoidable the top strand will be high tensile steel (non-barbed wire) to avoid fauna getting caught and tangled in the barbs. 	At all times
<ul style="list-style-type: none"> Driving vehicles on freshly topsoiled sections of the GTP ROW will be prohibited. 	Construction & Operational Phases
<ul style="list-style-type: none"> Temporary access tracks have been selected to minimise or eliminate the need for any clearing, and are all based on the route of existing 	Operational Phase

⁴ 'Temporary' vegetation will be used to stabilise temporary banks/stockpiles and will be removed and re-established as native vegetation post construction.

⁵ Plant available water. The portion of water in a soil that can be readily absorbed by plant roots. That soil moisture held in the soil between field capacity and permanent wilting point (DMR 2008).

Actions	Timing
<p>tracks. Where a previously cleared alternative feasible route to a portion of an access track was identified as representing a lesser impact (e.g. around a patch of significant vegetation), this was selected in preference to the original route. The selection process for temporary access tracks has minimised any requirement for clearing of remnant vegetation in particular, by utilising alternative existing tracks where practicable, or by selecting routes which have previously been cleared. Where clearing is required, this is likely to be minimal, in the order of 0.5 m to 1.0 m width of clearing.</p> <p>Where clearing is required for the construction or maintenance of temporary access tracks, reinstatement and rehabilitation to pre-clearance conditions will be undertaken or, for cropping and pastoral land, as agreed with the landholder.</p> <p>Rehabilitation actions will consist of stabilisation of soils and reseeded, ensuring that the track is left in a stable condition. Where minor clearing of remnant or high value regrowth is necessary, any cleared areas will be revegetated with equivalent vegetation using locally collected seed.</p>	Operational Phase
<ul style="list-style-type: none"> Where non-public access routes are to be retained, the entrance will be disguised. 	Construction & Operational Phases
<ul style="list-style-type: none"> Monitoring the success of rehabilitation strategies will be undertaken as per the Principal Contractors LRMP with the findings reported to Principal. Monitoring and reporting should occur at the same time each month for the first 2 years. 	Construction & Operational Phases
<ul style="list-style-type: none"> Ongoing monitoring of the fauna measures implemented during construction to facilitate fauna movement and colonisation. This includes checking the nest and bat boxes, the success of gliders poles and the colonisation of fauna in rehabilitation areas. 	Operational Phase
<ul style="list-style-type: none"> Implement corrective actions where necessary if the performance objectives are not being achieved. This will include replanting of species which have not survived, installation of additional controls if erosion is occurring etc. 	Operational Phase
<ul style="list-style-type: none"> In accordance with EA condition E36, rehabilitation can be considered successful when the site can be managed for its designated land-use without any greater management input and there is evidence that the rehabilitation has been successful for at least 3 years. 	Operational Phase
<ul style="list-style-type: none"> A further review will be undertaken at the time of decommissioning to determine an appropriate rehabilitation policy in accordance with best practice at the time. 	Decommissioning Phase
<ul style="list-style-type: none"> On decommissioning, land will be rehabilitated to a level consistent with the pre-clearance condition. 	Decommissioning Phase
<ul style="list-style-type: none"> On decommissioning, the Pipeline will remain in situ and all above ground infrastructure will be removed by cutting at ground level. The decommissioned Pipeline will be inert and at atmospheric pressure, thus presenting negligible environmental impact and low environmental risk. 	Decommissioning Phase
<ul style="list-style-type: none"> During decommissioning phase rehabilitation, vegetation with large root balls (i.e. trees greater than 10 m) will be re-established within the RoW. This type of vegetation will be restricted during the operational phase to protect the structural integrity of the pipeline. Revegetation of these species may be undertaken through passive (i.e. allow for the natural encroachment of the species) or active (i.e. planting/seeding) methods depending on best practice at the time of rehabilitation. 	Decommissioning Phase
<ul style="list-style-type: none"> Risks and impacts during decommissioning of the pipeline will be limited to weed, vegetation and waste impacts. Impacts will be managed in accordance with the Project Pest and Weed Management Plan and Waste Management Plan. Should there be a requirement to clear vegetation to access the RoW to 	Decommissioning Phase

Actions	Timing
<p>remove above ground infrastructure, areas of impact will be rehabilitated to pre-clearance condition in accordance with the rehabilitation management plan.</p> <ul style="list-style-type: none"> Management plans will be reviewed and amended at the time of decommissioning to adopt current best practice. 	

It should be noted that failure to comply with the mitigation measures outlined in this plan will result in the Principal Contractor being responsible for any and all mitigation costs associated with that non-conformance.

9. Constraints

Rehabilitation of the GTP ROW will vary between areas depending on the level of clearing, the vegetation and habitat complexity and composition within each area, landholder requirements as well as the ongoing operation and maintenance requirements.

In addition, there are several constraints that will influence the rehabilitation works along the GTP ROW. These constraints are outlined in Table 8.1 below.

Table 8.1 Constraints and Actions

Constraint	Action
Weather	The success of the rehabilitation strategy will be dependent on weather conditions during and post construction (e.g. recent flooding in the last year along sections of GTP ROW and prior to this the extended drought conditions).
Land Owner Negotiations/ Requirements.	<p>Interference to landholder activities will vary according to the level of impact caused by the construction of the pipeline, type of activities being undertaken and the duration of the work on a landholder's property.</p> <p>Each landholder will be consulted prior to the works being undertaken to identify specific requirements and outcomes. Temporary provisions, such as fencing, driveways or stock access to water, will be discussed with each landholder.</p> <p>Reinstatement of cropping and pastoral grasslands will be as required by landowners. However rehabilitation of all Regional Ecosystems, high value regrowth areas and native vegetation not classified as either of these categories will be restored to its pre-disturbance condition during the decommissioning phase, in accordance with 3d of the EPBC Act conditions.</p> <p>Every effort will be made to minimise the impacts to landholders by limiting the area of works, using existing tracks which avoid homesteads and minimising the amount of time the trench is left open.</p>
Off-set Distances from Pipeline (operational phase)	<p>The Operator of the pipeline will need to ensure that the structural integrity of the pipeline is maintained (Refer to Section 6.3). In this regard, planting in close proximity to the pipeline must consider the root system of the chosen plant species. While trees and deep-rooted vegetation cannot be re-established directly across the pipeline (due to potential damage to the corrosion protection systems), grassland re-establishment and return of native understory/ mid level species will be undertaken.</p> <p>Habitat will be re-established as much as practicable through installation of glider poles, nest boxes, woody debris, logs, hollows etc.,</p>
Other infrastructure	The GTP ROW intersects other linear infrastructure, including power lines, roads and rail lines. Rehabilitation in these areas will need to be in accordance with the relevant stakeholders requirements for operations and maintenance.

Fencing/ Property Boundaries	Dependent on the outcomes of discussion with relevant landholders. However, preference will be to use wire (non-barbed) fencing with a plain wire strand on the top.
Weed Infestation Areas	Some areas along and adjacent the GTP ROW are heavily infested with weeds. The level of rehabilitation will be assessed in site-specific rehabilitation plans to ensure no spread of infestation.
Maintenance Tracks	An access track will be required along the pipeline route within the ROW for ongoing operations and maintenance. Some additional works may be required to access the ROW - these will be determined as construction works progress.

10. Rehabilitation completion criteria

Rehabilitation completion criteria will be dependent on the vegetation communities and land uses prior to clearing, pre-existing health and integrity of the landscape and landholder requirements. Therefore specific completion criteria for determining when a site has been completely rehabilitated will be specified within specific rehabilitation schedules.

However, the overall aim of the rehabilitation works is to rehabilitate impacted environs to as a minimum, their pre-existing condition. This is a particular prerequisite for all significant ecological communities, protected areas and other sensitive areas identified within the GTP ROW.

General guidelines on heights, canopy cover and potential complexity have been briefly discussed below to provide direction for desired outcomes.

Barrier plantings

The objective of the barrier plantings is to minimise weed infiltration into areas of considerable conservation value. The width of these plantings should be a minimum of 20m with a minimum density of 70% foliage cover.

Riparian zone

The vegetation within the riparian zone of a watercourse should achieve high densities, particularly in the lower stratum in order to keep weed infiltration to a minimum. The upper stratum in some instances may take on the structure of an open or closed forest community.

Samphire and mangrove communities

Optimum outcome for these communities is to be free of introduced weed species and to be further enhanced through natural regeneration. The structural formation of a closed samphire community would consist of approximately >80% foliage and surface cover (Attiwill and Wilson 2003).

Woodland

The structural formation of woodland generally consists of approximately 10-30% foliage cover and 20-50% foliage cover in the canopy (Confinas and Creighton 2001). The species complexity of woodland communities is highly variable due to factors such as aspect, rainfall and soil type. However as a guide, sclerophyllus woodlands containing an acacia understorey are likely to achieve the 30% foliage cover if fire and other disturbance factors are maintained.

Open forest

The structural formation of an open forest generally consists of approximately 30-70% foliage cover, 50-80% crown cover in the canopy and tree heights ranging between 10-30m (Confinas and Creighton 2001).

Closed forest

The structural formation of a closed forest generally consists of approximately 70-100% foliage cover, 80-100% crown cover in the canopy and heights of <30m (Confinas and Creighton 2001).

Landforms

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Pre-existing surface levels will be reinstated.

Open Areas and Agricultural Areas

The level of rehabilitation within these areas will be determined in consultation with the individual landholders. It is likely that rehabilitation will involve normal agricultural seeding, hydro-seeding or basic hydromulching techniques to return the pre-existing ground cover (or an appropriate or preferred replacement) to the site.

Habitat Rehabilitation

Habitat rehabilitation will be implemented along the GTP ROW to facilitate fauna movement and re-colonisation of the ROW. The following habitat features will be considered:

- Replacement of hollows, large woody debris in adjacent habitats and within the GTP ROW (subject to landholder permission);
- Placement of artificial structures, including bat and nest boxes and glider poles, at key locations to facilitate fauna movement and recolonisation;
- Bee hives for native bees dependent on the existing distribution and abundance; and
- Feeder and/or habitat trees for key species and migratory birds.

In determining whether the completion criterion is met, the following factors will be used:

- The similarity between the rehabilitated landforms and the natural landforms in adjacent areas;
- The stability of the landform and its resistance to erosion;
- Whether appropriate drainage patterns have been developed either naturally or through shaping activities during the rehabilitation programme;
- The degree to which the surface conditions are conducive to plant establishment;
- Whether the site conditions and existing habitat components provide resources, including for fauna movement, foraging habitat and/or shelter;
- Compliance with the relevant standards; and
- Public safety issues (e.g. signage, fencing etc.).

11. Training and awareness

11.1 Project Personnel induction

In accordance with Santos Management Standard EHSMS06, all personnel and visitors are required to undertake appropriate environmental training and induction programs.

As part of the training programme, all project personnel⁶ are required to complete site specific environmental awareness training which is to be conducted by the EO. As a minimum, the training will consist of a presentation and an assessment questionnaire. The site induction will address the following.

- Fauna and flora likely to be present within the corridor, including significant species (awareness training);
- Location of sensitive areas (e.g. wetlands and habitat trees);
- Landholder constraints;
- Vegetation protection areas and no go zones;
- Procedures and actions associated with encountering fauna;
- Threatened species habitat areas;
- Weed identification and control; and
- Responses and reporting of environmental issues.

This training will be developed with the assistance of the project ecologist and delivered by the Environmental Construction Manager / Environmental Officer(s). This will be undertaken within the initial induction process, ongoing toolbox meetings and relevant Construction Method Statements.

⁶ Project personnel include all staff, contractors and consultants that may undertake onsite works.

Where possible, personnel will also be shown photographs and given general information on significant species and ecological communities identified within and adjacent the GTP ROW, this will enable them to identify these species should they be encountered.

12. Monitoring and Maintenance

A rehabilitation monitoring and maintenance plan will be developed to complement each rehabilitation schedule. Monitoring of the rehabilitated GTP RoW is required every 20 days for the first 120 days, and annually for the first five (5) years following completion of rehabilitation, in accordance with the EA, Schedule J22-J24. The monitoring and maintenance plan is designed to be flexible to allow adaptations for natural disasters such as fire, drought and flood.

All monitoring will be undertaken by a suitably qualified person (EA Schedule H12).

Monitoring periods may require extension in the case of ineffective rehabilitation or natural disasters impeding rehabilitation efforts. Where monitoring extensions are required, it will be recorded and implemented by GLNG.

Specific monitoring criteria will be outlined within each rehabilitation schedule, reflective of the performance criteria. Generally, the following indicators will be monitored:

- Indicators of growth and survival of all plantings;
- Plant height;
- Native species richness;
- Evidence of recruitment;
- Native species cover;
- Weed control – extent of declared and environmental weeds and adequacy of treatment, as well as any secondary weed responses to treatments;
- Indicators of the presence of EVNT species and / or key habitat features (as per SSMP);
- Adequacy of site preparation, mulching, tree (and plant) protection and maintenance; and
- Landform stability – evidence of soil erosion as per the Soil MP and ESCM.

Monitoring will consist of vegetation surveys and photologging, monitoring locations established within representative areas of the GTP RoW and for each ancillary site. Monitoring locations are to be determined by the suitably qualified ecologist using BioCondition assessment methods (Nelder et al. 2011). This will include but not be limited to the establishment of permanent photologging points for monitoring purposes. Monitoring and photologging stations will be set up at locations that include the locations where photos and data were collected prior to disturbance. Where possible, monitoring plots will be established within the core of rehabilitation areas to avoid edge effects. Monitoring will take the impacts from seasonal variation into consideration.

Performance criteria to monitor the progress of each rehabilitation site will comprise of a combination of pre-clearing data and benchmark guidelines. It is noted that while three (3) years is insufficient time for rehabilitation to meet the benchmark guidelines, it is sufficient to ensure that rehabilitation is well established and regenerating, and an improvement in BioCondition scoring should be clearly evident. The progression and improvement of key rehabilitation indicators such as species composition and diversity, weed cover, and plant densities will be evident over a three (3) year period.

All monitoring results and records will be compiled and stored for a minimum of five (5) years and made available for inspection upon request, in accordance with CG Condition, Appendix 3, Part 4, Schedule J3.

13. Reporting and Record Keeping

A monitoring and evaluation report will include details on species survival, natural recruitment, percentage coverage of the rehabilitation area and percentage and species of weeds in the rehabilitated areas. In addition the following will also be recorded:

- Planning and impact assessment details;
- Activity site location and site access details;
- Commencement and completion dates;
- The area of native vegetation removed, and the amounts of material excavated and fill placed;
- The disposal location/s and quantity of spoil material removed;
- The disposal location/s and quantity of native vegetation removed;
- Impact management and rehabilitation details;
- Before, during and post activity photographs of the site;
- Any incidents of unanticipated failure of management methods and subsequent remedial action; and
- Any notable fauna activity will also be recorded.

In accordance with EA condition E36, rehabilitation can be considered successful when the site can be managed for its designated land-use without any greater management input and there is evidence that the rehabilitation has been successful for at least 3 years.

The Coordinator General Conditions, Appendix 3, Part 3, Condition 4g, state that:

For clearing impacts that result in permanent loss of least concern native plants (cannot be re-established within three (3) years of clearing or floristic modification), the permit holder must provide DERM with a written detailed report of permanent vegetation loss, including the area, species affected and mapping of affected areas, within twelve (12) months of completion of the pipeline construction (Note: this is in addition to the required Return of Operations).

In addition to complying with the above requirement, GLNG shall undertake a review of unsuccessful vegetation areas and provide management measures and revised timeframes to rectify issues and allow pre-clearance conditions to be achieved.

Species of Conservation Interest (SOCI) logbook

Species of conservation interest encountered during the landscape and rehabilitation works will be recorded in the Species of Conservation Interest (SOCI) logbook and mapped in the supporting ecological GIS database. The information collated in the SOCI will include:

- Location of the community or species;
- Person reporting the sighting;
- Habitat type the species was inhabiting or adjoining the area where;
- Total area cleared and time of the clearing works;
- Where necessary, where the species was relocated or translocated to;
- Incidents; and
- Remedial actions.

The records will also be made available to the DSEWPC and DERM upon request.

Annual Environmental Return

This information will support the Annual Environmental Return, which will be submitted to DSEWPac electronically, within 20 business days of each anniversary date from the date of Commonwealth approval. The Annual Environmental Return will document the following information:

- Addresses compliance with these conditions;
- Detail any rehabilitation work undertaken in connection with any unavoidable impact on MNES;
- Detail all non-compliances with these conditions; and
- Detail any amendments needed to plans to achieve compliance with these conditions.

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Any other landscape and rehabilitation related reporting will be conducted in accordance with the relevant approval conditions.

Incidents

Any incident that results in the injury or fatality of an animal will be recorded on Accident, Injury and Incident Reports. Details of the incident including time and date of incident, cause of injury/ mortality and the species (if known) will be recorded and reported to DSEWPaC and DERM within 24 hours of its occurrence.

Revision

All environmental management plans, including the LRMP will be reviewed and updated as required during the life of the Project. When the LRMP is updated, the reviewed plans will be submitted to SEWPaC for approval (EPBC Act Condition 31). Updates to the LRMP may be required due to:

- Changes in EVNT flora and fauna species;
- Changes in TECs;
- Updates to related plans, including the SSMP, SMP, and ESCM;
- Revisions to databases and datasets, including data provided by DERM such as REs, High Value Regrowth (HVR), and Wildlife Online records;
- Amendments to EAs;
- Amendments to legislation;
- At the request of the State or Commonwealth Governments; and
- Following periodic internal review of the LRMP.

Data collected as part of rehabilitation monitoring will be used to satisfy the reporting requirements of the EPBC Act, EA and CG approval requirements. The information collected as part of monitoring will be assessed and summarised to provide an overview of rehabilitation progress within the GTP. Additionally, assessment of collected data will be used to identify any amendments required to the LRMP.

Table 12.1 outlines a review and reporting program for the LRMP document. The program includes provision for periodic review and revision as required. A revision register has been included at the beginning of this document to ensure all amendments are documented. Reporting timeframes will be tracked by GLNG.

Table 13.1 LRMP Review and Reporting Program

Timing	Requirement	Responsibility
Review		
Annual	Revision of LRMP framework, benchmark guidelines and schedules to ensure: <ul style="list-style-type: none"> • additional requirements / amendments to conditions are updated • changes in ‘best practice’ methods are included • feedback from rehabilitation successes and failures are reflected in the LRMP to ensure effective methods are highlighted 	<ul style="list-style-type: none"> • GLNG • Suitably Qualified Restoration Ecologist
As requested by SEWPaC	<ul style="list-style-type: none"> • SEWPaC may request in writing for revisions to made to the LRMP 	<ul style="list-style-type: none"> • As per SEWPaC request
Reporting		
Annual Environmental Return (AER) as per EPBC Act Approval (2008/4096) (Condition 62)	<ul style="list-style-type: none"> • Address compliance with the conditions • Include record of any unavoidable adverse impacts on Matters of National Environmental Significance (MNES), mitigation measures applied to avoid adverse impacts on MNES, and any rehabilitation work undertaken in connection with unavoidable adverse impact on MNES • Identify all non-compliance with the conditions and provide details regarding complaints • Identify any amendments needed to plans to achieve compliance with the conditions 	<ul style="list-style-type: none"> • GLNG

Timing	Requirement	Responsibility
Annual Return for EA Conditions to DERM (Schedule J, Condition 8)	<ul style="list-style-type: none"> Summary of rehabilitation actions, including monitoring and maintenance completed 	<ul style="list-style-type: none"> GLNG Suitably Qualified Restoration Ecologist (or similar), that is either 'independent', or an 'other expert approved by SEWPaC
DERM Permanent Vegetation Loss report (CG Conditions: Appendix 3, Part 3, Condition 4(g))	<ul style="list-style-type: none"> Where pipeline construction will result in the permanent loss of vegetation, a detailed report must be provided to DERM within twelve (12) months of the completion of pipeline construction 	<ul style="list-style-type: none"> GLNG Suitably Qualified Restoration Ecologist (or similar), that is either 'independent', or an 'other expert approved by SEWPaC

14. Correction and Prevention

14.1 Preventative Actions

Preventative actions will be managed as follows.

- Environmental Incidents along with their corrective and preventative actions will be recorded in the Incident Management System. Corrective and preventative actions will be updated into the relevant EMP. Future audits will check for compliance with the EMP (s) and that the necessary preventative actions are in place;
- Reviews of environmental performance will be undertaken through consideration of key performance indicators, objectives and targets, and benchmark performance; and
- Where assessed by the relevant EO (as necessary), a preventative action will be raised and action undertaken as a Corrective Action. Preventative actions may include changes to specific procedures or training requirements, or other management areas.

