Australia Pacific LNG Project

Volume 5: Attachments

Attachment 9: Preliminary Site Investigation - Land Contamination Report - Pipeline

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Executive summary

Assessment of potential existing contamination

An assessment of potential existing contamination along the gas pipeline route has been undertaken by means of a Preliminary Site Investigation (PSI). The methodology of this PSI generally relied on a review of 2009 satellite imagery that covered the length of the proposed pipeline route. A 200m wide corridor was assessed along this route which defined the boundary of the study area. This approach was approved by the Department of Environment and Resource Management (DERM).

The findings from the PSI revealed that the majority of the proposed pipeline route was within a defined 'tick-infested zone', as established by the Department of Education and Economic Development and Innovation (DEEDI). The declared tick-infested zone included that section of the pipeline route from Taroom to Gladstone. A tick-free zone generally extends from Miles to Taroom (i.e. the southern section of the proposed route).

Given the rural setting of the study area and the identified 'tick-infested zone', the investigations conducted for the PSI focussed on the possible presence of cattle dips and spray races. Consideration was also given to the identification of other notifiable activities during the review of satellite imagery such as waste dumps, service stations, mines, railway yards, scrap yards and crop fields. In addition, likely locations of notifiable activities were also considered which included commercial/industrial areas, workshops, timber yards and disturbed ground.

Based on the results of the site history review, the following details were identified within the 200m pipeline corridor:

- One potential waste dump located within the road easement of the Warrego Highway.
- Lot 5 DW390 which contains a suspected waste dump and a former dip.
- Lot 4 CTN406 which contained a disused dip, which was confirmed by site inspection.
- Lot 3 DW464 which contains a dip.
- Lot 9 DW19 which contains a former dip and current dip.
- Lot 9 SP200837 which contains a suspected dip or spray race..

The primary hazardous contaminants of concern associated with these potential sources may include heavy metals, hydrocarbon compounds, arsenic and pesticides.

The sites identified above (as well as other unforseen sites that may be identified in subsequent preliminary stages of the Project) may need to be investigated further by conducting subsurface investigations. These investigations would need to satisfy DERM requirements as well as adhering to State and Federal guidelines. These investigations would also need to be undertaken by a person that is suitably qualified under Section 381 of the *Environmental Protection Act 1994* (EP Act). Any notifiable activities or contamination from hazardous contaminants that are identified on land where Australia Pacific LNG is the land manager, require DERM to be notified, in accordance with Section 371 of EP Act. Where construction activities encounter unforeseen contamination from a hazardous contaminant or a notifiable activity, then all construction activities must cease and an investigation is undertaken to determine the nature and extent of the contamination. If necessary, strategies are developed to manage or remediate the impacted area.

Management and/or remedial strategies are to be developed if construction activities are likely to disturb contaminated areas. Remedial measures should be carried out to the extent practicable to

minimise adverse environmental or human health impacts that could result during subsequent construction, commissioning, operations and reinstatement works. The remediation strategies required will depend upon the nature and extent of contamination identified, but may include removal of contaminated soil and validation samples of the remaining soils to confirm that hazardous materials have been removed. Further comments about likely remediation and management strategies are provided in Section 6 of this report.

Contamination due to project activities

A risk assessment was carried out to identify activities that could potentially cause land contamination during construction, commissioning, operation and decommissioning activities. Risks identified that could potentially change soil or groundwater chemistry include leachate from waste, chemicals and fuel spills, fires involving structures or liquids, groundwater from extraction or construction dewatering, and water from hydro-testing. Acid sulphate soils have not been addressed in this report but have been discussed in a separate technical report on geology, topography, geomorphology and soils prepared by WorleyParsons (WorleyParsons, 2010a).

This report includes recommendations to reduce potential exposure to the environment from sources of contamination as well as measures to remediate areas where land contamination occurs. Measures to protect the land from contamination include:

- Storing waste in impermeable containers or in lined bunds.
- Water and hydro-test water should be managed in accordance with the mitigation and management measures described in the water resources technical report (WorleyParsons, 2010b).
- Leachate collected in sumps and disposed by a licensed operator.
- Storing chemicals and fuels within designated stores. These stores, as well as maintenance and refuelling areas, should have low permeability floors and secondary containment and well designed transfer stations to prevent releases to the environment.
- Aboveground storage tanks used for fuel storage should include concrete or alternative impermeable bunds to contain spills and leaks.
- Records of maintenance services and inspections of plant.
- Appropriate spill kits specific to the activity should be available and staff should receive training on how to use the kits.

Further comments about mitigation measures and remediation requirements are provided in Section 6. It is expected that the environmental impacts of proposed construction and operations will not lead to any contamination due to sound construction processes and the standards of operations that will be applied. Where construction may impact on previously contaminated land, prior investigation of suspect areas will delineate the extent and nature of contamination to ensure proper management systems can be implemented to safely complete construction. If remediation of contamination is required, an improvement of environmental values would result and could contribute to offsets. Therefore no significant impacts to land status should be experienced in relation to gas pipeline activities.

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1. Introduction

The Project comprises the further development of Australia Pacific LNG Pty Limited's (Australia Pacific LNG) Coal Seam Gas (CSG) fields in southern and central Queensland, the establishment of a major gas transmission pipeline and a Liquefied Natural Gas (LNG) plant, with ancillary marine and on-shore facilities within the Gladstone State Development Area at Laird Point, Curtis Island.

Australia Pacific LNG commissioned WorleyParsons to carry out a Preliminary Site Investigation (PSI) for the proposed gas pipeline, which extends from Miles to Curtis Island in Gladstone, Queensland (the study area). The location of the proposed pipeline is shown on Figure 1. This report also discusses suitable measures for preventing and managing land contamination due to gas pipeline activities.

1.1 Project and study areas

The proposed pipeline is approximately 450km long and extends from Miles to the shoreline of Curtis Island in Gladstone, Queensland (refer Figure 1). The study area for the PSI was a 100m wide corridor at either side of the pipeline (i.e. 200m wide corridor). Proposed construction camp sites, lay down areas and scraper locations associated with the works were also considered (refer Figure 1).

The rationale for establishing a 200m wide corridor was to target those areas where construction activities had the potential to disturb land, given possible minor pipeline route deviations as part of the route assessment process. The width likely to be affected by the pipeline construction is only 40-50m.

A primary risk to the Project is to knowingly disturb hazardous materials, which could result in potential harm to the environment or human health. Similarly, the rationale for investigating construction camps and laydown areas was that site stripping and changes to site drainage could potentially disturb pre-existing soil contamination. It was also important to assess the potential for contamination within these areas due to the possible exposure of contamination to workers.

This report also considers the possible contamination of land resulting from the gas pipeline activities. Potential impacts from gas pipeline construction, commissioning, operations and remediation were considered for not only the study area for the PSI but also other areas that could be potentially impacted by gas pipeline activities. These areas include transport routes surrounding the study area, quarries, local creeks and areas where associated water may be released, such as farm dams and paddocks.