14.2 Non-conformance

For clarity, environmental non-conformances will be referred to as environmental issues to differentiate them from Project non-conformances, which typically relate to quality defects in items of plant or materials. An environmental issue will be detected through verification processes such as monitoring, inspections, audits and receipt of complaints.

The process for managing environmental issues will be in accordance with GLNG's Internal and Project Policies and Procedures. When an environmental issue is detected, the following actions will occur.

- The incident will be recorded in the Incident Management System (IMS);
- The nature of the event will be investigated by the relevant EO;
- Advice may be sought from a specialist where the extent of the issue is beyond the expertise of the in-house resource;
- Monitoring will be undertaken where the issue is complaint driven and the impact may be outside the project parameters;
- The effectiveness or need for new/additional controls will be reviewed;
- An appropriate preventative and corrective action will be entered into the environmental IMS and implemented;
- Strategies will be identified to prevent reoccurrence;
- The IMS will be closed-out; and
- Environmental documentation (i.e. CEMP) will be reviewed and revised.

Where the issue impacts on a 3rd party (i.e. is outside the project area or in breach of regulatory conditions) the relevant EO will also issue an Incident Report. In addition to the above, where an issue of a more serious nature has been identified, the following will apply.

- Stop work;
- Implement an immediate action to rectify the incident and stop further damage;
- Report the incident;
- Identify corrective and preventative actions;

- If the incident impacts upon state or commonwealth interests, the incident report will also be forwarded to the relevant authority;
- The incident will be reported in monthly management reports; and
- Associated environmental issues and corrective actions will be tracked.

14.3 Contingency measures

The Proponent recognises that contingency measures and adjustments to the management strategies may need to be considered in the event that a detrimental impact is recorded, and/or performance measures or targets are not met. Where this occurs, DSEWPC, DERM and/or DEEDI will be consulted and contingency measures determined and implemented (where required).

14.4 Environmental incidents and Corrective Actions

All incidents in breach of state or commonwealth policy/regulations will be reported to the relevant regulatory authority within 5 business days.

Non-specific environmental incidents are discussed in detail in Section 9.5 of the relevant EMP. The incident reporting form will be located in the EMP.

Detailed below are actions that will be taken should an event relating to directly to flora and fauna occur.

14.4.1 Flora

If vegetation outside the approved GTP ROW is incorrectly cleared the following actions must occur:

- The EO must be notified immediately and a stop work must occur until the situation has been assessed and is given approval to proceed by the proponent;
- The Spotter catcher(s) will conduct a search for any injured or orphaned wildlife; and
- If native vegetation was impacted a report will be provided to DERM and management measures agreed.

14.4.2 Fauna

If a native animal is injured on site and where it is safe for staff and the animal, the animal will be bundled in a dry warm blanket or jacket and taken to a vet or approved wildlife carer (do not attempt to handle marine animals or platypus). If it is unsafe or not possible to bundle the animal then:

- The location of the injured animal will be identified/ marked so it can be found again. If the animal is moving, a note will be made of the direction in which it was headed;
- The species of animal will be identified if possible and its approximate size determined;
- The type of injury sustained will be identified if possible (without handling or causing the animal further stress); and
- The relevant EO will be contacted immediately to capture or organise the possible capture of the animal for transportation to a specialist veterinarian or wildlife carer.

The relevant EO shall immediately contact the following organisations listed in Table 7.1 and provide details of the last known location of the injured/dead animal.

Table 14.1 Contact Details in the Event of an Injury to or Death of Native Wildlife (incl. marine)

Organisation	Contact Details
The Proponent PEM	07 3838 3666
QPWS Gladstone Office or DERM	(07) 4971 6500 or 1300 130 372 (Option 3)

Following the capture/recovery of the animal, an investigation into the cause of the event will be undertaken within 72 hours including an assessment of the effectiveness of corrective and preventative actions currently in place.

Any corrective and preventative actions identified will be implemented. The risk register, relevant procedures and documentation (including this plan) will be reviewed and revised as is necessary.

In the event that a control measure appears to be ineffective, the measure will be adjusted in consultation with the DEWHA and/or DERM. This Plan will be updated if necessary to reflect any significant changes to control measures.

Prior to construction a list of suitably licensed and experienced wildlife carers, hospital and/or vets local to the project area will be developed and included within the SMP.

14.5 Emergency preparedness and response

An Incident Response Plan will be prepared for the project and will be outlined in the CEMP. This plan will document suitable incident procedures to ensure effective response in the event of an emergency (including environmental emergencies such as fire, flood and large fuel spills).

The emergency procedures shall be tested on a six-monthly basis. Records of all site emergencies will be maintained (incl. results of emergency practice drills). The Emergency Response Controller for the project will be defined within the Incident Response Plan. This will also include the use contingency measures to check open trenches during and after rainfall events.

An up-to-date list of emergency response personnel and organisations will be maintained at each site office and compound.

15. Compliance and Evaluation

The compliance component of this Plan will be developed in accordance with the CEMP and State and Commonwealth Approvals.

15.1 Monitoring (Landscape and Rehabilitation)

Upon completion of the Management (monitoring) Strategy by the Principal Contractor, compliance and evaluation measures will be developed and incorporated into this Plan.

15.1.1 Inspection and surveillance

The monitoring of the landscaping and rehabilitation works will be ongoing from the first planting. Visual inspections will be undertaken regularly during construction and operational phases of the Project.

Following construction monitoring will be undertaken on a quarterly basis over the first 2 years of the Project and the monitoring will focus on key performance criteria developed for project and where necessary specific areas, including but not limited to:

- The physical stability of the rehabilitated areas;
- The biological structure of the vegetation community in rehabilitated areas (including the establishment of weed species);
- Water drainage from the site;
- Any public safety aspects;
- Non-conformances; and
- Monitoring of the rehabilitated areas shall ensure that any areas requiring remedial work are identified.

The rehabilitation programme shall be modified, as required, to address any conditions of approval and/or depending upon the findings of the monitoring programme results, including remedial works to action any non-conformances.

15.2 Ecological performance auditing

All monitoring required under this Plan will be compliant with relevant section of the CEMP and will be conducted by suitably qualified person, as per the Coordinator-General's Report.

The Proponent will conduct internal compliance audits of the implementation of Project environmental management commitments during the construction and operational phases, including.

- On-site audits of compliance with this management plan;
- Audits of contractors environmental management; and
- Work area inspections and monitoring.

Non-conformances identified during inspections will be documented, addressed with appropriate corrective and preventive actions and rectified within an agreed time frame.

The regulatory agencies associated with environmental matters may also conduct regular works inspections. The relevant EO shall attend these inspections.

15.2.1 External audits

External audits will be undertaken on an annual basis by an independent auditor approved by the minister. The audits will be conducted in accordance with AZ/NZ ISO9011.2003 *Guidelines for Quality and/or Environmental Systems Auditing* and/or section 458 of the EPBC Act and may be used to verify compliance with the Commonwealth conditions.

The external auditors report must document the following:

- The components of the project being audited;
- The conditions that were activated during the period covered by the audit;
- A compliance/non-compliance table;
- A description of the evidence to support audit findings of compliance or noncompliance;
- Recommendations on any non-compliance or other matter to improve compliance;
- A response by the proponent to the recommendations in the report (or, if the proponent does not respond within 20 business days of a request to do so by the auditor, a statement by the auditor to that effect); and
- Certification by the independent auditor of the findings of the audit report.

Audits or summaries of audits carried out under these conditions, or under section 458 of the EPBC Act, may be posted on the Department's website. The results of such audits may also be publicised through the general media.

If during the auditing process, any non-compliance with the Commonwealth conditions are identified, DSEWPC will be provided with written advice within 20 business days of the audit report. The written advice will outline:

- Actions taken by the proponent to ensure compliance with these conditions; and
- Actions taken to prevent a recurrence of any non-compliance, or implement any other recommendation to improve compliance, identified in the audit report.

15.3 Non-compliance

Where non-compliance occurs with regard to the Commonwealth or any State conditions of approval, a report must be submitted to DSEWPC within 5 business days. The report will outline the type of non-compliance and the remedial actions taken to ensure that the matter is resolved within a reasonable time frame. The time frame will be specified in writing by DSEWPC.

Where non-compliance occurs with regard to the other relevant conditions of approval (e.g. NC Act), a report must be submitted to the relevant governing agency within the designated timeframe. The report will outline the type of non-compliance and the remedial actions taken to ensure that the matter is resolved within a reasonable time frame. The time frame will be specified in writing by the relevant agency.

15.4 Variations to the LRMP

Once the LRMP has been approved by the relevant state and commonwealth agencies, a revised plan will need to be submitted for approval, if the works are to be undertaken other than in accordance with the approved plans and governing conditions. This will include any changes to the LRMP requested by the Commonwealth and/or the State.

For any revision to the approved LRMP, ensure the relevant assessment agencies are provided at least 20 business days for review and consideration of the revised plan, unless otherwise agreed in writing between the proponent and the agencies.

- Until the revised LRMP is re-approved, works must continue in accordance with the original LRMP. Once the revised LRMP is approved, this plan will supersede the original LRMP.

16. References

Animal Care and Protection Act 2001 (Queensland) Reprint No. 3A [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_A.htm

Attwill, P. and Wilson, B. (2003) *Ecology: an Australian Perspective*. Oxford University Press; Melbourne
Australian Pipeline Industry Association's (APIA) (2005) *Code of Environmental Practice (Operations)*

Australian Pipeline Industry Association (APIA) 2005. *Code of Environmental Practice – Onshore Pipelines*. Kingston, ACT.

Australian Standard/New Zealand Standard (AS/NZS) 2885 *Pipelines – Gas and liquid petroleum*

Australian Standard/New Zealand Standard (AS/NZS) 4801:2000 *Occupational Health and Safety Management Systems – Specification with guidance for use*

Australian Standard (AS)2885.1-1997 *Gas and Liquid Petroleum - Design and Construction*.

Australian Standard/New Zealand Standard and International Standard Organisation AS/NZS ISO 14001:1996 *Environmental Management Systems*.

Bennett, J., Sanders, N., Moulton, D., Phillips, N., Lukacs, G., Walker, K. & Redfern, F. (2002). *Guidelines for protection of Australian waterways*. Land and Water Australia, Canberra.

Coastal Protection and Management Act 1995 (Queensland) Reprint No. 4E [Online] Accessed. May 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_C.htm

Confinas, M. and Creighton, C. (2001), National Land and Water Resource Audit, Australian Native Vegetation Assessment 2001, Appendix 7: NVIS classification information.

Department of Environment and Climate Change (2008) *Saltwater wetlands rehabilitation manual* Department of Environment and Climate Change Sydney.

Department of Main Roads (2004) *Road Landscape Manual*. Department of Main Roads, Brisbane.

Ecofund Queensland (2010) *Offset Package Report for the Gladstone Liquefied Natural Gas Project*, Ecofund Queensland, Brisbane, Qld.

Ecologica Consulting (2010) *Significant Species Management Plan for the GLNG Gas Transportation Pipeline Corridor*, Brisbane.

Ecologica Consulting (2010) *Species Management Plan for the GLNG Gas Transportation Pipeline Corridor*, Brisbane.

Environment Protection Act 1994 (Queensland) Reprint No. 9E [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_E.htm

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) [Online] Accessed. June 2010, Available at: <http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/7EC1BA887FF2D99FCA2576790019FA1E?OpenDocument>

Environment Protection and Biodiversity Conservation Regulation 2000 (Commonwealth) [Online] Accessed June 2010, Available at: <http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/7EC1BA887FF2D99FCA2576790019FA1E?OpenDocument>

Environmental Protection Agency (2006) *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016*. Queensland Government, Brisbane.

Fisheries Act 1994 (Queensland) Reprint No. 6E [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_F.htm

Great Barrier Reef Marine Park Act 1975 (Commonwealth) C2010C00166 [Online] Accessed. June 2010, Available at: <http://www.frli.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/124C6B80DCDDABEECA2576E2007B0A1F?OpenDocument>

Great Barrier Reef Marine Park Amendment Act 2007 (Commonwealth) C2010C00166 [Online] Accessed. June 2010, Available at: <http://www.comlaw.gov.au/ComLaw/Legislation/Act1.nsf/asmade/bytitle/052A05562F944DC1CA25730D001F3439?OpenDocument>

Institution of Engineers Australia (1996) *Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites*, Institution of Engineers Australia Queensland Division, Brisbane.

Land Protection (Pest and Stock Route Management) Act 2002 Reprint No. 3F [Online] Accessed. October 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_L.htm

Land Protection (Pest and Stock Route Management) Regulation 2003 Reprint No. 4H [Online] Accessed. October 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_L.htm

Lovett, S. & Price, P. (eds) (2007) *Principles for riparian lands management*. Land & Water Australia, Canberra.

Lovett, S. & Price, P. (eds). 2002. *Riparian Land Management Technical Guidelines Volume 1: Principles of Sound Management and Volume 2: On-ground Management Tools and Techniques*. Land & Water Australia, Canberra. <http://www.rivers.gov.au/publicat/guidelines.htm>

Marine Parks Act 2004 (Queensland) Reprint No. 1C [Online] Accessed. May 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_M.htm

Nelder, V.J., B.A. Wilson, E.J. Thompson and H.A. Dillewaard (2005) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 3.1 Updated September 2005. Queensland Herbarium, Environmental Protection Agency, Brisbane. 128 pp.

Model Code of Practice, Florabank Guideline 6: Native Seed Collection Methods, [Online] Accessed. March 2012. Available at <http://www.florabank.org.au/> 5 Feb 2012'

Nature Conservation Act 1992 (Queensland) Reprint No. 6D [Online] Accessed. June 2010, Available. http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Dugong) Conservation Plan 1999 (Queensland) Reprint No. 1A [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Forest Reserves) Regulation 2000 (Queensland) Reprint No. 5B [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Koala) Conservation Plan 2006 (Queensland) Reprint No. 2 [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Macropods) Conservation Plan 2005 (Queensland) Reprint No. 1B [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Protected Areas) Regulation 1994 (Queensland) Reprint No. 14P [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Protected Plants) Conservation Plan 2000 (Queensland) Reprint No. 3A [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Wildlife) Regulation 2006 (Queensland) Reprint No. 1C [Online] Accessed. June 2010, Available. http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Nature Conservation (Whales and Dolphins) Conservation Plan 1997 (Queensland) Reprint No. 1B [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_N.htm

Petroleum and Gas (Production and Safety) Act 2004 (Queensland) Reprint No. 4I [Online] Accessed. May 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_P.htm

Queensland Co-ordinator General (2010) *Co-ordinator Generals Report for an Environmental Impact Statement – GLNG Project*, Queensland Government, Qld.

Queensland Herbarium (2009) *Regional Ecosystem Description Database (REDD)*, Version 6.0b updated November 2009, Department of Environment and Resource Management, Queensland, Australia

Rutherford, I. D., Jerie, K. and Marsh, N. (2000) *A Rehabilitation Manual for Australian Streams. Volumes 1 and 2*. Land and Water Resources Research and Development Corporation, Canberra and Cooperative Research Centre for Catchment Hydrology, Melbourne.
<http://www.rivers.com.au>

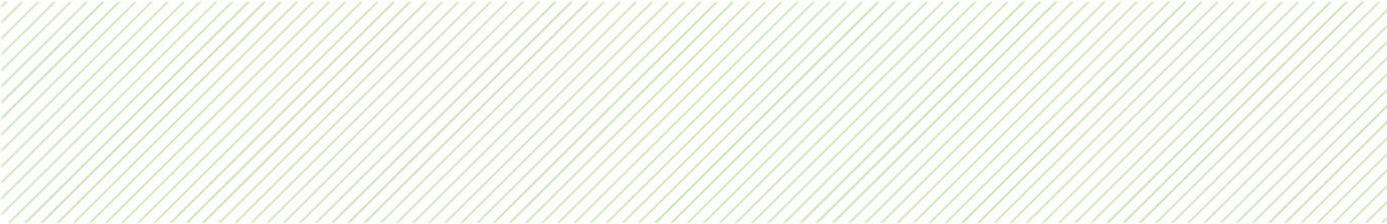
URS (2009) *Environmental Impact Statement for the Gladstone Liquefied Natural Gas Project*, Accessed [online] May 2010, Available at. <http://www.glng.com.au/Content.aspx?p=90>

URS (2010) *Supplementary Environmental Impact Statement for the Gladstone Liquefied Natural Gas Project*, Accessed [online] May 2010, Available at. <http://www.glng.com.au/Content.aspx?p=96>

Vegetation Management Act 1999 (Queensland) Reprint No. 3D [Online] Accessed. May 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_V.htm

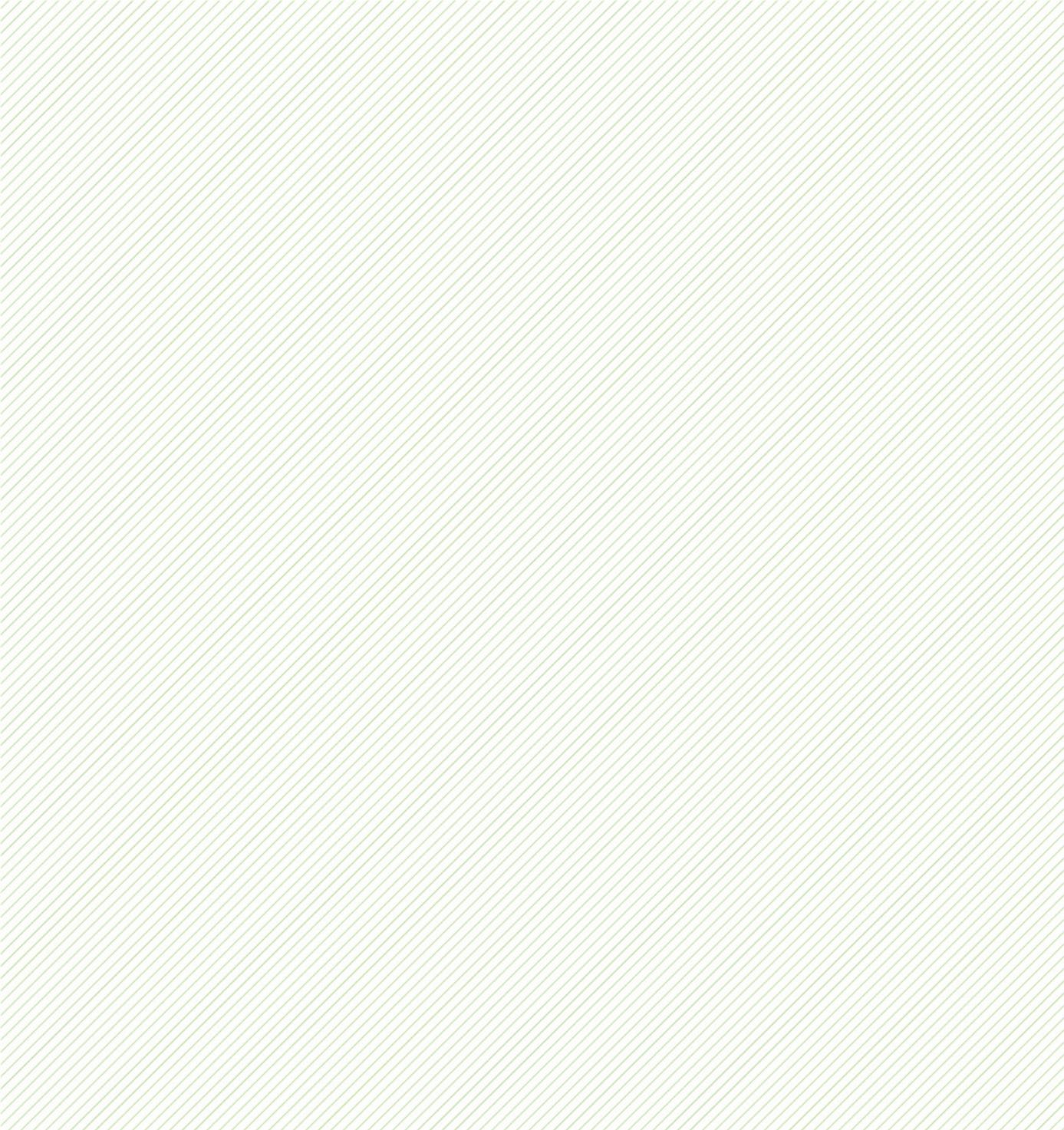
Water Act 2000 (Queensland) Reprint No. 7D [Online] Accessed. June 2010, Available at: http://www.legislation.qld.gov.au/acts_sls/Acts_SL_W.htm

WetlandCare Australia (2008) *Wetland Rehabilitation Guidelines for the Great Barrier Reef catchment* Compiled for Department of the Environment, Water, Heritage and the Arts.