1.2 Purpose of the PSI

The purpose of the PSI was to:

- Assess the potential occurrence of land contamination that may be present within the study area due to current site uses
- Determine the nature of probable contaminants
- Determine the location of possible contamination
- Recommend measures to prevent land contamination and the management for land contamination arising out of gas pipeline activities.

Due to the size and sensitivity of undertaking soil sampling within grazing and farming properties (i.e. no landholder access agreements were obtained to allow contaminant sampling to be undertaken), the

PSI was based upon a desktop study although limited field reconnaissance was undertaken (refer Section 2.2.4). This approach was accepted by Department of Environment and Resource Management (DERM).

It was determined that, at the commencement of this PSI, should the desktop study identify areas of potential contamination within areas of proposed major development, then subsequent Stage 2 investigations would be undertaken, as applicable, prior to the construction phase to determine the nature and extent of any identified contamination. Based on these investigations, remedial options and management of contamination can then be assessed to determine the most appropriate mitigation measures. This staged approach is in accordance with former Department of Environment (DoE) *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (draft DoE guidelines) dated May 1998.

1.3 Scope of work

The scope of work was aimed at addressing the required tasks of a PSI, as detailed in the Project's Terms of Reference (TOR) dated December 2009. The scope of work included the following:

- Identifying land used for a Notifiable Activity as listed in Schedule 3 of the EP Act and land which is listed on the Queensland Environmental Management Register (EMR) or the Queensland Contaminated Land Register (CLR) [refer to Section 1.4.1 for a description of the EMR/CLR].
- Identifying potentially contaminated land not listed within the EMR/CLR, which may require management or remediation.
- Conducting a PSI consistent with draft DoE guidelines and other applicable guidelines and standards to determine background contamination levels.
- Conducting a Preliminary Site Investigation (PSI) consistent with the draft DoE guidelines dated May 1998 and other applicable guidelines and standards.
- Recommending means of preventing land contamination (within the meaning of the *Environmental Protection Act 1994* (EP Act) and managing any contamination of land that may arise from construction, commissioning, operation and decommissioning of the pipeline.

Tasks not undertaken for this study included the following:

- Determining past land uses based on information provided by current landholders as landholder interviews were not able to be undertaken by WorleyParsons. It is envisaged that landholder interviews will be conducted, where possible, for those properties identified by the PSI as a potential concern.
- Historical land title reviews as there were no notifiable activities confirmed by EMR/CLR searches. Historical land title reviews may be conducted at a later stage for those properties identified by the PSI as a potential concern and therefore require subsequent Stage 2 investigations and potentially listing on the EMR or CLR.
- Reviewing historical aerial photographs as it was not practical given the number of properties located along the full gas pipeline corridor and the relatively short project timeframe.
- Site inspections and background contaminant sampling as land access was not available.
- Carrying out Stage 2 investigations, where applicable, as contaminant sampling was not able to be undertaken. Investigations should be undertaken to determine background contaminant

concentrations as well as the nature and extent of soil contamination in accordance with the stages outlined in Appendix 5 of the draft DoE guidelines

- Describing a remediation and validation sampling plan where contamination has been identified and not remediated. As above (refer Section 1.2), this will be undertaken as required as part of subsequent Stage 2 investigations.

Should Stage 2 investigations be required, these would be undertaken during the supplemental Environmental Impact Statement (EIS) stage and should provide the necessary information to assess remediation and validation requirements as well the management of contaminated areas. These works will be conducted in accordance with draft DoE guidelines.

It is envisaged that the review of historical aerial photographs, land titles and interviews with landholders will be completed prior to or concurrently with subsequent Stage 2 investigations. Site inspections will only be conducted where land access has been approved by the landholder, and interviews with landholders will be conducted where possible.

1.4 Legislation

This PSI report is a supporting document for the Australia Pacific LNG EIS. The PSI process is regulated by the EP Act. The primary objectives of the EP Act is to protect environmental values and human health whilst allowing developments that improve the total quality of life both now and in the future in a way that maintains ecological processes. The requirements of the EP Act are administered by DERM; formerly the Environmental Protection Agency (EPA).

1.4.1 Guidelines and standards

DERM maintains databases of confirmed contaminated and potentially contaminated sites in Queensland . Potentially contaminated sites for these purposes are those that have had one or more notifiable activity carried out on the land. Notifiable activities are listed in Schedule 3 of the EP Act. Land presently or formerly used for a notifiable activity or land that is confirmed to be contaminated is recorded on the EMR. Land that is proven to be contaminated and has the potential to cause serious environmental harm is recorded on the CLR.

The guidelines and standards that were followed during the PSI included the following:

- AS4482.1-2005 *Guideline to the investigation and sampling of site with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds*
- DoE draft guidelines
- National Environment Protection (*Assessment of Site Contamination*) Measure 1999 (NEPM) Schedule B(1) *Guideline on the Investigation Levels for Soil and Groundwater*, dated 1999.

The methodology used as part of the PSI, which generally followed the above guidelines and standards, is provided in Section 2.

2. Methodology

PSIs are generally based upon desktop information and are often supported by limited sampling and analysis. This PSI was based on a desktop study which was an appropriate and practicable approach for the Project's initial stage of development approval. This approach was appropriate given the scale of the study area and that the pipeline will primarily cross rural areas, which are conducive to being investigated by a desktop study. This approach was also considered appropriate as there will be an opportunity to undertake further investigations of potentially contaminated areas once the detailed pipeline alignment has been confirmed prior to final design.

No soil sampling and analysis was undertaken for this PSI due to the complexity of undertaking field studies within a remote 450km pipeline route that was mainly located on private properties. In addition, there were no landholder access agreements in place at the time of this PSI. Furthermore, the pipeline alignment is subject to ongoing review, with minor realignments necessary to take account of local factors. Soil sampling should be undertaken to allow the detailed pipeline alignment to be confirmed.

The approach for conducting the PSI therefore required modification from the aforementioned guidelines and standard (refer Section 1.4.1). A draft methodology was forwarded to the DERM for review and agreement for the approach was subsequently obtained. A summary of the methodology is described below.

2.1 Site history

The focus of the site history was to target land parcels (registered lots) where major land disturbances from pipeline construction activities were proposed. This included eight construction camp sites, six laydown areas and two scraper stations and a 200m wide pipeline corridor study area.

2.1.1 Interviews with landholders

Landholder interviews were undertaken by Australia Pacific LNG staff. The interviews were required for obtaining permission to access land. During the interviews, Australia Pacific LNG asked questions about land use and, in particular, if notifiable activities occurred on their property, such as fuel storage and use of cattle dips and spray races. Not all land owners affected by the proposed pipeline were interviewed.

2.1.2 Historical land titles

A historical land title review was not conducted for any property as there were no lots listed on the EMR or CLR. A historical land title review would be completed prior to subsequent Stage 2 investigations that will be undertaken for those properties that have been identified by this PSI as a potential concern. This approach was in agreement with the DERM-approved methodology.

2.1.3 Department of Employment Economic Development and Innovation (DEEDI)

DEEDI was contacted to identify cattle tick free and non-free zones within the study area and to obtain information about historical cattle dips, sprays races and pesticide use within the study area. DEEDI has created a map showing areas of cattle tick free zones, controlled zones and infested zones for

Queensland, which was reviewed as part of this PSI. Interviews were also conducted with livestock inspectors from DEEDI.