Appendix H

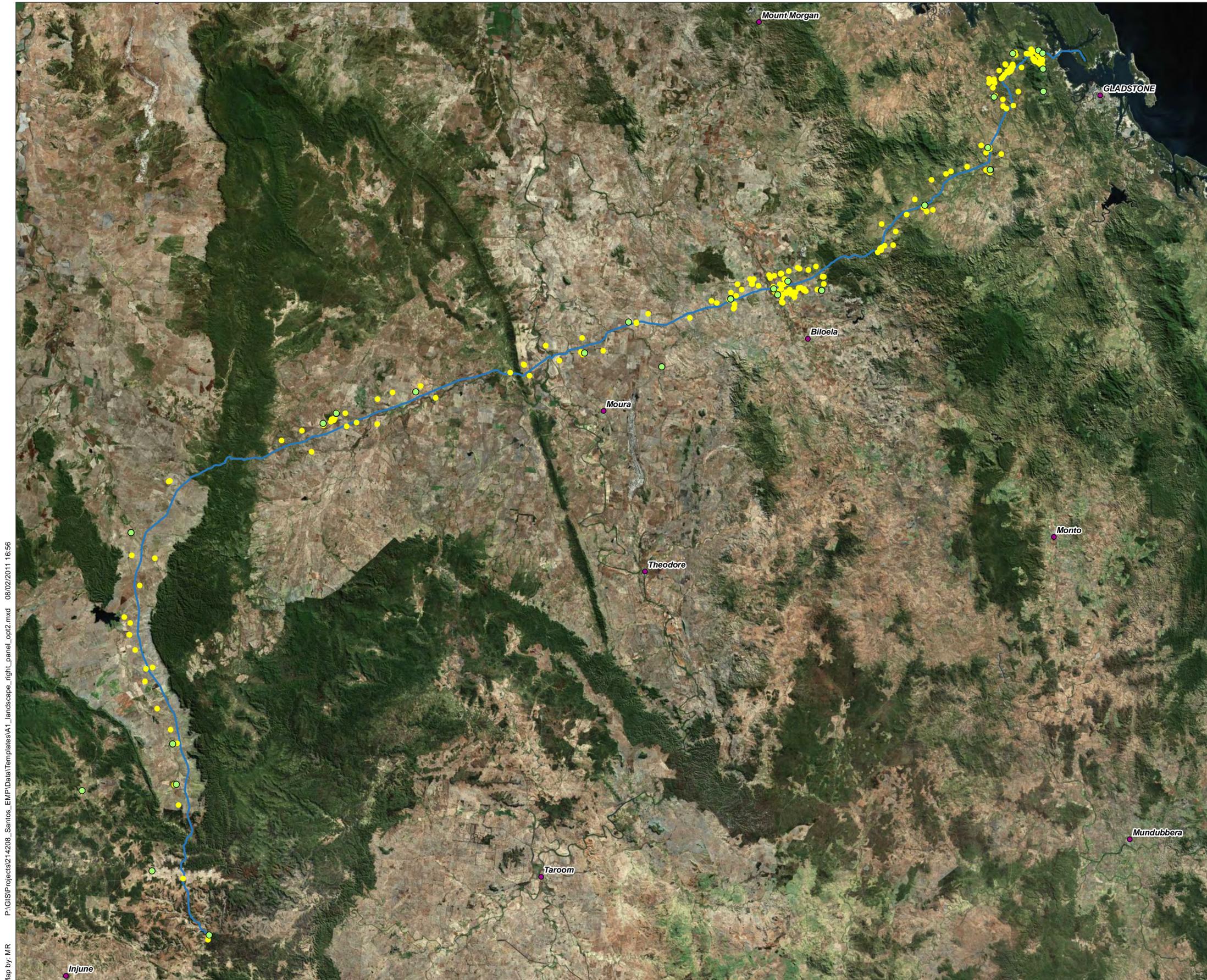
Noise Contours and Tables





GTP EM Plan

- Noise Monitoring Locations
- Towns
- Sensitive Receivers
- Pipeline



Source:
Pipeline - SLR, 2011 derived from Santos 2010
Sensitive Receivers - SLR, 2011
Aerial Image - ArcGIS Basemaps, 2011.

Identified Receptors Aerial Photograph

Appendix H1

P:\GIS\Projects\214208_Santos_EMP\Data\Templates\A1_landscape_right_panel_opt2.mxd 08/02/2011 16:56
Map by: MR



A1 scale: 1:500,000
0 10 20 30 40 Kilometers

GLNG No:
Coordinate system: MGA Zone 55

Date: 14/03/2011

Version: 1



Mainland GTP EM Plan - Noise APPENDIX H2



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
1	8	AB200	694129.8764	7149764.748	832	Injune Road	Baroondah	4454	Residential	≤25
2	8	AB200	693974.0304	7149385.169	1051	Injune Road	Baroondah	4454	Residential	≤25
3	8	AB200	693816.8422	7148658.765	1701	Injune Road	Baroondah	4454	Residential	≤25
4	4	WT217	688087.2617	7164695.325	224	Fairview Road	Beilba	4454	Commercial+ Residential	≤25
5	8	TR23	687787.306	7183527.282	2689	Arcadia Valley Road	Baroondah	4454	Residential	≤25
6	7	TR22	686901.3526	7188858.666	2885	Arcadia Valley Road	Baroondah	4454	Residential	≤25
7	5	TR18	688169.1636	7199434.04	760	Arcadia Valley Road	Baroondah	4420	Residential	≤25
8	9	TR17	686594.2563	7202961.879	1758	Arcadia Valley Road	Baroondah	4454	Residential	≤25
9	8	TR15	683393.5927	7208528.935	3202	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
10	5	TR10	680577.1163	7215713.364	2421	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
11	6	TR11	682729.3025	7219128.913	1156	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
12	4	TR7	680950.993	7218889.039	608	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
13	3	TR31	678450.1327	7223813.516	1548	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
14	2	TR30	677199.0333	7227807.188	2081	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
15	2	TR30	677049.1096	7227860.994	2225	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
16	4	TR32	677486.9771	7230849.2	2076	Arcadia Valley Road	Arcardia Valley	4454	Residential	≤25
17	5	TR33	676008.0327	7232417.614	3717	Arcadia Valley Road	Arcardia Valley	4702	Residential	≤25
18	13	CUE94	680326.6597	7240362.67	1363	Arcadia Valley Road	Arcardia Valley	4702	Residential	≤25
19	1	CUE95	684498.0069	7247170.886	3482	Arcadia Valley Road	Arcardia Valley	4702	Residential	≤25
20	2	CUE92	678673.5121	7248169.078	2416	Arcadia Valley Road	Arcardia Valley	4702	Residential	≤25
21	42	SP113263	688972.9297	7266681.406	3147	-	Arcardia Valley	4702	Residential	≤25
22	43	SP113263	689306.0107	7266824.187	3027	-	Arcardia Valley	4702	Residential	≤25
23	1	BH240	718488.4093	7275975.62	1697	Dawson Hwy	Bauhinia	4702	Residential	≤25
24	2	BH259	726064.6785	7272788.342	3226	Fairfield Rd	Bauhinia	4718	Residential	≤25
25	7	BH283	723815.617	7278308.795	2695	Dawson Hwy	Bauhinia	4702	Residential	≤25
26	1	RP912777	729356.9721	7279417.014	2280	Bauhinia Camp	Bauhinia	0	Residential	≤25
27	21	B9591	904026.5505	7343525.813	2595	25916 Dawson Hwy	Bauhinia	4718	Commercial	≤25
28	21	SP186084	731559.7709	7280794.985	2783	Dawson Hwy	Bauhinia	47180	Residential	≤25
29	16	BH269	731388.4798	7280256.089	2351	Dawson Hwy	Bauhinia	4718	Residential	≤25
30	20	BH190	732101.3071	7280627.197	2423	Fitzroy Development Road	Bauhinia	4718	Residential/School	≤25
31	40	CP888745	732137.6751	7281019.627	2774	-	Bauhinia	4718	Residential/School	≤25
32	209	B9592	731996.5079	7280790.502	2616	25896 Dawson Hwy	Bauhinia	4718	Residential	≤25
33	507	B9593	732383.9131	7281099.414	2757	Fitzroy Development Road/ Dawson Highway	Bauhinia	4718	Residential/School	≤25
34	13	BH293	733062.6831	7282500.517	3808	Fitzroy Development Road	Bauhinia	4702	Residential	≤25
35	15	BH243	735351.9257	7278873.668	419	Dawson Hwy	Bauhinia	4718	Residential	≤25
36	36	BH278	735184.8318	7282262.148	2823	Fitzroy Development Road	Bauhinia	4718	Residential	≤25
37	27	RP911528	737894.4765	7279772.386	543	Dawson Hwy	Bauhinia	4718	Residential	≤25
38	14	BH207	743223.356	7279136.232	2818	Simmonds Road	Bauhinia	4718	Residential	≤25
39	7	BH139	743579.0578	7285530.779	3169	Oombabeer Road	Oombabeer	4718	Residential	≤25



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
40	5	BH138	747592.502	7287086.335	3660	Oombabeer Road	Oombabeer	4718	Residential	≤25
41	13	RP620842	754837.741	7288481.009	2425	Oombabeer Road	Oombabeer	4702	Residential	≤25
42	10	BH223	758562.7616	7285199.474	1931	Oombabeer Connection Road	Oombabeer	4702	Residential	≤25
43	4	KM74	778064.7435	7290786.923	243	Avoca Road	Mimosa	4718	Residential	≤25
44	8	KM87	783031.2997	7289849.125	1039	1821 Denby Road	Alberta	4702	Residential	≤25
45	7	KM142	781581.872	7292784.009	2209	1602 Denby Road	Alberta	4702	Commercial	≤25
46	7	KM142	781814.9524	7292682.801	1996	1602 Denby Road	Alberta	4702	Residential	≤25
47	1	RP616753	787476.7415	7297326.598	2849	2021 Moura-bindaree Rd	Baralaba	4718	Residential	≤25
48	16	FN506	790868.7527	7293395.973	1684	Banana Mungi Road	Alberta	4718	Residential	≤25
49	31	FN193	796495.0583	7295374.476	1144	2380 Banana-Mungi Rd	Moura	4718	Residential	≤25
50	1	RP620104	796929.3109	7294681.927	1812	2371 Banana-Mungi Rd	Moura	4718	Residential	≤25
51	10	FN207	796939.523	7299000.393	2221	1836 Moura-Baralaba Rd	Moura	4718	Residential	≤25
52	2	FN197	802260.7301	7295424.098	2359	1828 Banana-Mungi Rd	Moura	4718	Residential	≤25
53	25	FN302	811130.292	7302388.702	103	1344 Baralaba-Banana Rd	Banana	0	Residential	≤25
54	25	FN302	811077.8112	7302099.24	170	1344 Baralaba-Banana Rd	Banana	0	Residential	≤25
55	23	SP189741	814227.2034	7304437.501	2260	935 Fairview Rd	Banana	4702	Residential	≤25
56	2	SP122586	824962.023	7302901.725	1243	9011 Leichardt Hwy	Banana	4702	Residential	≤25
57	96	PM236	830685.0007	7307060.412	1564	595 Johnson Parry's Rd	Orange Creek	4715	Residential	≤25
58	97	PM236	832023.6592	7306429.238	901	490 Johnson Parry's Rd	Orange Creek	4715	Residential	≤25
59	91	PM224	835299.4232	7307170.659	398	941 Belleen-Greycliffe Rd	Orange Creek	4715	Residential	≤25
60	1	PM222	836271.854	7304793.267	2169	1431 Crowsdale-Camboon Rd	Prospect	4715	Commercial	≤25
61	1	PM222	836433.8149	7304999.708	2027	1431 Crowsdale-Camboon Rd	Prospect	4715	Commercial	≤25
62	81	PM222	836606.8389	7305924.008	1200	850 Davis Rd	Orange Creek	4715	Residential	≤25
63	89	PM210	835780.8298	7308910.178	1898	Camboon Rd	Prospect	4715	Residential	≤25
64	82	PM222	837073.4899	7308128.623	771	1106 Belleen-Greycliffe Rd	Orange Creek	4715	Residential	≤25
65	104	SP118423	837578.8333	7311026.52	3418	260 Argoon Rd	Argoon	4702	Residential	≤25
66	84	PM207	838612.0842	7309637.648	1761	1749 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
67	2	CP897088	840818.5152	7312236.221	3376	43 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential/School	≤25
68	73	PM207	841348.1037	7310893.321	1962	1749 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
69	73	PM207	841250.9614	7311000.682	2081	1749 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
70	105	RP859961	841437.394	7311468.092	2525	1760 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
71	105	RP859961	841405.5046	7311538.148	2597	1760 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
72	38	RP859961	841899.6352	7312259.862	3169	1816 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
73	43	RP848864	843019.2393	7310426.035	1052	1600 Prospect Creek-Goovigen Rd	Orange Creek	4715	Residential	≤25
74	3	RP609127	845793.1057	7313074.426	3509	Burnett Hwy	Orange Creek	4715	Residential	30
75	142	RN343	846146.1145	7312306.151	2724	42557 Burnett Hwy	Orange Creek	4715	Residential	30
76	24	RN347	846761.065	7309966.232	373	246 Jambin-Dakemba Rd	Dakenba	4715	Residential	30
77	22	RN348	847096.806	7308715.747	897	42091 Burnett Hwy	Orange Creek	4715	Residential	≤25
78	20	RN348	847559.1409	7308037.986	1629	41925 Burnett Hwy	Orange Creek	4715	Residential	29
79	32	RN1155	847538.9709	7308783.06	888	42088 Burnett Hwy	Argoon	4702	Residential	29
80	2	RP612447	847180.4116	7312842.556	3185	105 Argoon Rd	Argoon	4702	Residential	≤25



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
81	148	RN1242	848852.8953	7306096.438	3724	41781 Burnett Hwy	Orange Creek	4715	Residential	29
82	148	RN1242	848843.5341	7305930.371	3887	41781 Burnett Hwy	Orange Creek	4715	Residential	29
83	31	RN349	848536.0106	7310563.262	685	220 Blacks La	Argoon	4702	Residential	29
84	35	RN1155	848797.1077	7309375.444	468	42088 Burnett Hwy	Argoon	4702	Residential	≤25
85	2	RP811956	849036.5365	7305816.555	4008	41755 Burnett Hwy	Orange Creek	4715	Residential	29
86	34	RN350	849017.35	7307868.384	1956	61 Callide Rd	Callide	4715	Residential	29
87	38	RN357	848831.7419	7307305.873	2523	60 Callide Rd	Callide	4715	Residential	≤25
88	51	RN349	849027.0242	7310263.756	435	1355 Jambin-Dakemba Rd	Argoon	4702	Residential	29
89	50	RP620969	849470.0408	7310445.945	529	1337 Jambin-Dakemba Rd	Argoon	4702	Residential	29
90	37	RN357	850120.3382	7308232.021	1768	200 Callide Rd	Callide	4715	Residential	≤25
91	1	RP618026	850040.0124	7308452.21	1537	Callide Rd	Argoon	4702	Residential	≤25
92	54	RN349	848776.9712	7313157.385	3261	260 Argoon Rd	Argoon	4702	Residential	29
93	50	RP620969	850276.0918	7310834.061	509	1337 Jambin-Dakemba Rd	Argoon	4702	Residential	29
94	52	RN349	849730.0389	7311844.569	1655	1457 Jambin-Dakemba Rd	Argoon	4702	Residential	29
95	55	RN1330	849004.3997	7313229.947	3219	1311 Argoon-Kilburnie Rd	Argoon	4702	Residential	29
96	2	RN1410	848910.9203	7313364.413	3381	1300 Argoon-Kilburnie Rd	Argoon	4702	Residential	29
97	55	RN1330	848890.3691	7313254.894	3294	1311 Argoon-Kilburnie Rd	Argoon	4702	Residential	≤25
98	48	RN350	850986.1998	7309123.981	1276	1155 Jambin Dakenba Road	Argoon	4715	Residential	≤25
99	59	RN1330	850718.3008	7311260.074	856	Jambin-Dakenba Rd	Dakenba	4715	Residential	29
100	81	RN1416	851301.6895	7307906.86	2536	310 Callide Rd	Callide	4715	Residential	≤25
101	102	C7512	851475.9836	7307996.744	2461	1015 Jambin-Dakenba Rd	Callide	4715	Residential	≤25
102	103	C7516	851455.5001	7307951.508	2505	1027 Jambin-Dakenba Rd	Callide	4715	Residential	29
103	143	RN1308	851414.5899	7308040.594	2413	1029 Jambin-Dakenba Rd	Callide	4715	Residential	29
104	1	RP617903	850889.3861	7313855.692	3417	12845 Eidsvold-Theodore Rd	Camboon	4719	Residential	≤25
105	69	RN375	852062.6046	7307153.574	3352	98 Callide-Kilburnie Rd	Callide	4715	Residential	≤25
106	154	RN1436	851933.4507	7308412.639	2087	41 Callide-Kilburnie Rd	Argoon	4702	Residential	≤25
107	69	RN375	852164.0196	7307122.943	3392	98 Callide-Kilburnie Rd	Callide	4715	Residential	≤25
108	66	RN375	852465.1204	7308322.797	2223	98 Callide-Kilburnie Rd	Callide	4715	Residential	≤25
109	1	RP616435	853277.2251	7309320.418	1409	220 Callide-Kilburnie Rd	Callide	4715	Residential	≤25
110	2	RP616435	853854.2859	7309393.812	1471	272 Callide-Kilburnie Rd	Callide	4715	Residential	≤25
111	4	RP619697	854450.9439	7308980.642	2020	723 Dudarkos Rd	Callide	4715	Residential	≤25
112	5	RP619697	854694.648	7308721.246	2337	681 Dudarkos Rd	Callide	4715	Residential	≤25
113	75	RN425	854740.5794	7309002.53	2080	708 Dudarkos Rd	Callide	4715	Residential	≤25
114	2	RP618127	853225.5731	7314642.648	3760	811 Argoon Kilburnie Rd	Argoon	4702	Residential	29
115	74	RN425	855119.7054	7308550.568	2619	654 Dudarkos Rd	Callide	4715	Residential	≤25
116	1	RP618127	853783.2749	7314351.327	3326	739 Argoon Kilburnie Rd	Argoon	4702	Residential	29
117	86	RN427	858098.2407	7308845.982	3260	146 Grevells Road	Dakenba	4715	Residential	≤25
118	77	SP163782	856057.4259	7313902.785	2149	531 Argoon-Kilburnie St	Callide	4715	Residential	29
119	77	SP163782	855989.4709	7313992.222	2261	531 Argoon-Kilburnie St	Callide	4715	Residential	29
120	88	RN1475	859816.7661	7310155.696	3093	10576 Dawson Hwy	Callide	4715	Residential	30
121	1	RP618390	859560.8397	7312079.497	1360	10364 Dawson Hwy	Callide	4715	Residential	≤25



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
122	94	RN1524	858028.2955	7314785.085	1745	Argoon-kilburnie Road	Argoon	4702	Residential	≤25
123	2	RP616094	859891.7919	7312012.825	1593	10363 Dawson Hwy	Callide	4715	Residential	30
124	9	RP843126	874101.9793	7317703.613	413	8630 Dawson Hwy	Dumgree	0	Residential	30
125	7	RP843126	874749.3734	7318619.926	470	8474 Dawson Hwy	Dumgree	4715	Residential	30
126	10	RP843127	875052.7386	7318219.795	811	8491 Dawson Hwy	Dumgree	4715	Residential	30
127	6	RP843128	875127.0179	7318903	320	8468 Dawson Hwy	Dumgree	4715	Residential	30
128	4	RN903	875970.7544	7319330.862	760	62 Blacks Rd	Dumgree	0	Residential	≤25
129	20	RN94	878147.4522	7319403.732	2805	270 Blacks Rd	Dumgree	0	Residential	≤25
130	1	RP604494	875406.2082	7324908.507	1941	3204 Inverness Rd	Dumgree	0	Residential	≤25
131	24	RN1599	878937.9036	7322825.946	1881	7853 Dawson Hwy	Dumgree	4715	Residential	29
132	3	SP217657	881957.7778	7327088.183	930	7547 Dawson Hwy	Mount Alma	4680	Residential	29
133	1	RP615957	884211.6933	7330909.471	2264	Unnamed Rd	Mount Alma	4680	Residential	≤25
134	16	CTN1870	886390.8288	7328677.334	650	Calliope_1 Camp	Calliope	0	Residential	29
135	16	CTN1870	887152.6063	7327696.857	1865	7005 Dawson Hwy	Mount Alma	4680	Residential	29
136	2	CTN1121	888747.7473	7327979.736	2110	6695 Dawson Hwy	Mount Alma	4680	Residential	29
137	2	CTN1749	888757.887	7335778.879	3294	210 Fig Tree Rd	Mount Alma	4680	Residential	≤25
138	2	RP606302	892571.3856	7337111.732	1457	27 Harper Creek Rd	Mount Alma	4680	Residential	≤25
139	2	RP865974	893882.788	7337721.868	1410	27 Harper Creek Rd	Mount Alma	4680	Residential	≤25
140	6	CTN812615	898062.9001	7338743.609	1121	1266 Mt Alma Rd	Mount Alma	4680	Residential	≤25
141	22	CL40301	902947.1584	7337711.843	1571	1735 Mt Alma Rd	Mount Alma	4680	Residential	≤25
142	41	CL405	903668.5128	7337276.31	2240	44 Galloway Plains Rd	Mount Alma	4680	Residential	≤25
143	99	CL4036	903947.8384	7337040.297	2562	44 Galloway Plains Rd	Mount Alma	4680	Residential	≤25
144	41	CL405	903872.7019	7337087.534	2491	44 Galloway Plains Rd	Mount Alma	4680	Residential	≤25
145	2	RP613233	906995.0786	7341609.895	2880	1291 Mt Alma Rd	Mount Alma	4680	Residential	≤25
146	3	RP860093	903098.6828	7342188.756	1057	1126 Mount Alma Rd	Bracewell	4695	Residential	≤25
147	49	CTN512	904089.3222	7343058.66	159	1073 Mount Alma Rd	East End	4695	Residential	≤25
148	2	RP860093	903670.8731	7343401.307	559	1066 Mount Alma Rd	Bracewell	4695	Residential	≤25
149	53	CTN514	901903.5364	7344059.201	2336	289 Kaluda Rd	Bracewell	4695	Residential	≤25
150	3	RP801363	908843.8696	7353309.131	448	56000 Bruce Hwy	East End	4680	Residential	30
151	14	SP101565	908011.9131	7353936.463	1452	52961 Bruce Hwy	East End	4695	Residential	≤25
152	10	SP228453	910650.9512	7354002.733	441	52254 Bruce Hwy	Yarwun	4694	Residential	≤25
153	12	SP 101565	908064.4196	7355676.29	2031	53081 Bruce Hwy	East End	4695	Residential	30
154	200	SP116496	912082.8458	7357493.872	2103	1261 Gladstone Mount Larcom Rd	Aldoga	4694	Residential	≤25
155	3	SP186808	906101.4585	7356701.791	3664	199 Wilmott Rd	East End	4695	Residential	≤25
156	11	SP182690	905599.5962	7358822.708	2819	53475 Bruce Hwy	East End	4695	Residential	30
157	8	RP620660	906078.2719	7360025.057	2147	1929 Gladstone-mount Larcom Rd	Mount Larcom	4695	Residential	≤25
158	1	RP886953	904676.0666	7360101.513	3534	118 Mount Larcom-bracewell Rd	Mount Larcom	4695	Residential	≤25
159	11	CP843216	905983.8688	7360943.722	2213	24 The Narrows Rd	Mount Larcom	4695	Residential	30
160	1	MPH40333	905819.4992	7360615.772	2355	1 Raglan St	Mount Larcom	4695	Commercial	30
161	1	MPH31157	905815.8774	7360747.503	2361	2 Gladstone St	Mount Larcom	4695	Residential	30
162	12	SP178165	905805.8599	7360697.464	2369	3 Gladstone St	Mount Larcom	4695	Residential	30



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
163	2	MPH40333	905789.9416	7360563.253	2385	7 Balfour St	Mount Larcom	4695	Residential	30
164	1	SP206865	905647.9468	7360456.576	2532	15 Balfour St	Mount Larcom	4695	Residential	30
165	1	RP612257	904710.2125	7361110.753	3497	53785 Bruce Hwy	Mount Larcom	4695	Residential	30
166	22	RP905534	907827.4022	7361055.324	497	237 The Narrows Rd	Aldoga	4695	Residential	≤25
167	11	RP905534	908158.5079	7361194.623	367	265 The Narrows Rd	Mount Larcom	4695	Residential	≤25
168	101	SP126769	907393.0163	7363093.625	2267	234 Gostevsky Rd	Mount Larcom	4695	Residential	≤25
169	40	SP227064	908765.7997	7362013.42	554	415 The Narrows Rd	Mount Larcom	4695	Residential	≤25
170	8	SP174121	908343.511	7361565.163	512	327 The Narrows Rd	Mount Larcom	4695	Residential	≤25
171	2	RP614649	909802.9722	7362476.716	422	520 The Narrows Rd	Mount Larcom	4695	Residential	≤25
172	5	RP905531	909479.4806	7362752.011	843	521 The Narrows Rd	Mount Larcom	4695	Residential	≤25
173	1	RP895866	909817.789	7362955.091	741	523 The Narrows Rd	Mount Larcom	4695	Residential	≤25
174	2	RP895866	910066.7453	7363124.737	705	559 The Narrows Rd	Mount Larcom	4695	Residential	≤25
175	1	DT4038	910419.4514	7362891.978	290	592 The Narrows Rd	Mount Larcom	4695	Residential	≤25
176	24	DS279	909120.7328	7364602.898	2415	259 Goodman Rd	Mount Larcom	4695	Residential	≤25
177	24	DS279	908981.9619	7364781.303	2639	259 Goodman Rd	Mount Larcom	4695	Residential	≤25
178	3	RP895866	910212.289	7363604.139	937	589 The Narrows Rd	Mount Larcom	4695	Residential	≤25
179	4	RP895867	910664.017	7363356.667	440	637 The Narrows Rd	Mount Larcom	4695	Residential	≤25
180	5	RP895867	910741.4154	7363959.728	845	675 The Narrows Rd	Mount Larcom	4695	Residential	≤25
181	6	RP895867	911013.4392	7364092.551	798	735 The Narrows Rd	Mount Larcom	4695	Residential	≤25
182	4	RP615603	910944.7501	7364600.536	1253	2 Goodman Rd	Mount Larcom	4695	Residential	≤25
183	45	RP894241	913191.7894	7363731.597	925	125 Cullen Rd	Aldoga	4694	Residential	≤25
184	100	DS698	911813.6264	7367042.983	2489	75 Mattson Rd	Mount Larcom	4695	Residential	≤25
185	98	DS698	911704.5203	7367715.075	3090	1198 The Narrows Rd	Mount Larcom	4695	Residential	≤25
186	1	MPH32620	914653.044	7367199.252	802	203 Nichols Rd	Targinie	4694	Residential	≤25
187	2	RP616661	914872.1659	7367120.343	593	153 Nichols Rd	Targinie	4694	Residential	≤25
188	1	MPH2925	916755.877	7365145.54	1948	101 Spresser Rd	Targinie	4694	Residential	≤25
189	2	MPH23037	916720.2734	7365462.783	1674	101 Spresser Rd	Targinie	4694	Residential	≤25
190	2	MPH33447	916562.8628	7365320.073	1695	101 Spresser Rd	Targinie	4694	Residential	≤25
191	1	MPH33447	916459.9296	7365670.964	1349	101 Spresser Rd	Targinie	4694	Residential	≤25
192	1	MPH2830	916262.5001	7365913.236	1036	101 Spresser Rd	Targinie	4694	Residential	≤25
193	1	RP616661	915636.3381	7367079.699	218	88 Nichols Rd	Targinie	4694	Residential	≤25
194	78	DS629	915902.1234	7368242.202	1144	101 Spresser Rd	Targinie	4694	Residential	≤25
195	77	DS629	916224.7731	7367705.757	523	29 Spresser Rd	Targinie	4694	Residential	≤25
196	1	RP897093	916427.4847	7367677.787	424	14 Spresser Rd	Targinie	4694	Residential	≤25
197	72	DS628	917663.915	7367764.311	499	63 Flinders Rd	Targinie	4694	Residential	≤25
198	102	RP866910	917794.1144	7367930.898	566	101 Spresser Rd	Targinie	4694	Residential	≤25
199	1305	MPH34872	917601.4082	7366681.231	317	1023 Targinie Rd	Targinie	4694	Residential	≤25
200	1	MPH2955	917511.3745	7366954.813	318	1057 Targinie Rd	Targinie	4694	Commercial	≤25
201	2	RP865973	917555.9464	7364750.253	2446	101 Spresser Rd	Targinie	4694	Residential	≤25
202	1	RP865973	917963.3198	7364636.405	2495	57 Swan Rd	Targinie	4694	Residential	≤25
203	1	MPH30856	918265.8521	7365808.326	1302	908 Targinie Rd	Targinie	4694	Residential	≤25



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Type	Daytime Background Noise Level (dBA)
204	1	RP913144	918040.0481	7364353.601	2772	67 Smith Rd	Targinie	4694	Residential	≤25
205	1	RP615663	918505.1002	7364753.211	2316	17 Swan Rd	Targinie	4694	Residential	≤25
206	41	DS290	918663.2254	7365252.649	1804	820 Targinie Rd	West Stowe	4680	Residential	≤25
207	58	DS290	918626.3322	7365552.65	1508	Unnamed Rd	Targinie	4694	Residential	≤25
208	1	MPH32480	918547.0084	7364098.469	2964	67 Smith Rd	Targinie	4694	Residential	≤25
209	1	RP612108	918884.3577	7366716.047	329	98 Chernih Rd	Targinie	4694	Residential	≤25
210	3	DS710	918645.6442	7363942.047	3111	11 Smith Rd	Targinie	4694	Residential	≤25
211	91	MPH33801	918801.3079	7363026.573	3825	611 Targinie Rd	Targinie	4694	Residential	≤25
212	91	MPH33801	918793.5295	7363077.641	3790	611 Targinie Rd	Targinie	4694	Residential	≤25
213	1	CP881441	918627.5602	7363233.702	3780	30 Mount Larcom Peak Rd	West Stowe	4680	Residential	≤25



Mainland GTP EM Plan - Noise APPENDIX H3



Receptor ID	LOT	PLAN	UTM X Co-ordinate	UTM Y Co-ordinate	Distance to Pipeline Alignment	Address	Suburb	Postcode	Receiver Detail
1001	20	WT32	688060.496	7157029.265	1216	Bonnie Doon Road	Baroondah	4454	Shed
1002	3	TR31	677643.1515	7223290.761	2413	Arcadia Valley Road	Arcardia Valley	4454	Shed
1003	3	TR31	676619.1239	7223100.296	3454	Arcadia Valley Road	Arcardia Valley	4454	Shed
1004	2	TR30	677206.9688	7227638.632	2092	Arcadia Valley Road	Arcardia Valley	4454	Shed
1005	6	TR34	675788.5105	7239394.14	3221	Arcadia Valley Road	Arcardia Valley	4702	Stockyard
1006	1	RP866568	732750.8954	7274653.757	3330	Mungabunda Road	Bauhinia	4718	Shed
1007	34	BH294	732933.3127	7282157.488	3537	Fitzroy Development Road	Bauhinia	4718	Shed - sports ground facilities
1008	1	RP620842	756561.5854	7286525.126	94	Oombabeer Rd Oombabeer	Oombabeer	4718	Industrial
1009	12	CP895590	796416.5958	7295456.12	1051	2380 Banana-Mungi Rd	Moura	4718	Shed
1010	2	CP895590	796816.2315	7296636.311	120	1635 Moura-Baralaba Rd	Moura	4718	Industrial
1011	1	RP620104	797944.5331	7294041.786	2689	2371 Banana-Mungi Rd	Moura	4718	Dam and Windmill
1012	25	FN302	811056.7746	7302399.146	125	1344 Baralaba-Banana Rd	Banana	4702	Shed
1013	1	RP621029	820639.4434	7302373.341	182	Leichardt Hwy	Banana	4702	Industrial
1014	73	PM207	841250.9614	7311000.682	2081	1749 Prospect Creek-Goovigen Rd	Orange Creek	4715	Shed
1015	24	RN347	846749.4072	7309790.925	198	246 Jambin-Dakemba Rd	Dakenba	4715	Shed
1016	54	RN349	848626.9503	7313009.736	3132	260 Argoon Rd	Argoon	4702	Shed
1017	171	SP147723	849078.5596	7313523.926	3453	1288 Argoon-Kilburnie Rd	Argoon	4702	Shed
1018	77	SP163782	855408.9237	7311200.328	154	531 Argoon-Kilburnie Rd	Callide	4715	Shed
1019	76	RN425	856157.7741	7310240.236	1291	708 Dudarkos Road	Callide	4715	Agricultural
1020	88	RN1475	859552.8536	7309772.462	3190	10577 Dawson Hwy	Callide	4715	Industrial
1021	1	RP618390	859458.6411	7313250.128	103	10364 Dawson Hwy	Callide	4715	Shed
1022	11	SP199386	878975.4538	7325467.089	192	7808 Dawson Hwy	Mount Alma	4680	Television Transmission Tower
1023	2	RP606302	892571.3856	7337111.732	1457	27 Harper Creek Rd	Mount Alma	4680	Shed
1024	2	RP865974	893735.6922	7337554.156	1330	27 Harper Creek Rd	Mount Alma	4680	Shed
1025	22	CL40301	903045.4229	7337688.59	1628	1735 Mount Alma Rd	Mount Alma	4680	Shed
1026	99	CL4036	904246.9119	7336665.088	3021	44 Galloway Plains Rd	Mount Alma	4680	Shed
1027	4	RP860093	903437.4412	7342136.4	714	1160 Mount Alma Rd	Bracewell	4695	Shed
1028	2	RP860093	903691.4389	7343322.6	542	1066 Mount Alma Rd	Bracewell	4695	Shed
1029	2	RP801363	908985.7966	7353036.426	141	52793 Bruce Hwy	East End	4680	QLD Gas Pipeline Larcom Creek meter station



Bauhinia GTP EM Plan

- Access Road
- Sensitive Recievers
- Construction Plant Item
- Contours - 5m

LA10 (dBA)

- 30
- 35
- 40
- 45
- 50

Predictions at 1.5m above ground and assumes neutral weather conditions.
Aerial image from Google Earth.

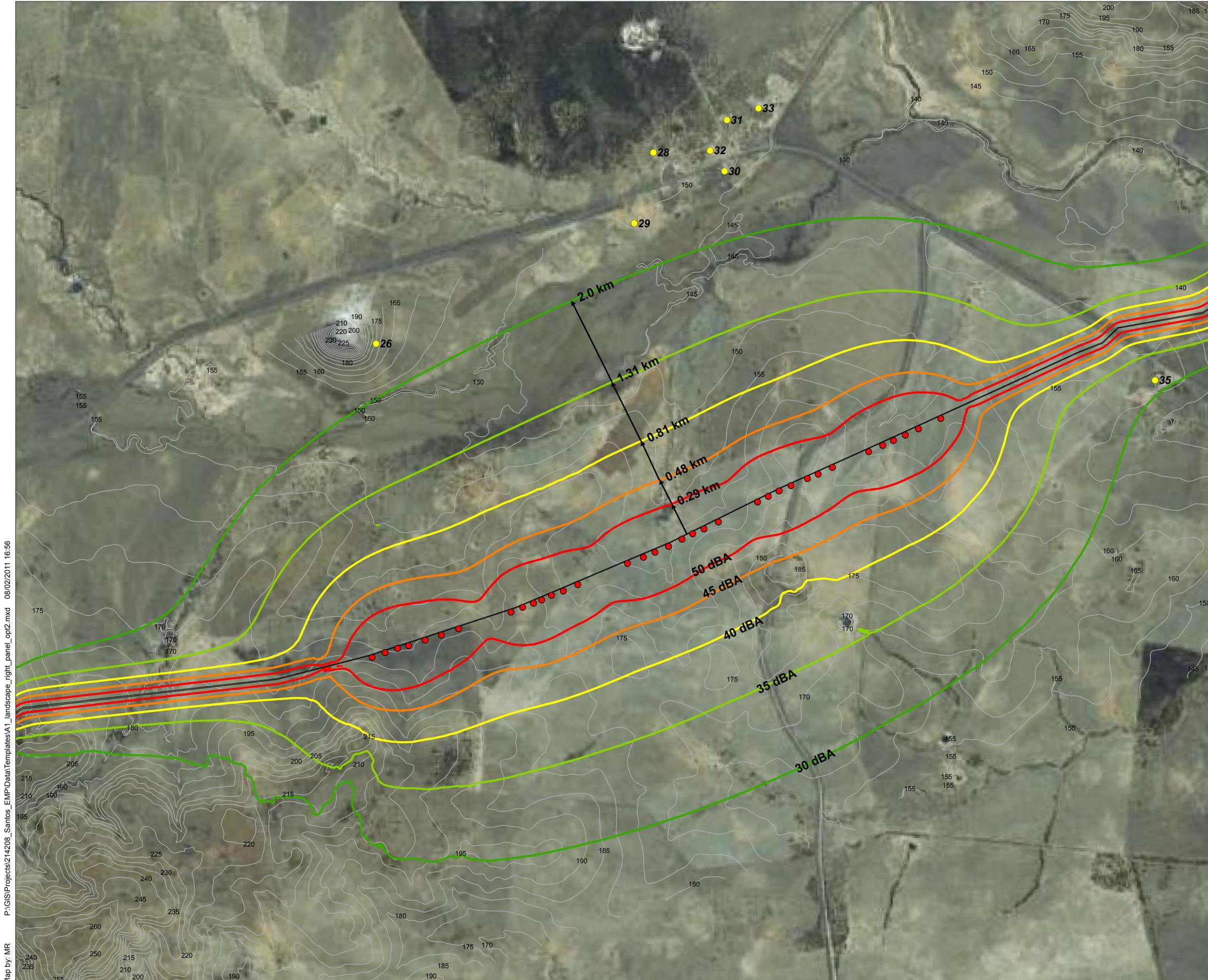
Source:
Topography: Santos, Feb 2011.
Grid Noise Map & Model Elements: SLR, March 2011.
Sensitive Recievers: SLR, March 2011.
Aerial Image: Google Maps, 2011.