2.2 Existing environment

2.2.1 Topography and geology

Information on topography and geology has been summarised from WorleyParsons' technical studies completed for the EIS (WorleyParsons, 2010a).

2.2.2 Hydrogeology and groundwater quality

Hydrogeology and groundwater quality have been summarised from WorleyParsons' technical studies completed for the EIS (WorleyParsons, 2010b).

2.2.3 Regional aquifer data

A review of the Queensland Department of Mines and Groundwater Resource map (Map 4, dated 1987, 1:250,000 series) provided information about aquifer characteristics within the study area.

2.2.4 Site inspections

No specific site investigations were conducted for this PSI because of project timeframes. Other studies that were able to conduct inspections along the proposed pipeline route included flora and fauna surveys, soil/geology/topography assessment and aquatic ecology investigations. Findings from those inspections were reviewed, where appropriate. Liaison with these study teams was undertaken to ascertain whether possible contaminated land had been noted during their field investigations. These field studies covered many of the road accessible areas of the study area, with a focus on areas of significant vegetation and water courses.

2.2.5 Aerial photography and satellite Imagery

A review of 2009 low-level aerial photography and 2007-2008 satellite imagery (i.e. Google Earth) was undertaken for the entire study area. The quality of the satellite imagery was used to identify site features along the majority of the pipeline route, however the 2009 aerial photography was not clear and therefore not relied upon. Specific site features that were considered sources of potential hazardous contaminants included:

- Cattle yards with associated dips and spray races
- Waste disposal areas (dumps)
- Mechanical workshops and service stations
- Quarries and mines
- Commercial/industrial sites
- Railway and timber yards
- Scrap yards and crop fields
- Disturbed ground.

There was a section along the pipeline route where the satellite imagery was not clear, which made it difficult to assess land features. This was a 120km stretch that extended south from Taroom to Miles as shown on Figure 1. The limitation of not being able to obtain clear images in this area has been addressed in the recommendations provided in Section 7.2.

2.2.6 EMR/CLR

EMR/CLR searches were conducted on lots that were identified from satellite imagery as having site features that suggested notifiable activities and/or that hazardous contaminants may be present within the study area.

2.3 Environmental impact assessment

An assessment was undertaken in relation to the potential environmental impacts of potential pre-existing contamination. The approach involved identification of the key impact mechanisms and possible impacts associated with each mechanism, followed by a qualitative risk assessment. Risk has been calculated in accordance with AS/NZS ISO 31000-2009 *Risk management - Principles and guidelines*.

The project risk matrix and criteria for likelihood and consequence were used in the calculation of risk and are contained in Volume 1, Chapter 4 of the EIS.

The identification of impacts, risks and mitigation measures will be relevant to the proposed construction facilities within the gas pipeline on the basis that construction activities could disturb pre-existing contamination that may result in a potential risk to human health and/or exacerbate impacts to the surrounding environment.

2.4 Project Impacts and Mitigation Measures

The methodology undertaken to assess impacts and mitigation measures associated with the existing environment, construction of facilities, commission stage, operation of facilities and decommissioning stage involved:

- Reviewing the findings of the desktop study
- Determining the receiving environment (receptors) which could be impacted by the activities
- Reviewing available information in relation to the construction, commissioning and operational processes and using experience and judgement to identify where potential environmental risk occurs.

3. Results - site history

3.1 Surrounding land use

A review of low-level satellite imagery indicated that the selected pipeline route passed through mainly undeveloped land and pastoral land that was used for livestock grazing. Agricultural land use (mainly broad acre cropping) was also present and more prevalent in the northern half of the study area, which was probably related to improved climate conditions. There were farms where the proposed pipeline route passed directly through or adjacent to (i.e. within 100m) cropping fields and these areas have been identified within Figure 2.

In cropping areas, there is potential for the presence of fertilisers, herbicides, and insecticides. It is considered unlikely that these contaminants would be present in concentrations that would exceed environmental or human health guidelines. Therefore, these areas represent a low risk of containing hazardous concentrations of contaminants and therefore are not considered a major concern.

The proposed pipeline route does not pass through developed areas such as industrial, mine or quarry sites. One proposed construction camp site (approximately 15ha in area) is approximately 50km south of Taroom (refer Figure 1) and is adjacent to what may be a sand/gravel sales yard. This was not a major concern as sand and gravel is relatively inert and this type of activity is not likely to be a source of hazardous contaminants.

3.2 Landholder interviews

Information received from landholder interviews conducted by Australia Pacific LNG is summarised in Table 3.1.

Table 3.1 Summary of Landholder Interviews

Lot and Plan	Interview Notes
Lot 3 DW464	Cattle dip present which is regularly tested by Meat and Livestock Australia (MLA), which is part of the audit involved with his livestock production.
Lot 4 CTN406	No interview conducted
Lot 5 DW390	Cattle dip used on the property which has been converted into a more environmentally friendly treatment method
Lot 9 DW19	Cattle dip and a disused cattle dip exist. Disused dip has been decommissioned by concreting over.
Lot 9 SP200837	No interview conducted

Table 3.1 indicates that cattle dips operated or have operated on three properties where landholder interviews were conducted. As a result, Lot 3 DW464, Lot 5 DW390 and Lot 9 DW19 were used for the notifiable activity of livestock dip.

With regards to MLA, WorleyParsons conducted a follow-up interview to obtain more information regarding Lot 3 DW464, however a representative of MLA was not available for comment.

3.3 Cattle tick zones

DEEDI has created a map showing areas of cattle tick free zones, controlled zones and infested zones for Queensland. This map indicates that the majority of the study area is located in a designated tick-infested zone, which extends from Taroom to Gladstone. The tick-free zone extends from Taroom to Miles, which is at the southern most limit of the pipeline study area. The possible presence of cattle dips is in agreement with the findings from the interviews with landholders discussed in Section 3.2. The DEEDI map is provided in Appendix A. This map is also reproduced onto Figure 3 to Figure 7, which identify the locations of cattle yards and suspected cattle yards within the study area (based on satellite imagery).

Measures necessary to control cattle ticks are significant and the primary identified source of hazardous contaminants within the study area.

Livestock inspectors from DEEDI also provided the following information:

- Cattle yards and possibly spray races would have been present within the study area as this as known to be a tick-infested area.
- The oldest cattle dips would have been built in the 1920s and 1930s and arsenic would have been the primary insecticide used on stock. Both cattle and sheep dips would have existed during this period. Most of the older treatment areas would be unknown to land owners or would have been buried or dismantled over time.
- By the 1950s and 1960s, cattle dips and spray races were most common. Some farmers chose to hand spray insecticides on stock rather than use the conventional method. Organochlorine (OC) pesticides replaced arsenic during this period. OC pesticides were phased out of use by the 1970s and 1980s because of the toxic and persistent nature. OC pesticides were replaced by Organophosphate (OP) pesticides, which later were replaced by carbamates, amidines compounds and synthetic pyrethrins.
- Insecticides also would have been widely used for timber treatment for white ants and would likely to be present at stockyards and on any wooden structures present on farms and residences.

3.4 Topography

Topography of the gas pipeline corridor is detailed in WorleyParsons' soil, geology and topography technical report (WorleyParsons, 2010). The key findings of the technical report are described below.

The topography across the study area varies from predominantly flat or gentle undulating plains to mountains and hills with slopes greater than 50%. However the majority of the route traverses level to gently undulating plains and low hills with slopes less than 20%. Field assessments of the topography have generally confirmed these features.

There are also numerous water courses that traverse the gas pipeline corridor, many of which have steep banks. Of the 26 waterway crossings inspected during the field assessment, ten were observed to have a medium to high level of existing erosion. In most locations where there was no evidence of significant erosion, there was generally either good vegetation or outcropping rock.

3.5 Geology of the gas pipeline corridor

Geology of the gas pipeline corridor is detailed in WorleyParsons' soil, geology and topography technical report (WorleyParsons, 2010a). The key findings from the technical report are described below:

- The majority of the geology in the gas pipeline corridor comprise sedimentary rocks, including coal beds with more recent deposits of river alluvium in the low lying areas and adjacent to waterways.
- There are also mud flats near the coast near Gladstone. However, in the central region of the gas pipeline corridor, in the vicinity of the Banana and Auburn Ranges, there are granites and other igneous volcanics of the Connors-Auburn Province. Also, in the northern segment of the pipeline corridor there are volcanics associated with the Yarrol Province.

3.6 Hydrogeology

Hydrogeology of the gas pipeline corridor is detailed in WorleyParsons' water resources technical report (WorleyParsons, 2010b). The key findings from the technical report are described below.

A search of the DERM groundwater bore database for 5km either side of the proposed pipeline route revealed that the water level is generally greater than 5m below ground surface (mbgs) and mostly in the range of 10mbgs to 20mbgs. Exceptions to this are generally in the vicinity of major creeks and rivers, particularly Kroombit and Callide Creeks, where water levels may be less than 10mbgs.

Water quality along the pipeline route is predominantly in the range of 1000µS/cm to 2500µS/cm . Saline groundwater is anticipated as the pipeline corridor approaches 'The Narrows' due to the influence of sea water. The available groundwater bore data is summarised in Table 3.2.

No groundwater bore data was available in the search radius in the vicinity of:

- Calliope Creek at the Dawson Highway
- Cockatoo Creek
- Bungaban Creek
- Dogwood Creek
- Juandah Creek

Table 3.2 Summary of hydrogeological information at major creek crossings along the pipeline

Crossing location	No of bores	Water level (mbgl)			Electrical conductivity (µS/cm)			Yield (L/s)	
		Min	Max	Median	Min	Max	Median	Min	Max
Bell Creek @ Dawson Highway	9	15.45	6	9.6	650	1,260	815	0.38	2
Kroombit & Callide Creeks @ Burnett Highway	170	18.5	0.71	11.3	500	7,300	1925	0.01	46.6
Pump Creek	8	20.9	12	20.7	1,200	5,600	4,250	0.03	1.7
Cockatoo Creek	6	33	33	33	1,500	1,500	1,500	3.78	3.78

3.7 Regional aquifer data

References to the Queensland Department of Mines and Groundwater Resource map (Map 4, dated 1987, 1:250,000 series) indicated the following aquifer characteristics could be encountered within the study area:

Miles to Wandoan area

- Bore yield - <5 litre per second
- Salinity – 500 to 1,500mg/L
- Suitability – suitable for most purposes. Marginal for human consumption and low salt tolerant crops.

Wandoan to Cracow area

- Bore yield – 5 to 15 litre per second
- Salinity – about 500mg/L
- Suitability – suitable for most uses

Cracow to Gladstone area

- Bore yield - <5 litre per second
- Salinity – 1,500mg/L to 5,000mg/L
- Suitability – suitable for most stock uses and some domestic uses

4. Results – existing environment

4.1 Satellite imagery review

Low-level satellite imagery was used to identify possible contaminated sites such as waste dumps, backyard workshops and cattle yards along the length of the study area.

As noted within Section 2.2.5, the 120km stretch that extended south of Taroom to Miles was not able to be adequately assessed due to the quality of satellite imagery. It is possible that within this section of the study area, potential contaminated sites could be present within the 200m corridor and/or construction camp sites, laydown areas and scraper locations. This limitation has been addressed in the recommendations provided in Section 7.2.

The review of low level satellite imagery indicated that there were several cattle yards containing possible dips or sprays races located between 100m and 500m from either side of the proposed pipeline route, and hence beyond the study area. These potential contaminated sites have been omitted from this PSI on the basis that the 100m to 500m distances were beyond the limits that would be disturbed by pipeline construction activities.

The review of the satellite imagery identified six areas (i.e. Site 1 to Site 6) of potential concern which fell within the 200m wide pipeline corridor. These areas are identified on Figure 3 to Figure 7. The satellite images are also provided in Plates 3 to 8 below. The areas of potential concern included two potential waste dumps, three likely cattle yards with potential for cattle dips or spray races and one area of disturbed land, which appeared to be a former dam. The disturbed area could not be adequately assessed based upon satellite imagery and therefore could not be discarded as a non-concern without access to further data, particularly as the area was in a designated tick-infested zone where dips and spray races were known to exist. Five of these six locations, namely the waste dumps and the cattle dips/spray races are notifiable activities under the EP Act.

For proposed camp sites, laydown areas and scraper locations, the footprint of these areas varied from 1ha to 15ha, as shown in Figures. Site features within a distance of 50m from the perimeter of these areas were assessed for the potential presence of hazardous materials. There were no site features identified within a 50m distance from the perimeter of proposed construction camp sites, laydown areas or scraper station sites that were considered likely to contain hazardous contaminants.