DRAFT

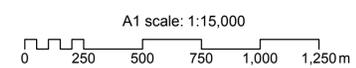
Predicted Noise Contours (LA10) Bauhinia 3D Noise Modelling Worst Stage Lowering and Backfilling Appendix H4

Date: 10/03/2011

Version 0



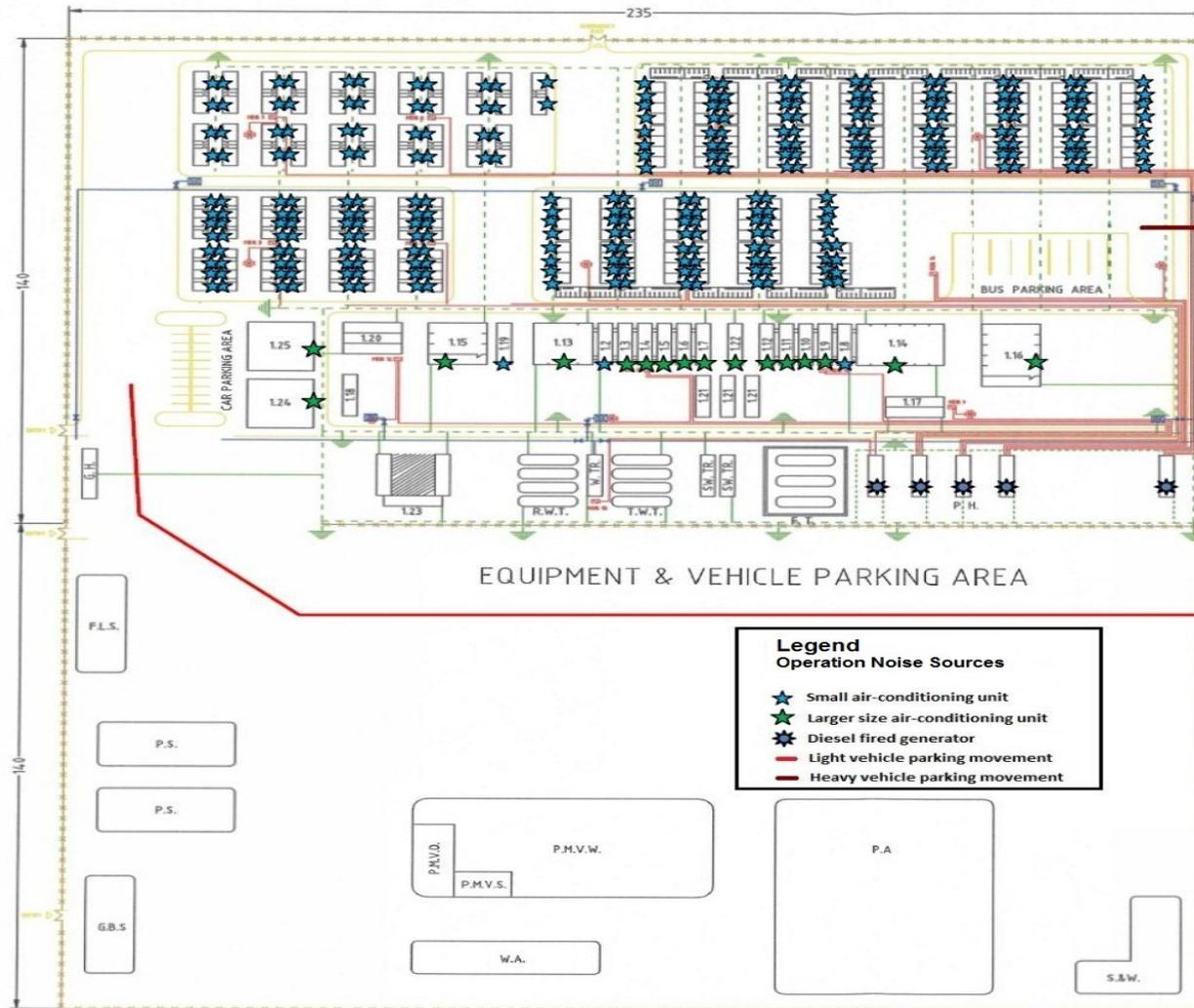
P:\GIS\Projects\214208_Santos_EMP\Data\Templates\A1_landscape_right_panel_opt2.mxd 08/02/2011 16:56
 Map by: MR



GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan - Noise APPENDIX H5



LEGEND CAMP FACILITIES

	A CLIENT	2P + 2WC	18 X 2 = 36
	A SENIOR STAFF	2P + 2WC	3 X 2 = 6
	B JUNIOR STAFF	4P + 2WC	12 X 4 = 48
	B OTHER Exp.	4P + 2WC	4 X 4 = 16
	C TCN + LOC Foreman & Skilled	4P	30X 4 = 120
	D LOC Semi Skilled	8P	8X 8 = 64
	E LOC Helper	16P	7X 16 = 112
			TOTAL 402

- 1.1 ABLUTION MODULE (SHOWER-WASH-BASIN-TOILET)
- 1.2 STAFF SELF SERVICE MODULE
- 1.3 STAFF KITCHEN MODULE
- 1.4 STAFF DISH WASH MODULE
- 1.5 STAFF FOOD STORE MODULE
- 1.6 STAFF FREEZER MODULE
- 1.7 BAKERY MODULE
- 1.8 LABOUR SELF SERVICE MODULE
- 1.9 LABOUR KITCHEN MODULE
- 1.10 LABOUR DISH WASH MODULE
- 1.11 LABOUR FOOD STORE MODULE
- 1.12 LABOUR FREEZER MODULE
- 1.13 STAFF MESS MODULES (NO. 4)
- 1.14 LABOUR MESS MODULES (NO. 6)
- 1.15 STAFF RECREATION MODULES (NO. 4)
- 1.16 LABOUR RECREATION MODULES (NO. 6)
- 1.17 LAUNDRY MODULES (NO. 2)
- 1.18 CAMP BOSS OFFICE
- 1.19 GYMNASIUM
- 1.20 FIRST AID MODULES (NO. 3)
- 1.21 STORE CONTAINERS
- 1.22 ICE MAKER CONTAINER
- 1.23 CARPENTRY / ELECTRICIAN WORKSHOP
- 1.24 CLIENT OFFICE BUILDING
- 1.25 CONTRACTOR OFFICE BUILDING
- G.H. GUARD HOUSE
- W.T.R. WATER TREATMENT PLANT
- SW.T.R. SEWAGE TREATMENT PLANT
- R.W.T. RAW WATER STORAGE TANKS
- T.W.T. TREATED WATER STORAGE TANKS
- F.T. FUEL STORAGE TANKS
- P.H. POWER HOUSE / GENERATORS
- F.L.S. FUEL SERVICE STATION
- P.S. PROJECT STORE
- G.B.S. GAS BOTTLE STORE
- P.H.V.O. PHV OFFICE
- P.M.V.S. PHV STORE
- P.M.V.W. PHV WORKSHOP
- W.A. WASHING AREA
- P.A. PREFABRICATION AREA
- S. & W. SCRAP AND WASTE

Legend Operation Noise Sources

- Small air-conditioning unit
- Larger size air-conditioning unit
- Diesel fired generator
- Light vehicle parking movement
- Heavy vehicle parking movement

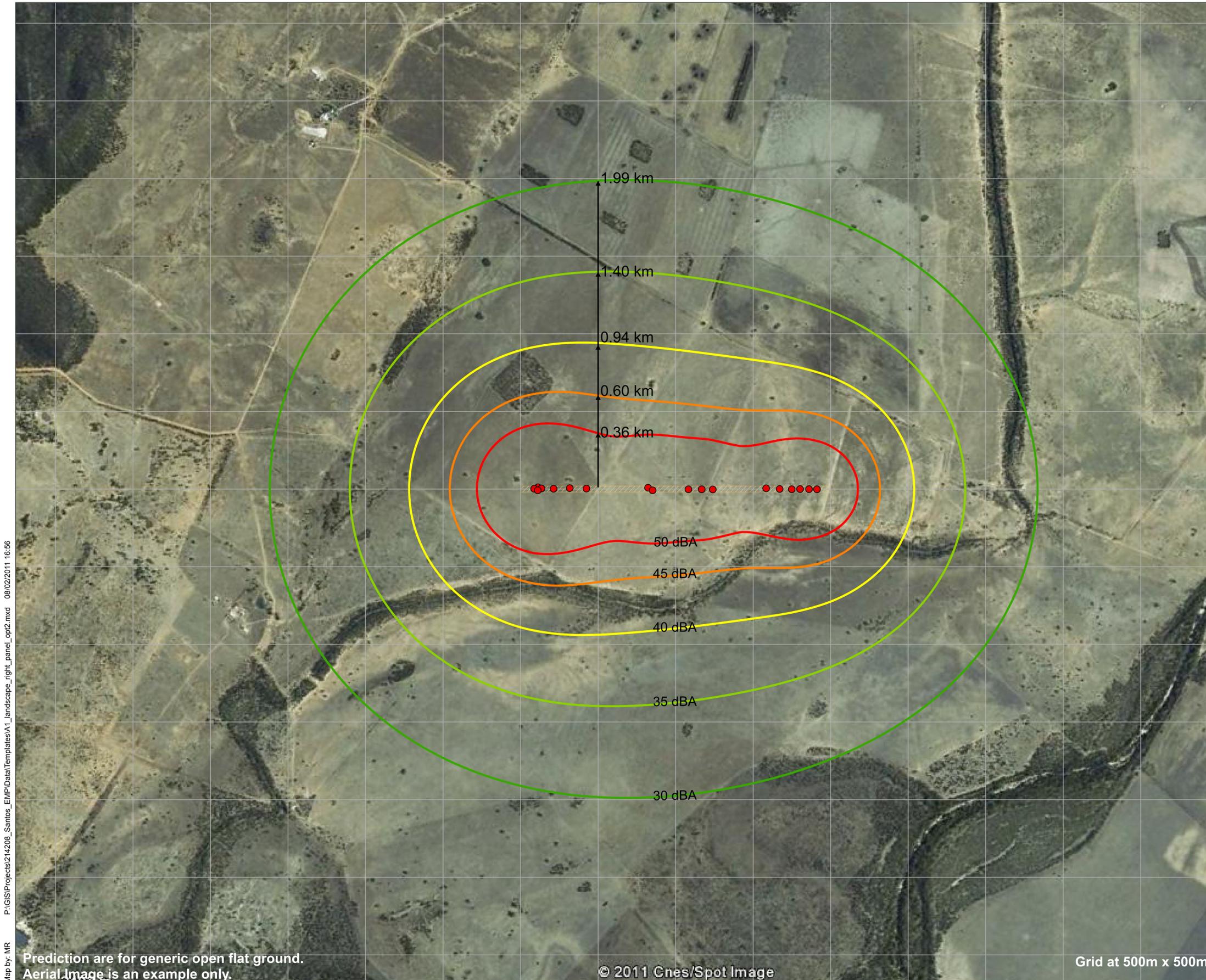
- ELECTRICAL LEGEND**
- MDB MAIN DISTRIBUTION BOARD
 - LIGHTING POLE 16 FT HGT (4X400 WATTS HPS FIXTURES)
- EARTHING LEGEND**
- EARTHING ROD 3 MT LENGHT
 - COPPER CABLE 95 mm²
 - INSULATED PVC COPPER CABLE 35 mm²
- FIREFIGHTING LEGEND**
- FIRE HYDRANT
 - C.S. GATE VALVE
 - C.S. PIPE DIA. 4"

		SAIPEM SPA	
STANDARD CAMP FACILITY 400 PEOPLES			
DRAWING TITLE : CAMP LAYOUT			
SCALE 1:1000 CAD FILE : CAMP 400 DWGNO:01			



Mainland GTP EM Plan

- Construction Plant Item
- Right of Way
- LA10 (dBA)**
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Stage 1 ROW and Bush Clearing Appendix H6

Date: 04/03/2011

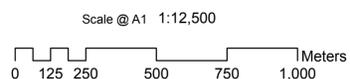
Version: 0

P:\GIS\Projects\214208_Santos_EMP\Data\Templates\A1_landscape_right_panel_opt2.mxd 08/02/2011 16:56

Map by: MR
Prediction are for generic open flat ground.
Aerial Image is an example only.

© 2011 Cnes/Spot Image

Grid at 500m x 500m

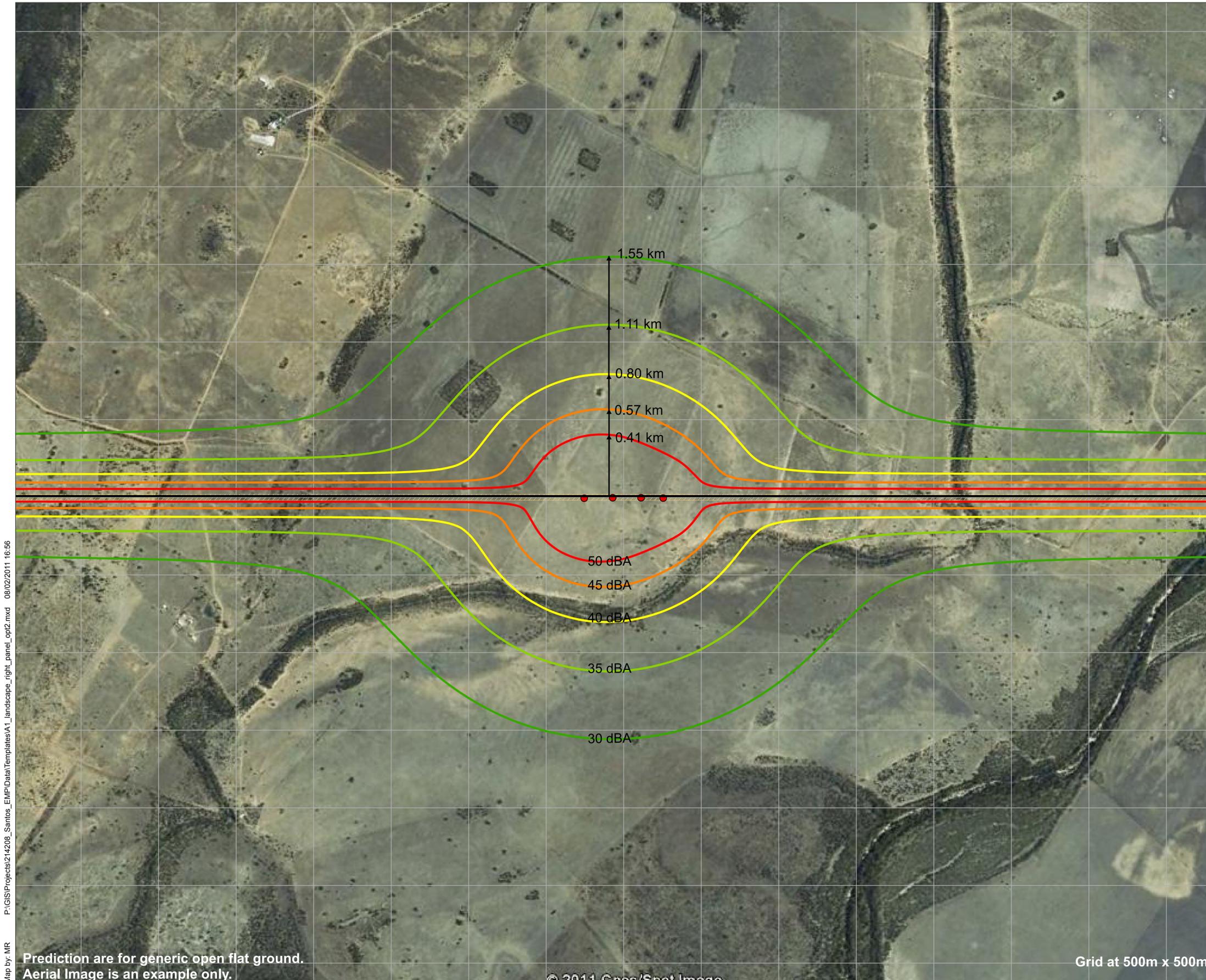


GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Access Road
- Construction Plant Item
- Right of Way
- LA10 (dBA)**
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
 Grid Noise Map: SLR Consulting, March 2011.
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Stage 2A Rock Exposure Appendix H6

Date: 04/03/2011

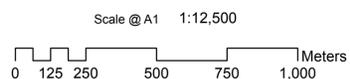
Version: 0

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

© 2011 Gnes/Spot Image

Grid at 500m x 500m

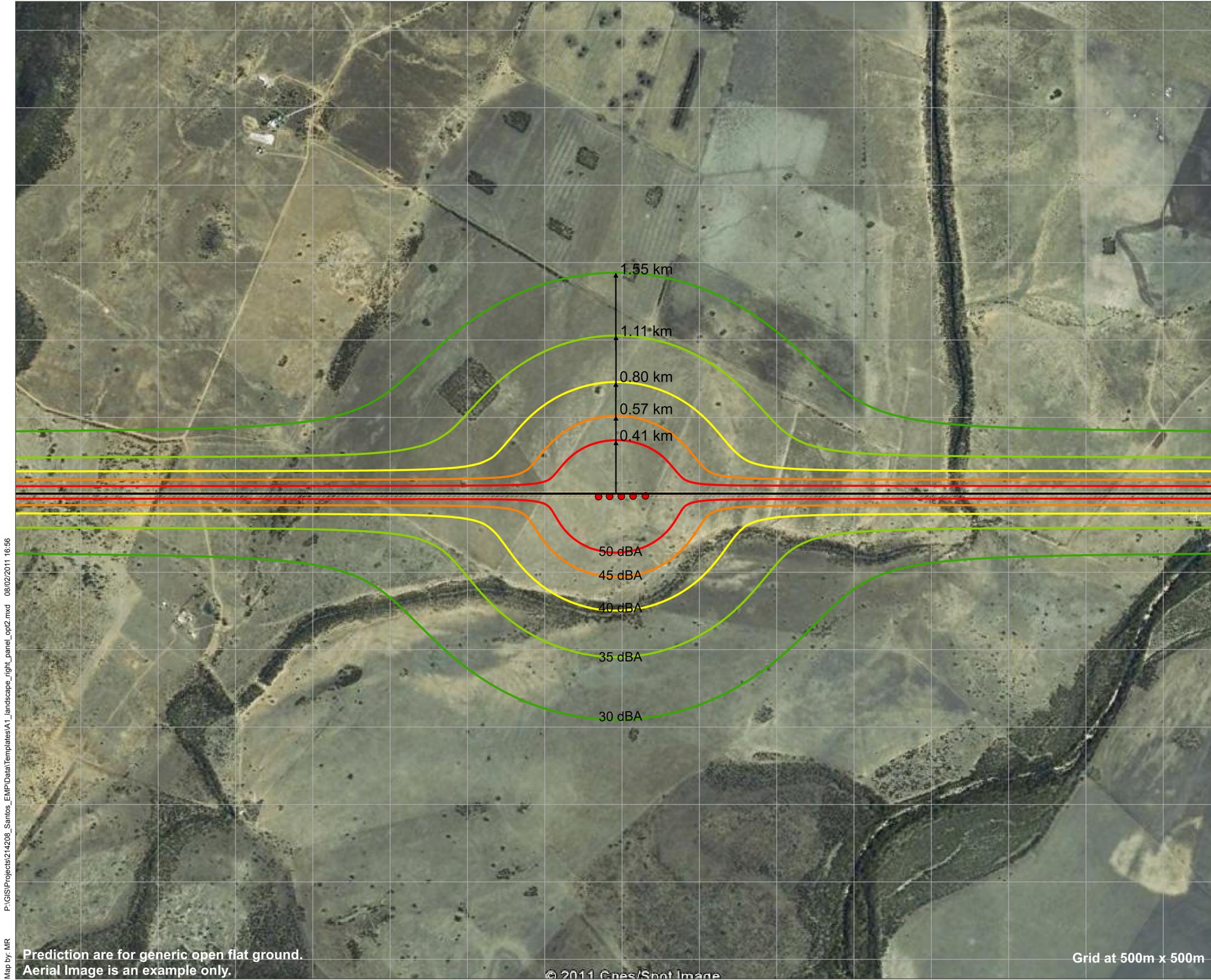


GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Access Road
- Construction Plant Item
- Right of Way
- LA10 (dBA)**
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

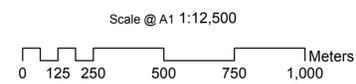
Predicted Noise Contours (LA10) Construction Stage 2B Pre-blasting Preparation Appendix H6

Date: 04/03/2011 Version 0

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m



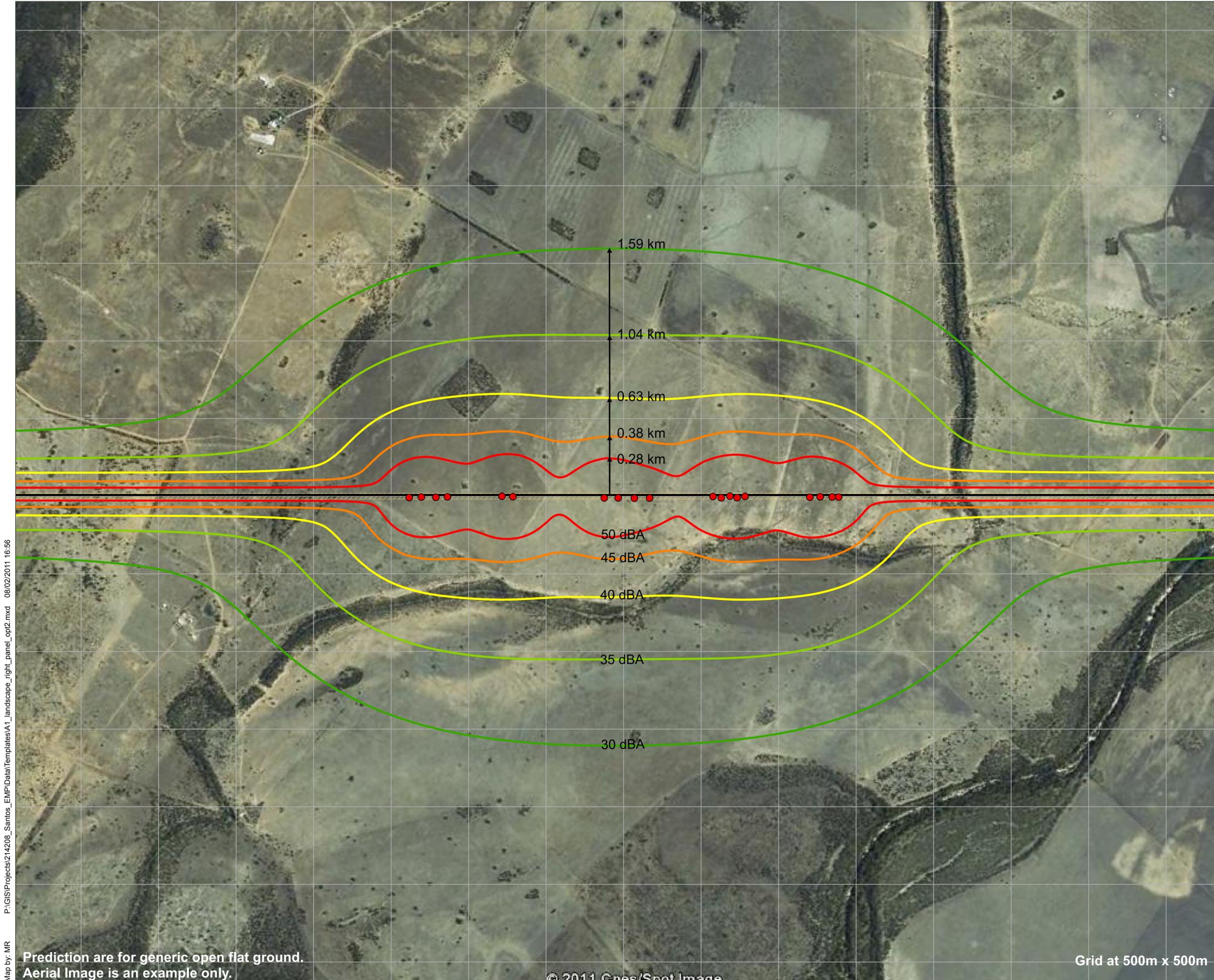
GLNG No:
Coordinate system: MGA Zone 55

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Mainland GTP EM Plan

-  Access Road
-  Construction Plant Item
-  Right of Way
- LA10 (dBA)**
-  30
-  35
-  40
-  45
-  50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

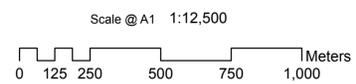
Predicted Noise Contours (LA10) Construction Stage 3 Stinging and Bending Appendix H6

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m

© 2011 Cnes/Spot Image



GLNG No:
Coordinate system: MGA Zone 55

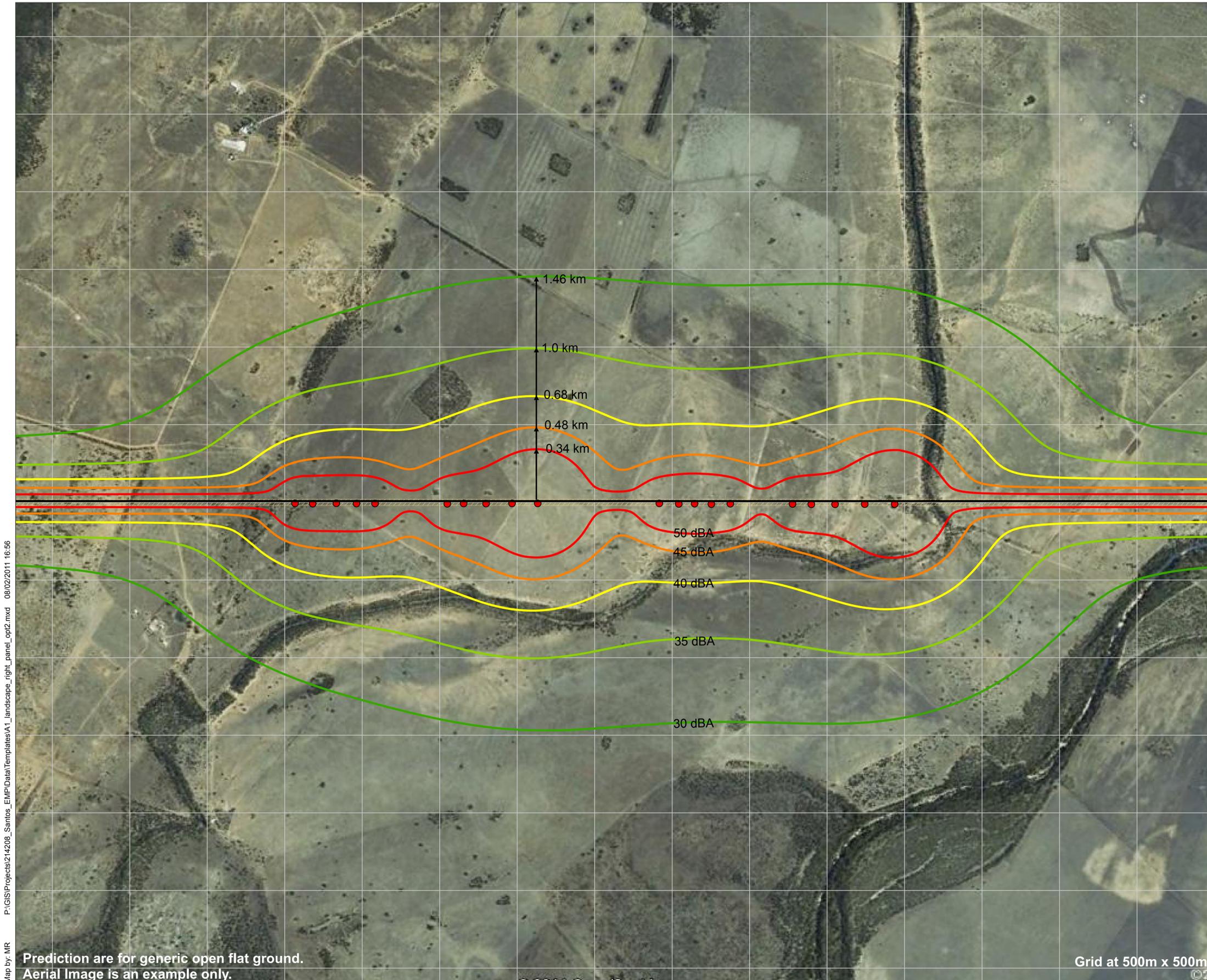
Date: 04/03/2011

Version 0



Mainland GTP EM Plan

- Access Road
- Construction Plant Item
- Right of Way
- LA10 (dBA)
 - 30
 - 35
 - 40
 - 45
 - 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

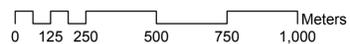
Predicted Noise Contours (LA10) Construction Stage 4 Trenching Appendix H6

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m

Scale @ A1 1:12,500



GLNG No:
Coordinate system: MGA Zone 55

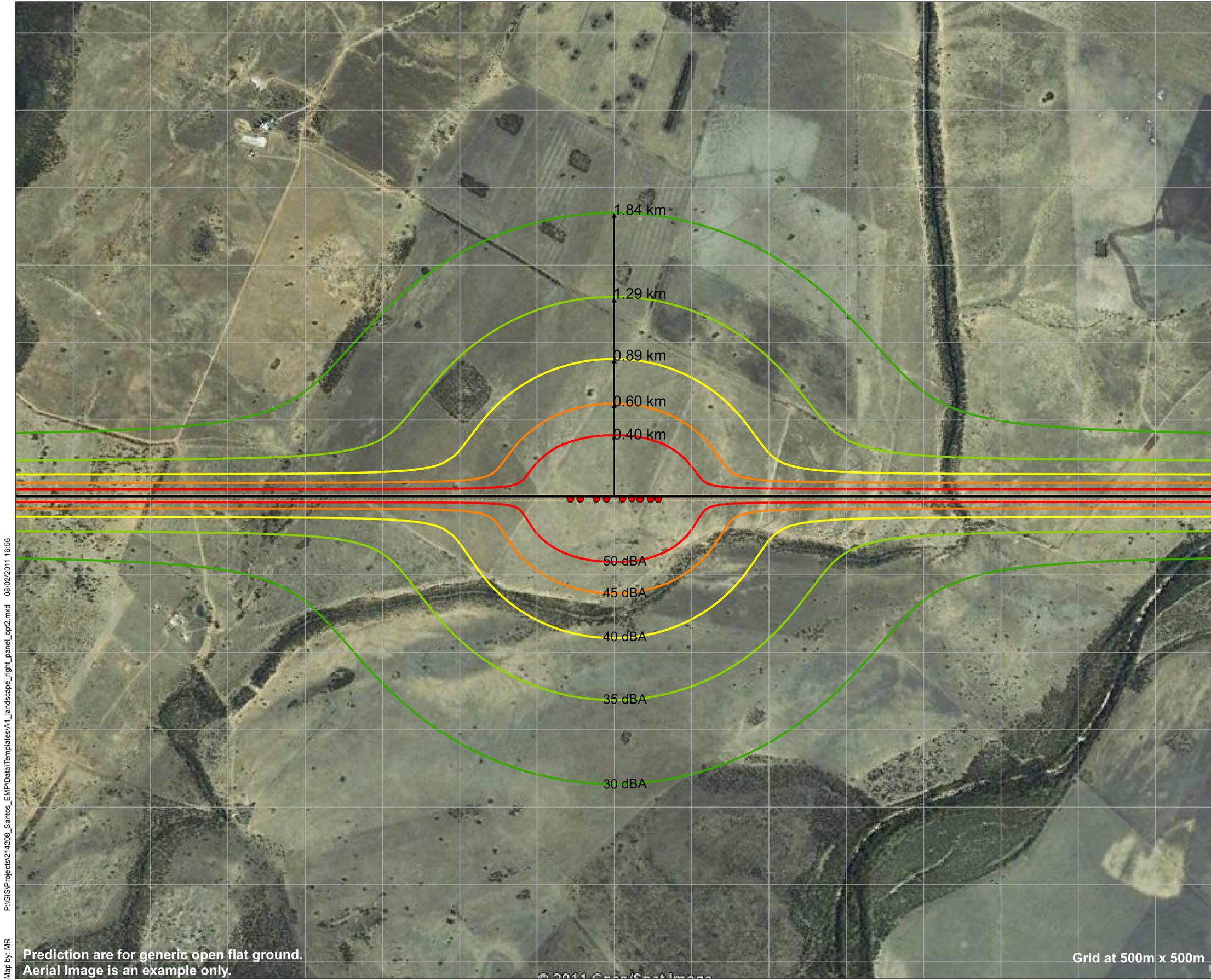
Date: 04/03/2011

Version 0



Mainland GTP EM Plan

-  Access Road
-  Construction Plant Item
-  Right of Way
- L10 (dBA)**
-  30
-  35
-  40
-  45
-  50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
 Grid Noise Map: SLR Consulting, March 2011.
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Stage 5 Welding Appendix H6

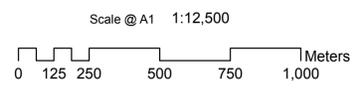
Date: 04/03/2011

Version 0

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Map by: MR
Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m

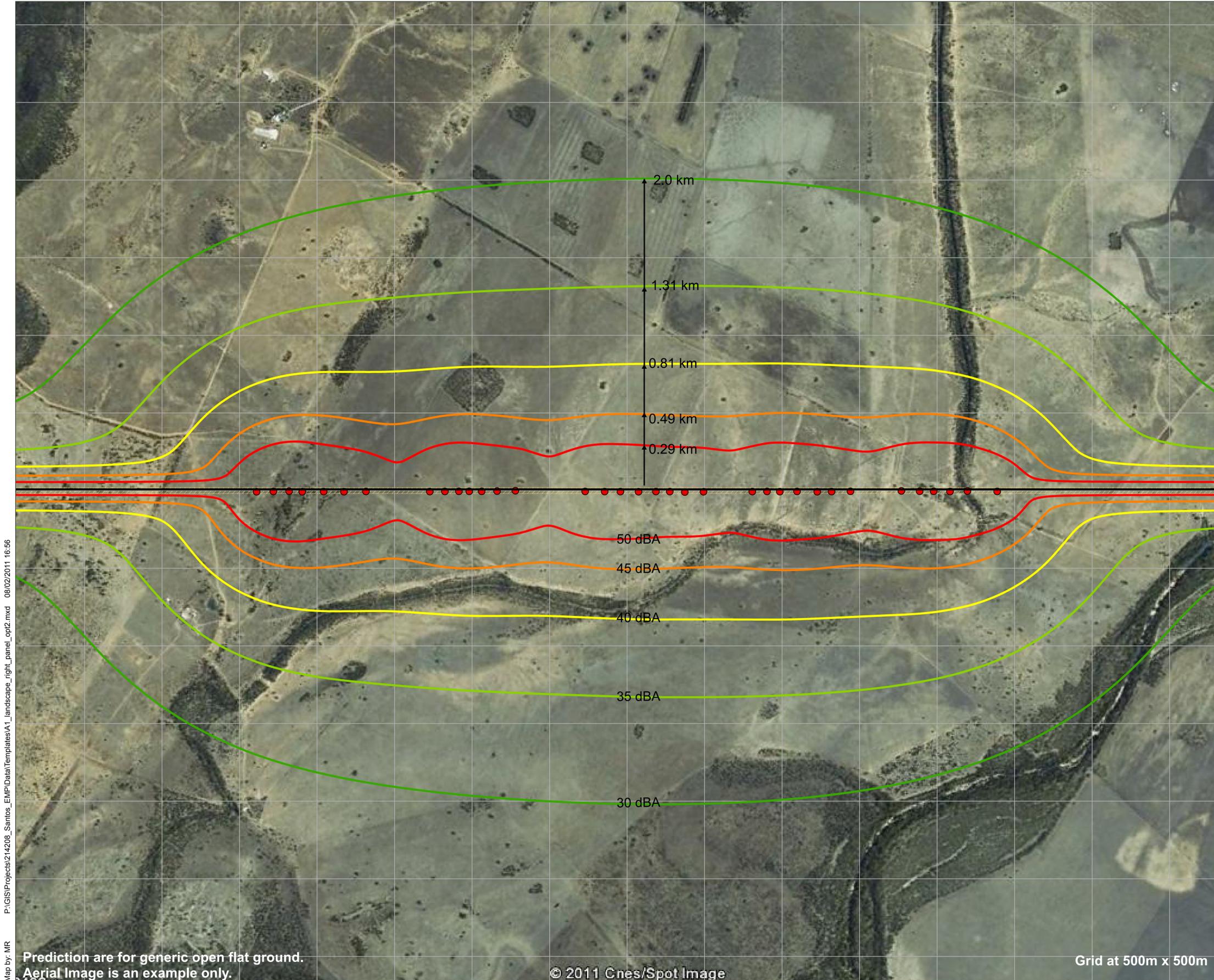


GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Access Road
- Construction Plant Item
- Right of Way
- LA10 (dBA)**
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Stage 6 Lowering and Backfilling Appendix H6

Date: 04/03/2011

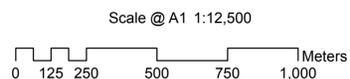
Version 0

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

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Grid at 500m x 500m

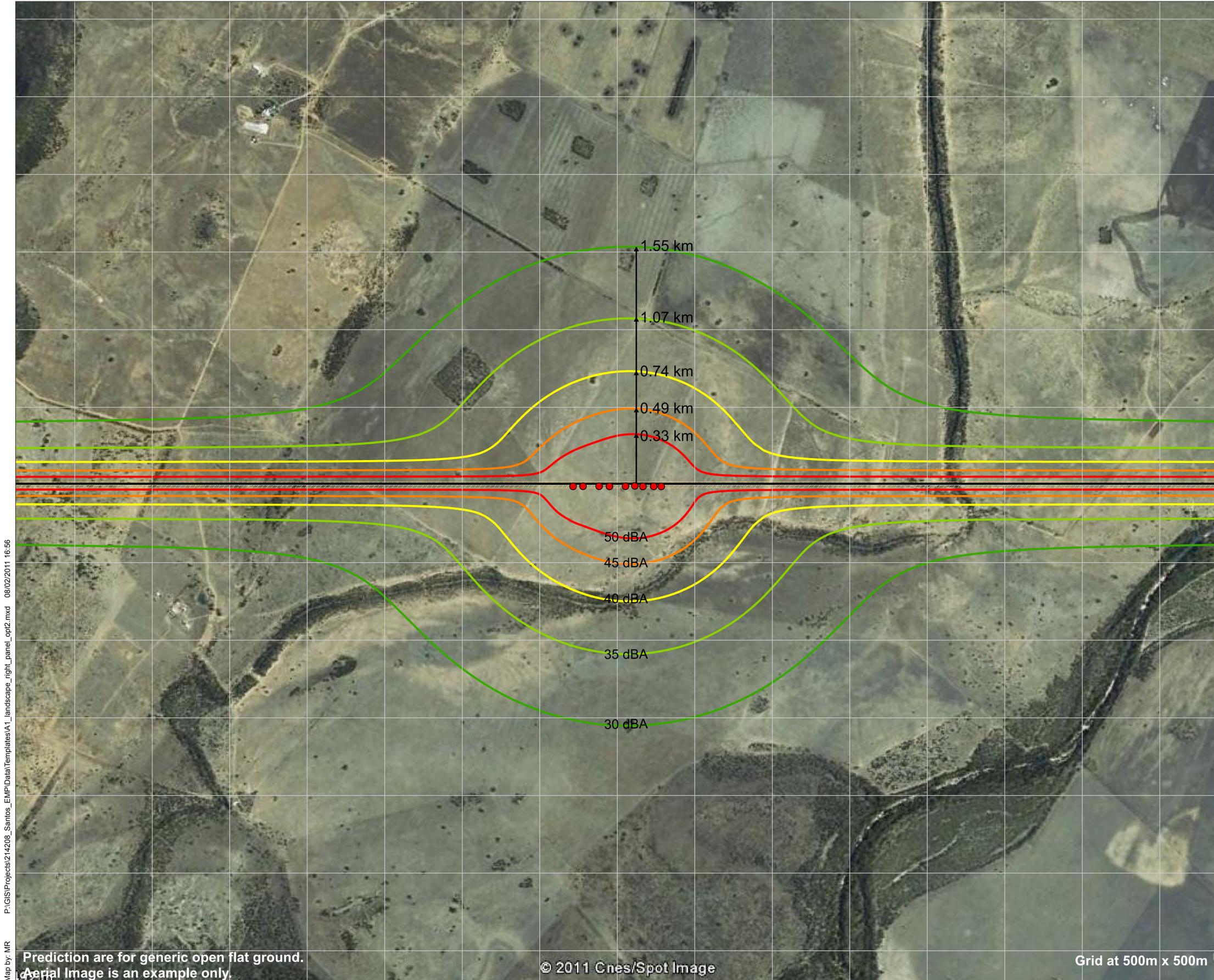


GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Access Road
- Construction Plant Item
- Right of Way
- LA10 (dBA)**
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

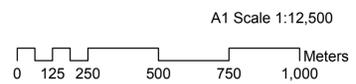
Predicted Noise Contours (LA10) Construction Stage 7 Clean Up and Restoration Appendix H6

Map by: MR P:\GIS\Projects\214208_Santos_EMP\Data\Templates\A1_landscape_right_panel_opt2.mxd 08/02/2011 16:56

Prediction are for generic open flat ground.
Aerial Image is an example only.