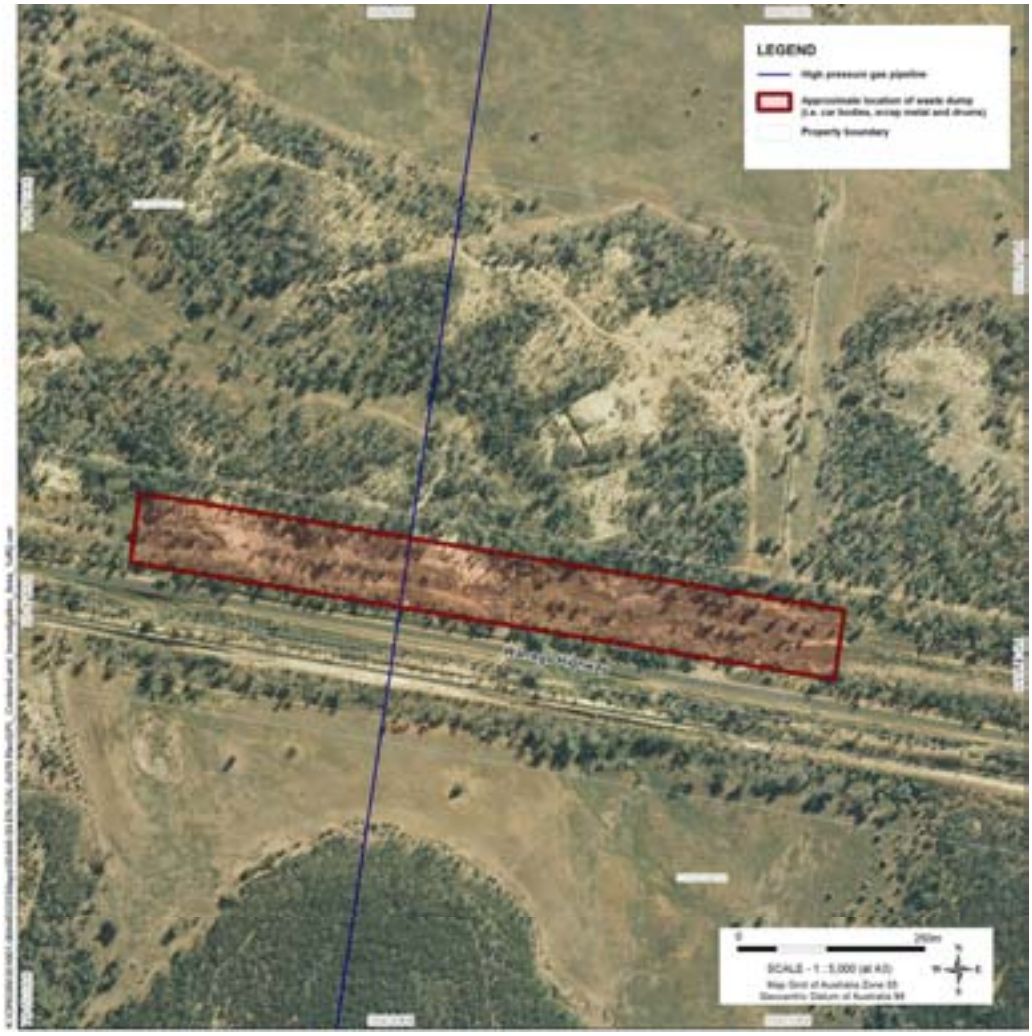

Plate 4.1 Waste dump located on road easement

Plate 4.2 Possible former cattle yard (Lot 3 on DW464)

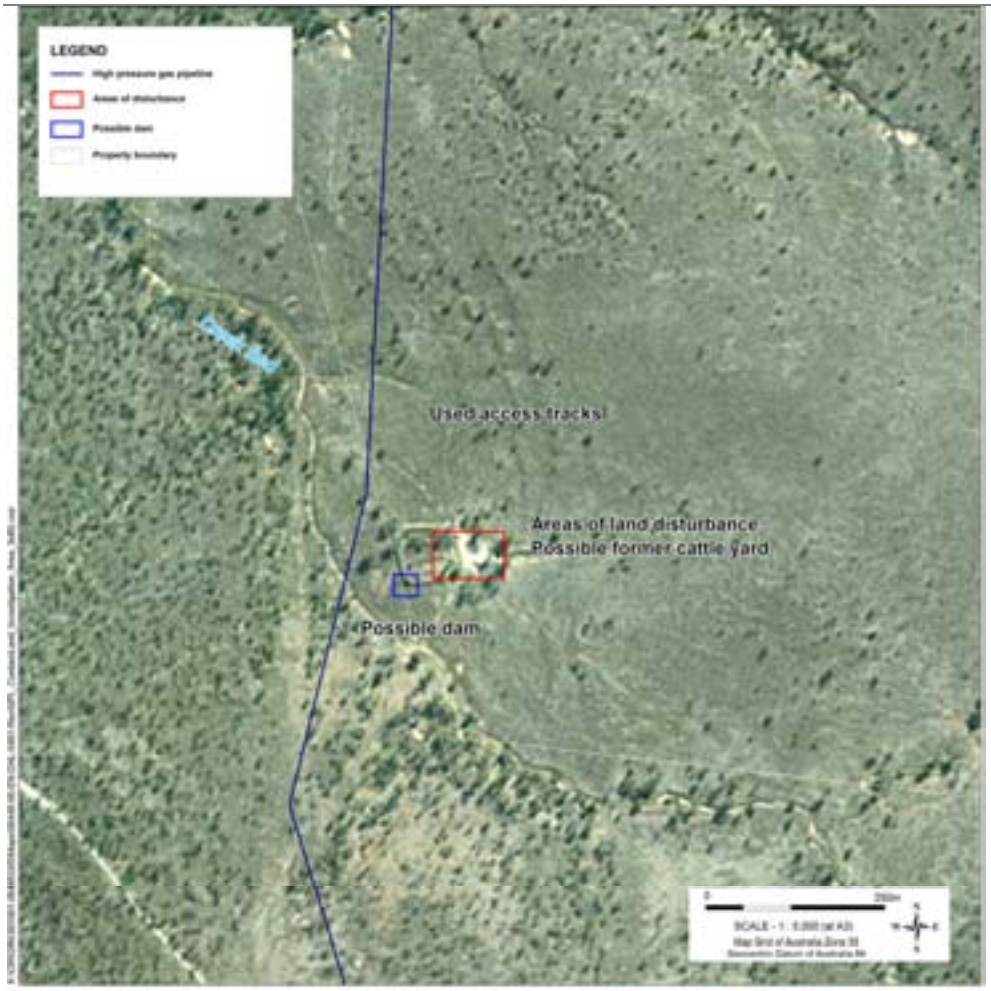

Plate 4.3 Disturbed land (possibly a former dam) [Lot 9 on DW19]

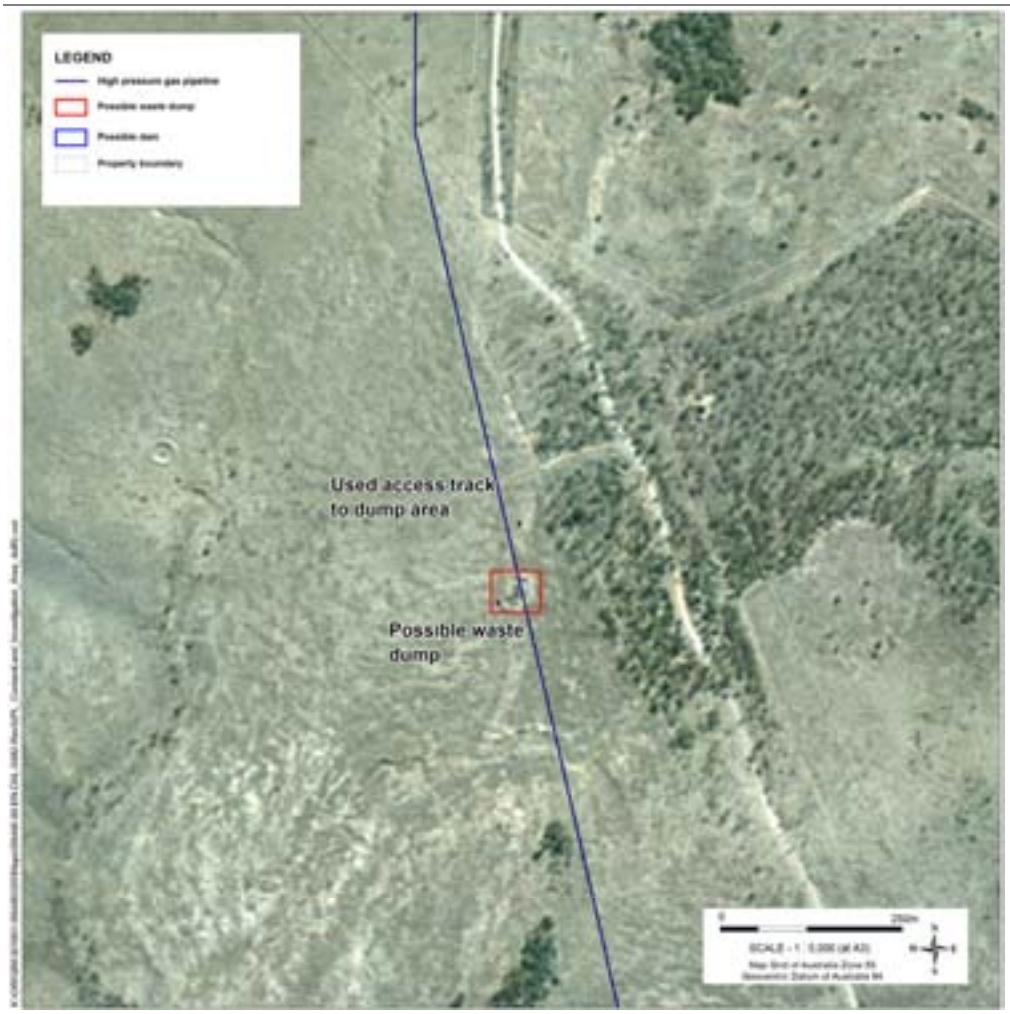

Plate 4.4 Possible waste dump (Lot 5 on DW390)

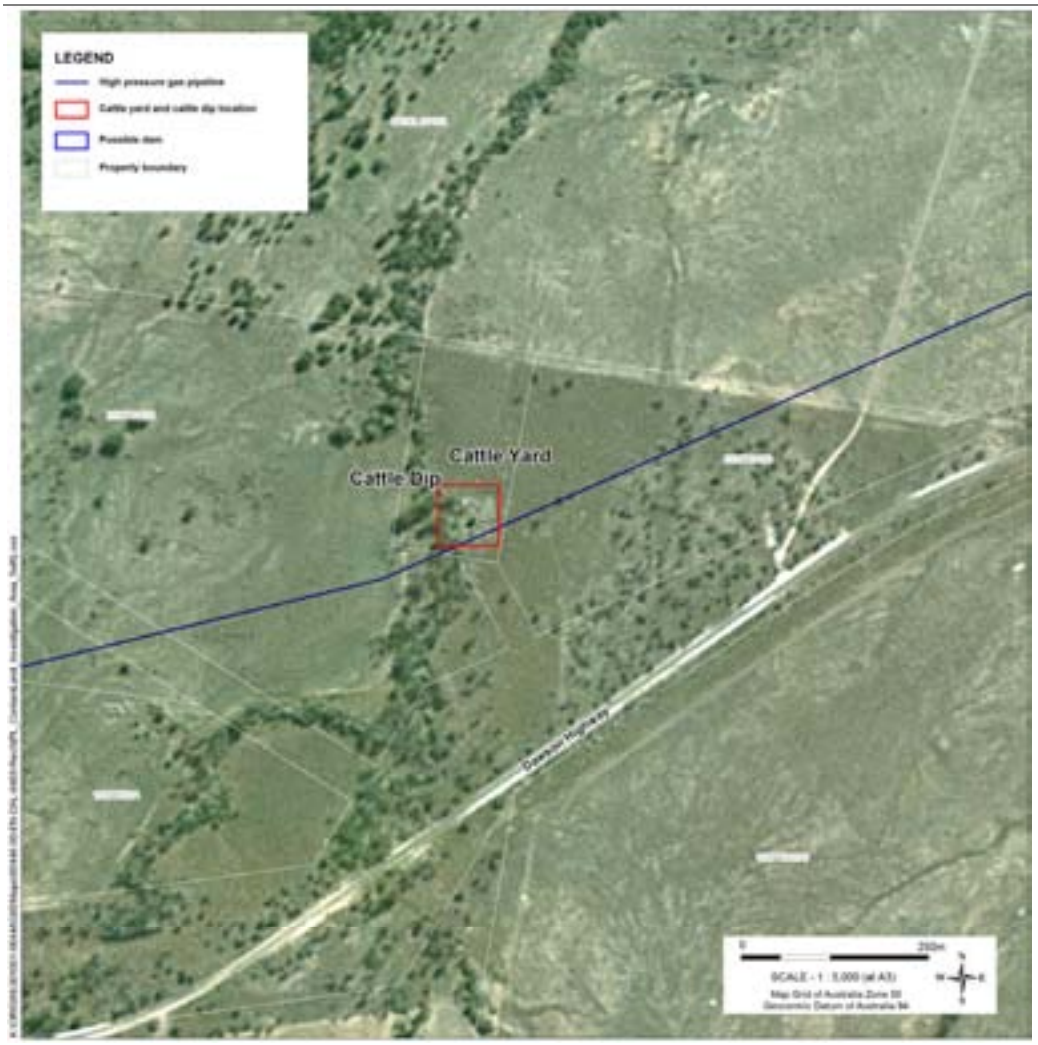

Plate 4.5 Cattle yard and dip (Lot 4 on CTN406)

Plate 4.6 Cattle yard and possible dip or spray race (Lot 9 on SP200837)

4.2 Site inspections

Potential contaminated sites were observed by field teams conducting other studies (flora and fauna surveys, soils/geology/topography and aquatic ecology investigations) for the EIS (refer Section 2.2.4). These potential contaminated sites included the waste dump identified in Section 4.1 located within the road easement at the northern side of Warrego Highway near Miles (refer Figure 3) and one cattle dip also identified in Section 4.1, located on Lot 4 on CTN406 (refer Figure 6). The photographs taken of these sites are identified on Plates 4.7 and 4.8 below. These sites are also discussed in Section 4.1.

As the cattle dip on Lot 4 on CTN406 was a notifiable activity, this lot was checked for a possible listing within the EMR/CLR and the result was negative. The road easement containing the dump was not a registered lot and subsequently no search for a possible listing within the EMR/CLR was possible.

Plate 4.7 Waste dump located on Warrego Highway road easement

This photograph identifies abandoned cars, scrap metal and drums which were dumped within the road easement off Warrego Highway near Miles (refer Figure 3). The area may be traversed by the proposed pipeline. The dump may span over 100m in length, however further assessment is required to confirm the extent of the affected area. It is likely that this area may have been used as a dumping ground for several years. A satellite image of this area is provided in Section 4.1.