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Grid at 500m x 500m



GLNG No:
Coordinate system: MGA Zone 55

Date: 11/03/2011

Version 0



Mainland GTP EM Plan - Noise APPENDIX H7



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
1	694129.9	7149764.7	Residential	832	41	39	37	37	41	39	38
2	693974.0	7149385.2	Residential	1051	38	36	35	34	38	37	35
3	693816.8	7148658.8	Residential	1701	32	29	30	28	31	32	29
4	688087.3	7164695.3	Commercial+ Residential	224	56	59	51	55	58	53	55
5	687787.3	7183527.3	Residential	2689	27	22	25	22	25	27	23
6	686901.4	7188858.7	Residential	2885	26	21	24	21	24	27	22
7	688169.2	7199434.0	Residential	760	42	41	38	39	42	40	39
8	686594.3	7202961.9	Residential	1758	32	28	29	27	31	32	29
9	683393.6	7208528.9	Residential	3202	25	19	23	19	23	26	21
10	680577.1	7215713.4	Residential	2421	28	23	26	23	27	28	24
11	682729.3	7219128.9	Residential	1156	37	34	34	33	36	36	34
12	680951.0	7218889.0	Residential	608	44	44	40	42	45	43	42
13	678450.1	7223813.5	Residential	1548	34	30	31	29	33	33	30
14	677199.0	7227807.2	Residential	2081	30	26	27	25	29	30	26
15	677049.1	7227861.0	Residential	2225	29	25	27	24	28	29	26
16	677487.0	7230849.2	Residential	2076	30	26	28	25	29	30	26
17	676008.0	7232417.6	Residential	3717	23	17	21	17	21	24	19
18	680326.7	7240362.7	Residential	1363	35	32	32	31	34	34	32
19	684498.0	7247170.9	Residential	3482	24	18	22	18	22	25	20
20	678673.5	7248169.1	Residential	2416	28	23	26	23	27	28	24
21	688972.9	7266681.4	Residential	3147	25	19	23	19	23	26	21
22	689306.0	7266824.2	Residential	3027	26	20	24	20	24	26	22
23	718488.4	7275975.6	Residential	1697	32	29	30	28	31	32	29
24	726064.7	7272788.3	Residential	3226	25	19	23	19	23	25	21
25	723815.6	7278308.8	Residential	2695	27	22	25	21	25	27	23
26	729357.0	7279417.0	Residential	2280	29	24	27	24	27	29	25
27	904026.6	7343525.8	Commercial	2595	28	22	25	22	26	28	24
28	731559.8	7280795.0	Residential	2783	27	21	24	21	25	27	23
29	731388.5	7280256.1	Residential	2351	29	24	26	23	27	29	25
30	732101.3	7280627.2	Residential/School	2423	28	23	26	23	27	28	24
31	732137.7	7281019.6	Residential/School	2774	27	21	25	21	25	27	23
32	731996.5	7280790.5	Residential	2616	27	22	25	22	26	28	23
33	732383.9	7281099.4	Residential/School	2757	27	21	25	21	25	27	23
34	733062.7	7282500.5	Residential	3808	23	17	21	17	21	24	19
35	735351.9	7278873.7	Residential	419	49	50	44	47	50	47	47
36	735184.8	7282262.1	Residential	2823	27	21	24	21	25	27	22
37	737894.5	7279772.4	Residential	543	46	46	41	43	46	44	44
38	743223.4	7279136.2	Residential	2818	27	21	24	21	25	27	22
39	743579.1	7285530.8	Residential	3169	25	19	23	19	23	26	21



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
40	747592.5	7287086.3	Residential	3660	24	17	22	17	21	24	19
41	754837.7	7288481.0	Residential	2425	28	23	26	23	27	28	24
42	758562.8	7285199.5	Residential	1931	31	27	28	26	30	31	27
43	778064.7	7290786.9	Residential	243	55	58	50	54	57	52	54
44	783031.3	7289849.1	Residential	1039	38	36	35	34	38	37	35
45	781581.9	7292784.0	Commercial	2209	29	25	27	24	28	29	26
46	781815.0	7292682.8	Residential	1996	31	26	28	26	29	30	27
47	787476.7	7297326.6	Residential	2849	26	21	24	21	24	27	22
48	790868.8	7293396.0	Residential	1684	33	29	30	28	31	32	29
49	796495.1	7295374.5	Residential	1144	37	35	34	33	37	36	34
50	796929.3	7294681.9	Residential	1812	32	28	29	27	30	31	28
51	796939.5	7299000.4	Residential	2221	29	25	27	24	28	29	26
52	802260.7	7295424.1	Residential	2359	29	24	26	23	27	29	25
53	811130.3	7302388.7	Residential	103	65	71	59	66	68	61	65
54	811077.8	7302099.2	Residential	170	59	63	53	59	62	56	59
55	814227.2	7304437.5	Residential	2260	29	24	27	24	28	29	25
56	824962.0	7302901.7	Residential	1243	36	33	33	32	35	35	33
57	830685.0	7307060.4	Residential	1564	33	30	30	29	32	33	30
58	832023.7	7306429.2	Residential	901	40	38	36	36	40	39	37
59	835299.4	7307170.7	Residential	398	49	50	45	48	50	47	48
60	836271.9	7304793.3	Commercial	2169	30	25	27	24	28	30	26
61	836433.8	7304999.7	Commercial	2027	30	26	28	25	29	30	27
62	836606.8	7305924.0	Residential	1200	37	34	33	33	36	36	33
63	835780.8	7308910.2	Residential	1898	31	27	28	26	30	31	28
64	837073.5	7308128.6	Residential	771	42	41	38	39	42	40	39
65	837578.8	7311026.5	Residential	3418	24	18	22	18	22	25	20
66	838612.1	7309637.6	Residential	1761	32	28	29	27	31	32	29
67	840818.5	7312236.2	Residential/School	3376	25	18	22	18	22	25	20
68	841348.1	7310893.3	Residential	1962	31	26	28	26	29	31	27
69	841251.0	7311000.7	Residential	2081	30	26	27	25	29	30	26
70	841437.4	7311468.1	Residential	2525	28	23	25	22	26	28	24
71	841405.5	7311538.1	Residential	2597	28	22	25	22	26	28	24
72	841899.6	7312259.9	Residential	3169	25	19	23	19	23	26	21
73	843019.2	7310426.0	Residential	1052	38	36	35	34	38	37	35
74	845793.1	7313074.4	Residential	3509	24	18	22	18	22	25	20
75	846146.1	7312306.2	Residential	2724	27	22	25	21	25	27	23
76	846761.1	7309966.2	Residential	373	50	51	45	48	51	48	49
77	847096.8	7308715.7	Residential	897	40	38	36	36	40	39	37
78	847559.1	7308038.0	Residential	1629	33	29	30	28	32	33	30
79	847539.0	7308783.1	Residential	888	40	38	36	37	40	39	37
80	847180.4	7312842.6	Residential	3185	25	19	23	19	23	26	21



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
81	848852.9	7306096.4	Residential	3724	23	17	21	17	21	24	19
82	848843.5	7305930.4	Residential	3887	23	16	21	16	20	24	18
83	848536.0	7310563.3	Residential	685	43	42	39	40	43	41	41
84	848797.1	7309375.4	Residential	468	47	48	43	45	48	45	46
85	849036.5	7305816.6	Residential	4008	23	16	21	16	20	23	18
86	849017.4	7307868.4	Residential	1956	31	27	28	26	29	31	27
87	848831.7	7307305.9	Residential	2523	28	23	25	22	26	28	24
88	849027.0	7310263.8	Residential	435	48	49	44	46	49	46	47
89	849470.0	7310445.9	Residential	529	46	46	42	44	47	44	44
90	850120.3	7308232.0	Residential	1768	32	28	29	27	31	32	28
91	850040.0	7308452.2	Residential	1537	34	30	31	29	33	33	30
92	848777.0	7313157.4	Residential	3261	25	19	23	19	23	25	21
93	850276.1	7310834.1	Residential	509	46	47	42	44	47	44	45
94	849730.0	7311844.6	Residential	1655	33	29	30	28	32	32	29
95	849004.4	7313229.9	Residential	3219	25	19	23	19	23	26	21
96	848910.9	7313364.4	Residential	3381	24	18	22	18	22	25	20
97	848890.4	7313254.9	Residential	3294	25	19	23	19	23	25	20
98	850986.2	7309124.0	Residential	1276	36	33	33	32	35	35	33
99	850718.3	7311260.1	Residential	856	40	39	37	37	40	39	38
100	851301.7	7307906.9	Residential	2536	28	23	25	22	26	28	24
101	851476.0	7307996.7	Residential	2461	28	23	26	23	26	28	24
102	851455.5	7307951.5	Residential	2505	28	23	26	22	26	28	24
103	851414.6	7308040.6	Residential	2413	28	23	26	23	27	28	24
104	850889.4	7313855.7	Residential	3417	24	18	22	18	22	25	20
105	852062.6	7307153.6	Residential	3352	25	18	23	19	22	25	20
106	851933.5	7308412.6	Residential	2087	30	26	27	25	29	30	26
107	852164.0	7307122.9	Residential	3392	24	18	22	18	22	25	20
108	852465.1	7308322.8	Residential	2223	29	25	27	24	28	29	26
109	853277.2	7309320.4	Residential	1409	35	31	32	30	34	34	31
110	853854.3	7309393.8	Residential	1471	34	31	31	30	33	34	31
111	854450.9	7308980.6	Residential	2020	30	26	28	25	29	30	27
112	854694.6	7308721.2	Residential	2337	29	24	26	23	27	29	25
113	854740.6	7309002.5	Residential	2080	30	26	27	25	29	30	26
114	853225.6	7314642.6	Residential	3760	23	17	21	17	21	24	19
115	855119.7	7308550.6	Residential	2619	27	22	25	22	26	28	23
116	853783.3	7314351.3	Residential	3326	25	19	23	19	22	25	20
117	858098.2	7308846.0	Residential	3260	25	19	23	19	23	25	21
118	856057.4	7313902.8	Residential	2149	30	25	27	25	28	30	26
119	855989.5	7313992.2	Residential	2261	29	24	27	24	28	29	25
120	859816.8	7310155.7	Residential	3093	26	20	23	20	23	26	21
121	859560.8	7312079.5	Residential	1360	35	32	32	31	34	34	32



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
122	858028.3	7314785.1	Residential	1745	32	28	29	27	31	32	29
123	859891.8	7312012.8	Residential	1593	33	30	30	29	32	33	30
124	874102.0	7317703.6	Residential	413	49	50	44	47	50	47	47
125	874749.4	7318619.9	Residential	470	47	48	43	45	48	45	46
126	875052.7	7318219.8	Residential	811	41	40	37	38	41	40	39
127	875127.0	7318903.0	Residential	320	52	54	47	51	53	49	51
128	875970.8	7319330.9	Residential	760	42	41	38	39	42	40	39
129	878147.5	7319403.7	Residential	2805	27	21	24	21	25	27	23
130	875406.2	7324908.5	Residential	1941	31	27	28	26	30	31	27
131	878937.9	7322825.9	Residential	1881	31	27	29	26	30	31	28
132	881957.8	7327088.2	Residential	930	39	38	36	36	39	38	37
133	884211.7	7330909.5	Residential	2264	29	24	27	24	28	29	25
134	886390.8	7328677.3	Residential	650	44	43	40	41	44	42	41
135	887152.6	7327696.9	Residential	1865	31	27	29	26	30	31	28
136	888747.7	7327979.7	Residential	2110	30	25	27	25	28	30	26
137	888757.9	7335778.9	Residential	3294	25	19	23	19	23	25	20
138	892571.4	7337111.7	Residential	1457	34	31	31	30	33	34	31
139	893882.8	7337721.9	Residential	1410	35	31	32	30	34	34	31
140	898062.9	7338743.6	Residential	1121	37	35	34	33	37	36	34
141	902947.2	7337711.8	Residential	1571	33	30	30	29	32	33	30
142	903668.5	7337276.3	Residential	2240	29	24	27	24	28	29	25
143	903947.8	7337040.3	Residential	2562	28	22	25	22	26	28	24
144	903872.7	7337087.5	Residential	2491	28	23	26	23	26	28	24
145	906995.1	7341609.9	Residential	2880	26	21	24	21	24	27	22
146	903098.7	7342188.8	Residential	1057	38	36	35	34	38	37	35
147	904089.3	7343058.7	Residential	159	60	64	54	60	62	56	60
148	903670.9	7343401.3	Residential	559	45	45	41	43	46	44	43
149	901903.5	7344059.2	Residential	2336	29	24	26	23	27	29	25
150	908843.9	7353309.1	Residential	448	48	49	43	46	49	46	46
151	908011.9	7353936.5	Residential	1452	34	31	31	30	33	34	31
152	910651.0	7354002.7	Residential	441	48	49	44	46	49	46	46
153	908064.4	7355676.3	Residential	2031	30	26	28	25	29	30	27
154	912082.8	7357493.9	Residential	2103	30	25	27	25	28	30	26
155	906101.5	7356701.8	Residential	3664	24	17	22	17	21	24	19
156	905599.6	7358822.7	Residential	2819	27	21	24	21	25	27	22
157	906078.3	7360025.1	Residential	2147	30	25	27	25	28	30	26
158	904676.1	7360101.5	Residential	3534	24	18	22	18	22	25	20
159	905983.9	7360943.7	Residential	2213	29	25	27	24	28	29	26
160	905819.5	7360615.8	Commercial	2355	29	24	26	23	27	29	25
161	905815.9	7360747.5	Residential	2361	29	24	26	23	27	29	25
162	905805.9	7360697.5	Residential	2369	29	24	26	23	27	29	25



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
163	905789.9	7360563.3	Residential	2385	29	24	26	23	27	29	25
164	905647.9	7360456.6	Residential	2532	28	23	25	22	26	28	24
165	904710.2	7361110.8	Residential	3497	24	18	22	18	22	25	20
166	907827.4	7361055.3	Residential	497	47	47	42	45	47	45	45
167	908158.5	7361194.6	Residential	367	50	52	45	49	51	48	49
168	907393.0	7363093.6	Residential	2267	29	24	27	24	27	29	25
169	908765.8	7362013.4	Residential	554	45	45	41	43	46	44	43
170	908343.5	7361565.2	Residential	512	46	47	42	44	47	44	45
171	909803.0	7362476.7	Residential	422	49	50	44	47	50	46	47
172	909479.5	7362752.0	Residential	843	41	39	37	37	41	39	38
173	909817.8	7362955.1	Residential	741	42	41	38	39	42	41	40
174	910066.7	7363124.7	Residential	705	43	42	39	40	43	41	40
175	910419.5	7362892.0	Residential	290	53	55	48	52	55	50	52
176	909120.7	7364602.9	Residential	2415	28	23	26	23	27	28	24
177	908982.0	7364781.3	Residential	2639	27	22	25	22	25	28	23
178	910212.3	7363604.1	Residential	937	39	38	36	36	39	38	37
179	910664.0	7363356.7	Residential	440	48	49	44	46	49	46	46
180	910741.4	7363959.7	Residential	845	41	39	37	37	40	39	38
181	911013.4	7364092.6	Residential	798	41	40	37	38	41	40	39
182	910944.8	7364600.5	Residential	1253	36	33	33	32	35	35	33
183	913191.8	7363731.6	Residential	925	40	38	36	36	39	38	37
184	911813.6	7367043.0	Residential	2489	28	23	26	23	26	28	24
185	911704.5	7367715.1	Residential	3090	26	20	23	20	23	26	21
186	914653.0	7367199.3	Residential	802	41	40	37	38	41	40	39
187	914872.2	7367120.3	Residential	593	45	44	40	42	45	43	43
188	916755.9	7365145.5	Residential	1948	31	27	28	26	29	31	27
189	916720.3	7365462.8	Residential	1674	33	29	30	28	31	32	29
190	916562.9	7365320.1	Residential	1695	33	29	30	28	31	32	29
191	916459.9	7365671.0	Residential	1349	35	32	32	31	34	34	32
192	916262.5	7365913.2	Residential	1036	38	36	35	35	38	37	35
193	915636.3	7367079.7	Residential	218	56	59	51	56	58	53	56
194	915902.1	7368242.2	Residential	1144	37	35	34	33	37	36	34
195	916224.8	7367705.8	Residential	523	46	46	42	44	47	44	44
196	916427.5	7367677.8	Residential	424	49	49	44	47	50	46	47
197	917663.9	7367764.3	Residential	499	47	47	42	44	47	45	45
198	917794.1	7367930.9	Residential	566	45	45	41	43	46	43	43
199	917601.4	7366681.2	Residential	317	52	54	47	51	53	49	51
200	917511.4	7366954.8	Commercial	318	52	54	47	51	53	49	51
201	917555.9	7364750.3	Residential	2446	28	23	26	23	26	28	24
202	917963.3	7364636.4	Residential	2495	28	23	26	23	26	28	24
203	918265.9	7365808.3	Residential	1302	36	33	32	31	35	35	32



Receptor ID	UTM X Co-ordinate	UTM Y Co-ordinate	Receiver Type	Distance to GTP Alignment	Predicted Noise Level LA10 (dBA) for the Construction of the Mainland Gas Transmission Pipeline						
					Stage 1	Stage 2A	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
204	918040.0	7364353.6	Residential	2772	27	21	25	21	25	27	23
205	918505.1	7364753.2	Residential	2316	29	24	26	24	27	29	25
206	918663.2	7365252.6	Residential	1804	32	28	29	27	31	31	28
207	918626.3	7365552.7	Residential	1508	34	30	31	29	33	33	31
208	918547.0	7364098.5	Residential	2964	26	20	24	20	24	26	22
209	918884.4	7366716.0	Residential	329	52	53	47	50	53	49	50
210	918645.6	7363942.0	Residential	3111	25	20	23	20	23	26	21
211	918801.3	7363026.6	Residential	3825	23	16	21	17	21	24	18
212	918793.5	7363077.6	Residential	3790	23	17	21	17	21	24	19
213	918627.6	7363233.7	Residential	3780	23	17	21	17	21	24	19



Mainland GTP EM Plan

- Construction Plant Item
- LA10 (dBA)
 - 30
 - 35
 - 40
 - 45
 - 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
 Grid Noise Map: SLR Consulting, March 2011.
 Construction Plant Item: SLR Consulting, March 2011
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Camp Construction Stage 1 Clear and Grade Appendix H8

Date: 04/03/2011

Version: 0

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Map by: MR
 Prediction are for generic open flat ground.
 Aerial Image is an example only.

Grid at 500m x 500m

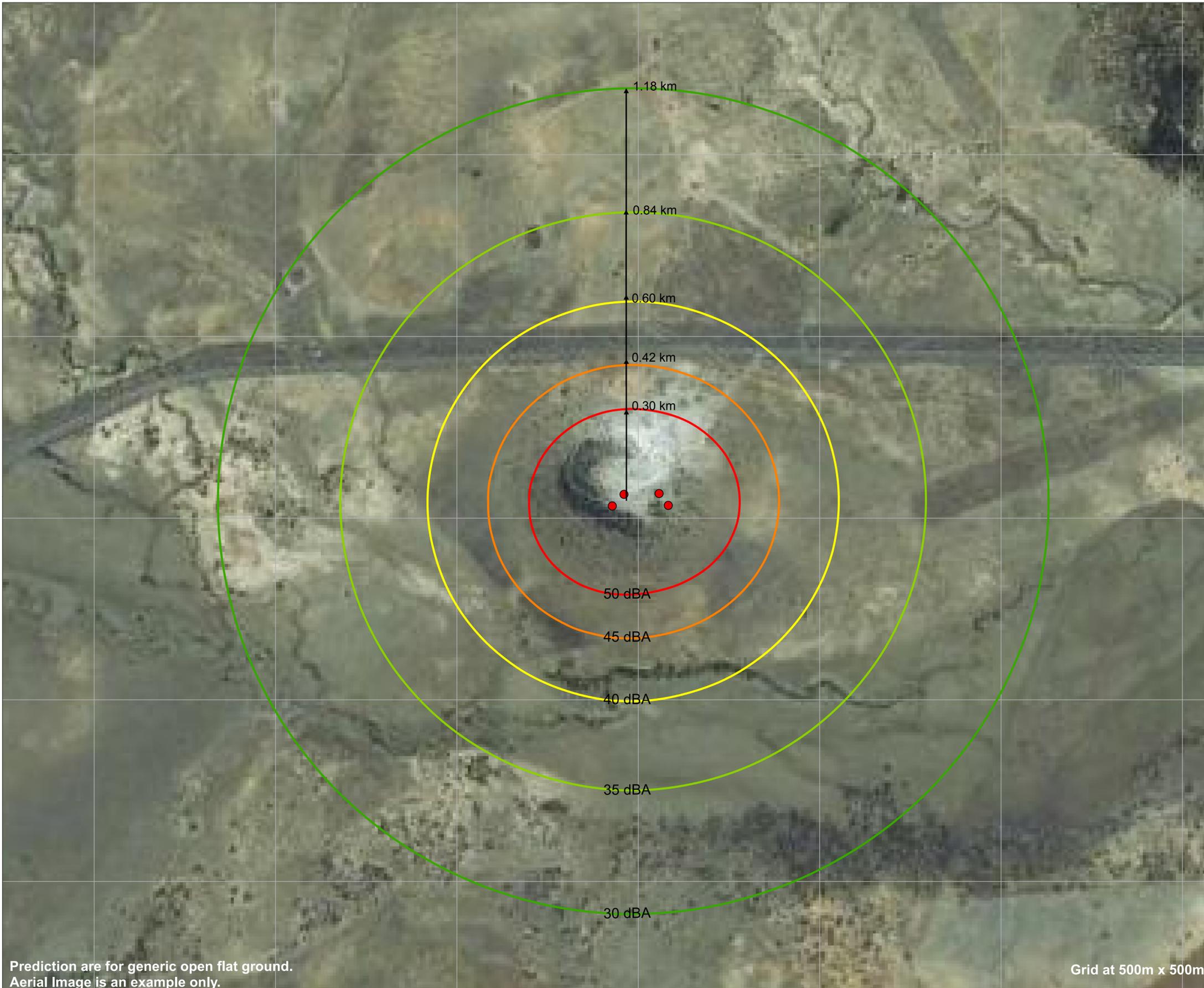


GLNG No:
 Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Construction Plant Item
- LA10 (dBA)
 - 30
 - 35
 - 40
 - 45
 - 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

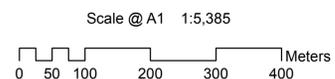
Source:
 Grid Noise Map: SLR Consulting, March 2011.
 Construction Plant Item: SLR Consulting, March 2011
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Camp Construction Stage 2 Surface Gravelling Appendix H8

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Map by: MR
 Prediction are for generic open flat ground.
 Aerial Image is an example only.

Grid at 500m x 500m



GLNG No:
 Coordinate system: MGA Zone 55

Date: 04/03/2011

Version: 1



Mainland GTP EM Plan

- Construction Plant Item
- LA10 (dBA)
 - 30
 - 35
 - 40
 - 45
 - 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

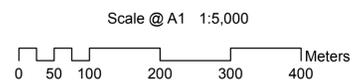
Source:
 Grid Noise Map: SLR Consulting, March 2011.
 Construction Plant Item: SLR Consulting, March 2011
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Camp Construction Stage 3 Installation of Prefabrication Units Appendix H8

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Map by: MR
 Prediction are for generic open flat ground.
 Aerial Image is an example only.

Grid at 500m x 500m



GLNG No:
 Coordinate system: MGA Zone 55

Date: 04/03/2011

Version: 0



Mainland GTP EM Plan

- Operation Plant Item
 - Vehicle Parking Movement
 - Camp Building
- LA10 (dBA)**
- 25
 - 30
 - 35
 - 40
 - 45
 - 50

Predictions at 1.5m above ground and assumes neutral weather conditions.

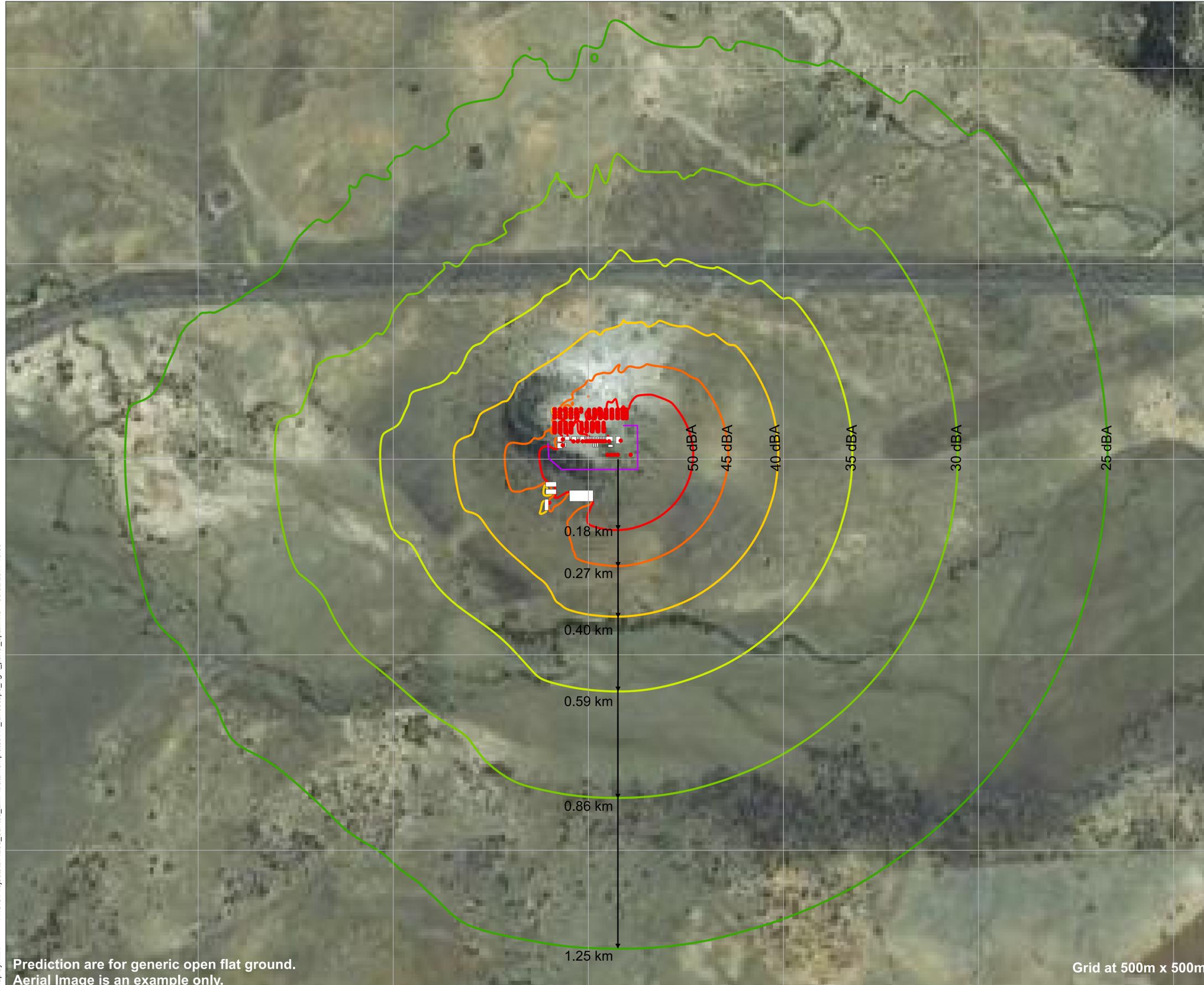
Source:

Grid Noise Map: SLR Consulting, March 2011.
 Operation Plant Item: SLR Consulting, March 2011
 Vehicle Parking Movement: SLR Consulting, March 2011
 Camp Building: SLR Consulting, March 2011
 Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Camp Operation Daytime Appendix H9

Date: 04/03/2011

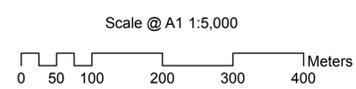
Version: 0



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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m

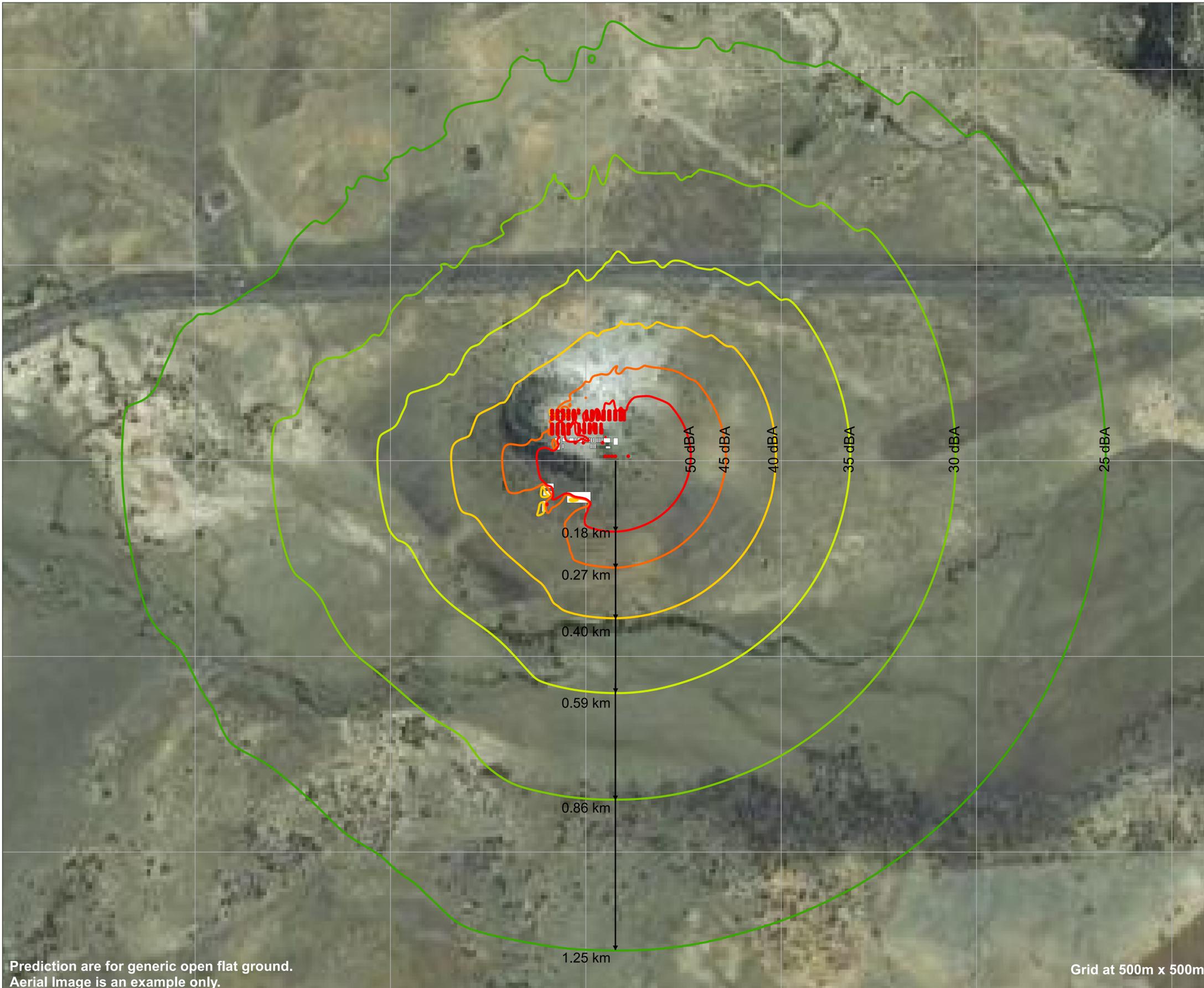


GLNG No:
Coordinate system: MGA Zone 55



Mainland GTP EM Plan

- Operation Plant Item
- Camp Building
- LA10 (dBA)
 - 25
 - 30
 - 35
 - 40
 - 45
 - 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
Grid Noise Map: SLR Consulting, March 2011.
Aerial image from Google Earth.

Predicted Noise Contours (LA10) Construction Camp Operation Night time Appendix H9

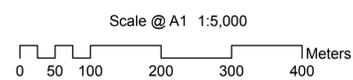
Date: 14/03/2011

Version: 1

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Map by: MR

Prediction are for generic open flat ground.
Aerial Image is an example only.

Grid at 500m x 500m



GLNG No:
Coordinate system: MGA Zone 55

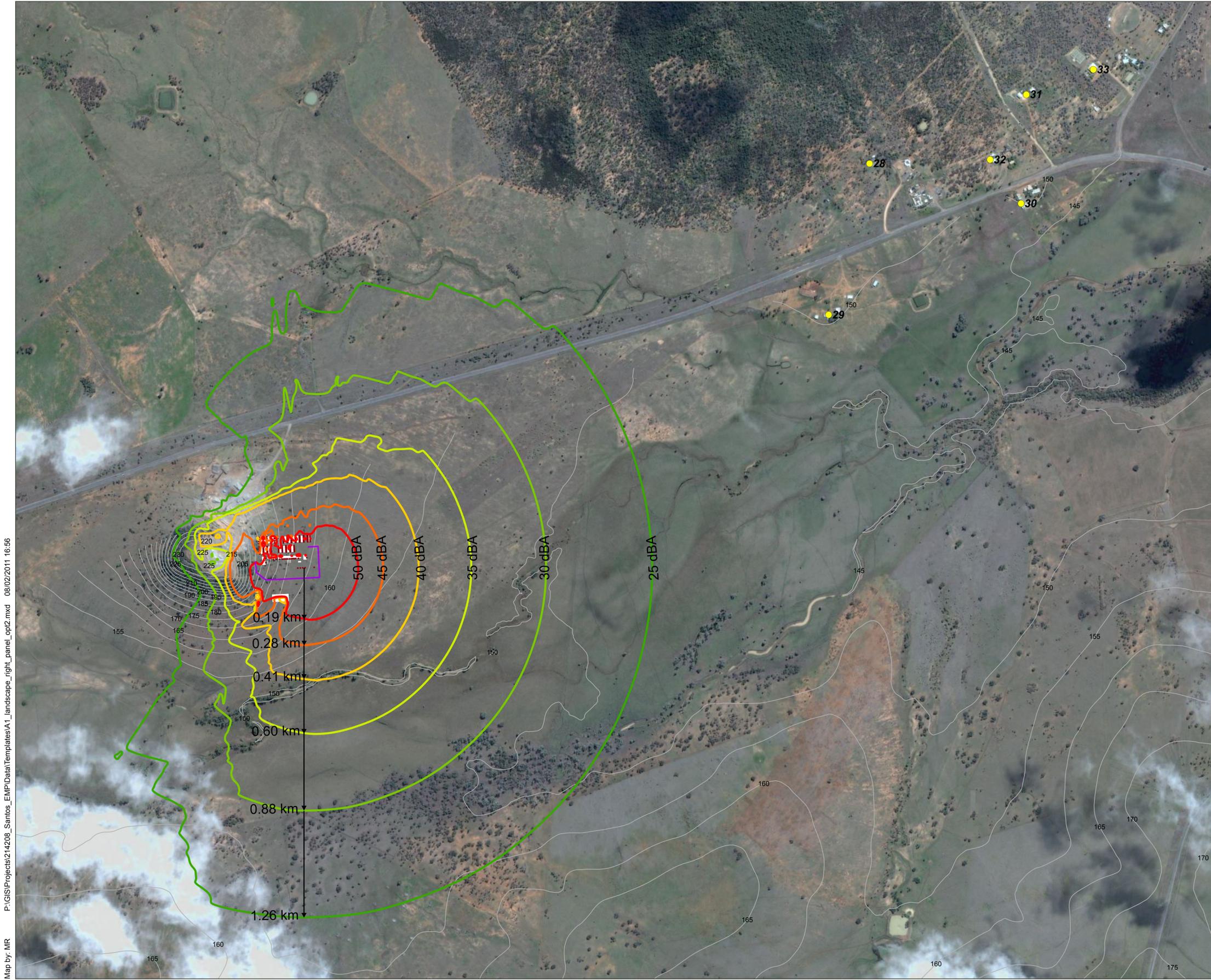


Bauhinia GTP EM Plan

- Camp Building
- Operation Plant Item
- Vehicle Parking Movement
- Contours - 5m

LA10 (dBA)

- 25
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
 Topography: Santos, Feb 2011.
 Grid Noise Map & Model Elements: SLR, March 2011.
 Sensitive Receivers: SLR, March 2011.
 Aerial Image: Bing Maps Aerial, via ArcGIS Web Service.

DRAFT

Predicted Noise Contours (LA10) Bauhinia 3D Noise Modelling Construction Camp Operation Daytime Appendix H10

Date: 10/03/2011

Version 0

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Map by: MR



A1 scale: 1:7,000
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GLNG No:
 Coordinate system: MGA Zone 55

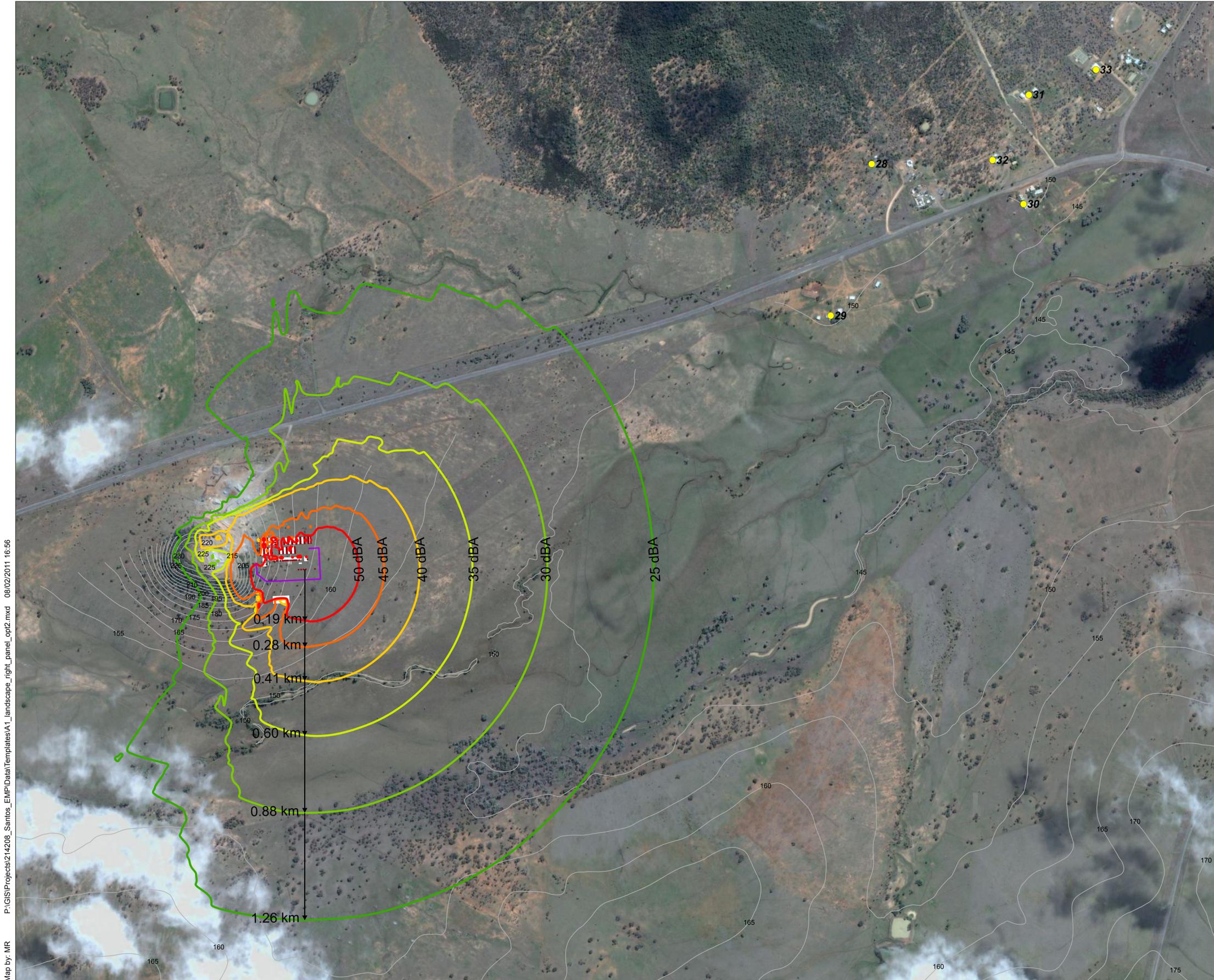


Bauhinia GTP EM Plan

- Camp Building
- Operation Plant Item
- Vehicle Parking Movement
- Contours - 5m

LA10 (dBA)

- 25
- 30
- 35
- 40
- 45
- 50



Predictions at 1.5m above ground and assumes neutral weather conditions.

Source:
 Topography: Santos, Feb 2011.
 Grid Noise Map & Model Elements: SLR, March 2011.
 Sensitive Receivers: SLR, March 2011.
 Aerial Image: Bing Maps Aerial, via ArcGIS Web Service.

DRAFT

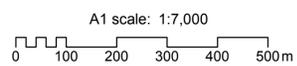
Predicted Noise Contours (LA10) Bauhinia 3D Noise Modelling Construction Camp Operation Night-time Appendix H10

Date: 10/03/2011

Version0

P:\GIS\Projects\214208_Santos_EMP\Data\Templates\A1_landscape_right_panel_opt2.mxd 08/02/2011 16:36

Map by: MR



GLNG No:
 Coordinate system: MGA Zone 55