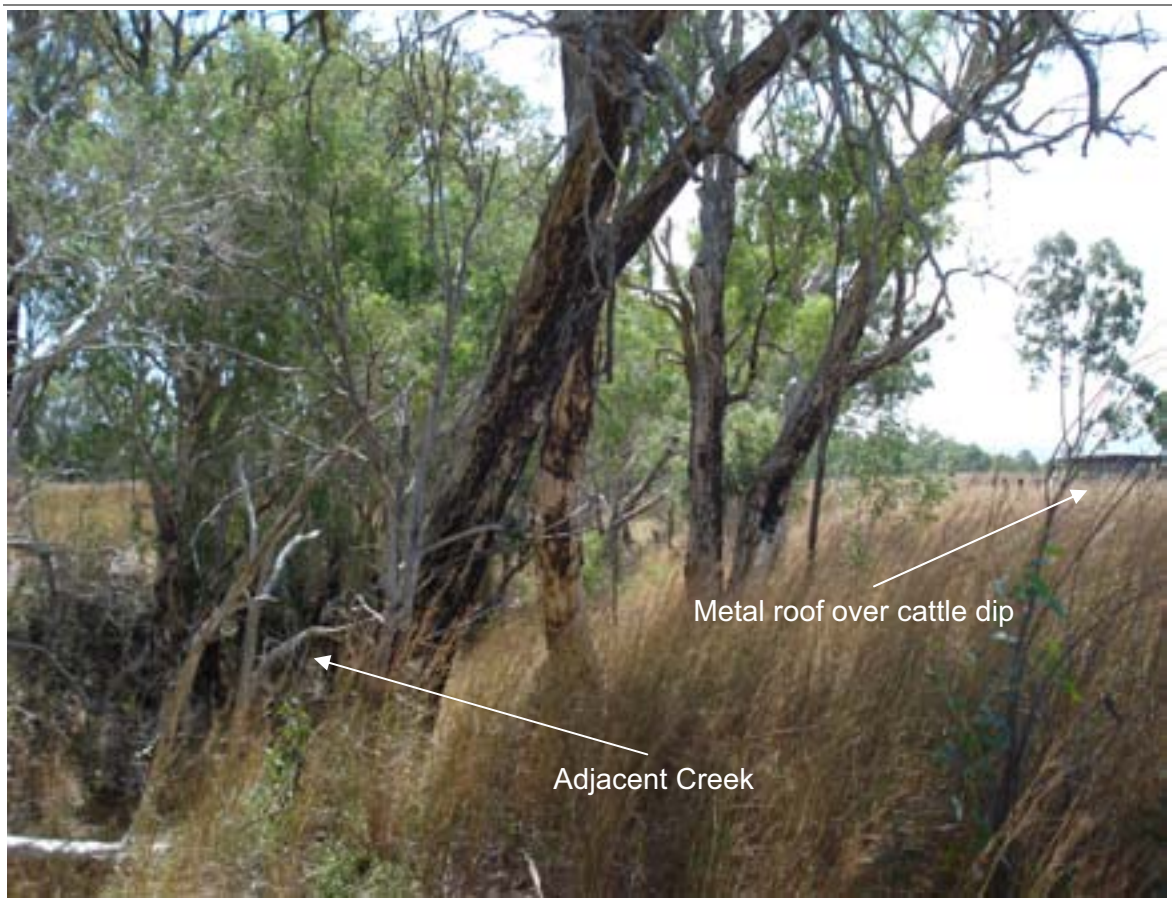

Plate 4.8 Suspected cattle dip, Lot 4 on CTN406

A suspected cattle dip was identified approximately 80m from the proposed gas pipeline, which was located within Lot 4 on CTN406 (refer Figure 6). Surrounding the dip was a cattle yard that contained several holding pens. A creek was also immediately south of the cattle yard. This would be the nearest receptor that could be affected by hazardous contaminants that are potentially present in and around the dip, such as arsenic and organochlorine pesticides. The dip was made of concrete and was filled with dark discoloured liquid and was sheltered by a rectangular roof. The dip did not appear to be in use. The brief site reconnaissance indicated there was no evidence of stressed vegetation beyond the dip.

4.3 EMR/CLR searches

A search of the EMR and CLR indicated that none of the five registered lots containing three potential cattle yards, one possible waste dump and a former dam, were listed for a notifiable activity. The sixth location was the waste dump located along the Warrego Highway and because the area was not within a registered lot, could not be searched for a listing on the EMR or CLR. The search results are provided in Appendix B.

5. Summary of potential existing land contamination

The study area consists mainly of remote rural land. The primary use of this land was pastoral and farming of crops. The primary concern regarding remote rural land was the dumping of waste materials within the study area and the use of cattle dips and spray races, as these could be sources of hazardous contaminants which have the potential to cause harm to human health and the environment.

5.1 Waste dumps

Two potential waste dump sites were identified within the study area. One area of waste dumping was confirmed by site inspection and was located within an unregistered road easement adjacent to Warrego Highway approximately 5km east of Miles. This area contained abandoned cars, scrap metal and drums. A Stage 2 investigation of this area will need to be conducted prior to the construction of the proposed pipeline.

The second area (Lot 5 DW390) was inferred by satellite imagery. Contaminants that could be associated with waste dumps may be wide ranging and further investigation would need to be undertaken to assess the contaminants of concerns that could be present. The possible contaminants that could be present, at a minimum, included heavy metals, petroleum compounds and pesticides.

An Australia Pacific LNG interview conducted with the landholder of Lot 5 DW390 indicated that a cattle dip once operated at Lot 5 DW390. Cattle tick treatment still occurs on site, however the method of treatment has been converted into a more environmentally friendly method. The method of treatment was not elaborated on during the interview. The location of the dip and current treatment area was also not identified and will need to be located and, if found to be a separate area to the suspected cattle yard, then this area will also need to be investigated as part of a Stage 2 investigation prior to the construction of the proposed pipeline.

5.2 Cattle yards

There were two cattle yards identified within the study area, one of which was confirmed by site inspection as containing a cattle dip (Lot 4 CTN406). The dip appeared disused. The second cattle yard identified by satellite imagery could also possibly contain a cattle dip or spray race and would likely be in use (Lot 9 on SP200837). It was not certain if this cattle yard was the location of the dip that was confirmed through landholder interviews with Australia Pacific LNG. Chemicals likely to be associated with these areas included arsenic and a range of pesticides, some of which would likely be persistent and not readily biodegradable. These lots will need to be investigated as part of a Stage 2 investigation prior to the construction of the proposed pipeline.

A third possible cattle yard occurring on Lot 9 on DW19 was suspected, based upon a review of satellite imagery, however the presence of a dip or spray race could only be inferred due to the clarity of the image. An Australia Pacific LNG interview conducted with the landholder indicated that a cattle dip was decommissioned on this site and that a second dip was constructed adjacent to the first. The location of these dips was not known but could be within the suspected area identified on Plate 5.1. Stage 2 investigations are required of the suspected cattle yard and dips prior to the construction of the proposed pipeline.

The site history revealed that dips and spray races were likely to be present within the study area, based on discussions with DEEDI inspectors. DEEDI confirmed that existing and disused dips and

the less common spray races were likely to be present within the tick-infested zone, which generally extended from Taroom to Gladstone. South of Taroom to Miles was a tick-free zone and therefore less likely to contain these treatment methods. The DEEDI inspectors also indicated that disused dips and spray races could be buried/removed, or unknown to current site owners. Therefore there is a potential risk that during the construction of the gas pipeline, additional dips or spray races could be encountered.

The primary concern with cattle dips and spray races was the use of persistent toxic chemicals that have the potential to contaminate surrounding areas of soil and possibly groundwater and sediment of nearby waterways. The persistent toxic chemicals included arsenic and organochlorine pesticides. These treatment methods have the potential to cause serious environmental harm. The confirmed disused dip is located adjacent to a creek, therefore there is a potential for sediments and surface water to be impacted by this former treatment method. Arsenic and organochlorine pesticides would be the primary contaminants of concern at this location.

Arsenic would be the likely contaminant of concern for the earlier treatment facilities (i.e. pre-1950s), however cattle and sheep owners operating treatment facilities after the 1950s would have systematically replaced arsenic with other pesticides.

Table 5.1 is a summary of the expected pesticides that could be present within the study area at disused or existing dips and spray races. Some of these pesticides could also be present within cattle yards where the pesticides were used for wood treatment for termites.

Table 5.1 Summary of Possible Pesticides used in study area

Insecticide group	Common chemicals	Approximate period of use
Arsenic	• Sodium arsenite • Arsenic trioxide	1900s to 1950s (and likely to be currently present)
Organochlorine pesticides	• Ddt • Chlordane • Aldrin • Dieldrin	1950s up to 1970s (and likely to be currently present)
Organophosphate pesticides	• Chlorpyrifos • Diazinon • Phosmet • Fenthion • Cythioate • Tetrachlorvinphos	1960s to 1970s. Some currently in use (Less environmentally persistent than organochlorine pesticides but not likely to be currently present)
Carbamates	• Carbaryl	Possibly being phased out of use (Not likely to be environmentally persistent)
Amidine based compounds	• Amitraz	Currently used
Pyrethrins	• Bifenthrin	Currently used

Insecticide group	Common chemicals	Approximate period of use
	• Cyfluthrin • Cypermethrin • Decamethrin • Permethrin • Pyrethrin	(Not likely to be environmentally persistent)

5.3 Disturbed land

The satellite imagery identified a possible dam and evidence of land disturbance on Lot 3 DW464. As the reason for the land disturbance could not be confirmed visually, this area could not be discarded as a non-concern without further review of data, particularly as the area was in a tick-infested zone where dips and spray races were known to exist. The dam itself was considered to have a low possibility of containing hazardous contaminants, however if a cattle yard once existed, then there was the possibility that a dip or spray race were also present or that the pesticides were used to protect wood structures against termites.

An Australia Pacific LNG interview conducted with the landholder indicated that a dip does exist on this site. The location of the dip was not determined and therefore it cannot be concluded that the land disturbance identified on the satellite imagery was also the dip area. This will need to be confirmed prior to construction activities and during Stage 2 investigations.

6. Potential risks, potential impacts and mitigating measures

6.1 Potential human health risks

The draft DoE guidelines make reference to a health-risk based approach when conducting assessments of contaminated sites. The assessment of health risks is based on DERM Health-based Investigation Levels (HILs) for the contaminants of concern. HILs are provided for a range of contaminants and for various exposure settings. The exposure setting that would be relevant to the Project would be commercial/industrial.

As no intrusive investigations were conducted during this PSI, no comparison of contaminant concentrations against HILs for commercial/industrial can be assessed. Where practicable, however, the construction works will avoid contaminated sites and therefore minimising the risk of exposure to potential contamination. Where this is not possible, Australia Pacific LNG and its representatives will develop site-specific health, safety and environment plans and procedures to maintain a safe environment and workplace for its employees and contractors, which is in accordance with *Workplace Health and Safety Act 1995*.

6.2 Environmental impact assessment

Pre-existing contamination has the potential to impact the environment and be exacerbated by construction activities within the gas pipeline corridor. Recommendations provided in Section 7.2 describe preventative actions that should be undertaken prior to construction of the proposed facilities to minimise disturbance of contaminated soil.

Mitigation measures are generally determined after the nature and extent of contamination has been determined from detailed investigations which have not been carried out during this PSI. However, there are generally two courses of action that can be undertaken which are in accordance with the EP Act. These comprise:

- Management of a contaminated area. This is achieved by providing a protective barrier (i.e. cap) over the managed area to minimise surface infiltration or exposure to contaminants. This can also be achieved by encapsulation of the contaminants within a purpose built cell and use of cut-off walls to contain contaminated groundwater. Capping materials often include:
  - Concrete
  - Asphalt
  - Soil
  - Other impermeable material approved by DERM.

Management of a contaminated area is often undertaken in accordance with a DERM-approved Site Management Plan (SMP). A DERM-approved SMP is a legally binding document that provides land owners or land managers with conditions that stipulate how the contaminated area will be managed over time. The SMP option results in a legacy of contamination that may also require on-going groundwater monitoring should there be a potential risk to groundwater or possibly surface waters.

- Remediation of a contaminated area in accordance with a DERM-accepted method. Remediation is often undertaken in accordance with a DERM-approved Remediation Action

Plan (RAP). To prepare a RAP, the draft DoE guideline requires a site to be fully assessed and the nature and extent of contamination fully characterised. Remediation methods include but are not limited to:

- Excavate and dispose to lined or unlined landfills which is typically undertaken for inorganic contaminants (i.e. heavy metals and metalloids such as arsenic). Stabilisation of the contaminants using a binding material (e.g. ash or cement) is sometimes required to ensure the material meets landfill acceptance criteria. An application for an off-site disposal permit must be made to DERM in accordance with Section 424 of the EP Act. The off-site soil disposal permit can only be obtained if the land has been listed on the EMR or CLR, unless agreed by DERM
- Landfarming which is generally applied to volatile contaminants that readily degrade under natural conditions such as volatile hydrocarbons and pesticides other than organochlorine pesticides
- Biological treatment for contaminants that are readily biodegradable such as volatile and some semi-volatile hydrocarbons and pesticides other than organochlorine pesticides
- Thermal desorption which generally applies to contaminants that are not able to be landfarmed, not readily biodegradable and cannot be disposed to lined landfill.

A summary of the impacts and mitigation measures relating to potential contamination identified by the PSI is provided in Table 6.1. The possible sources of contamination that were identified and assessed have been categorised as follows:

- Cattle dips and spray races
- Unauthorised use of landfills
- Unlawful disposal of wastes
- Scrap yards.

The risk ranking shown in Table 6.1 was in accordance with the Project risk matrix and criteria for likelihood and consequence.

Table 6.1 Environmental risk assessment

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
Arsenic and organochlorine pesticide contamination of soil from existing dips or spray races and degradation of vegetation	Leaking dip structures Splashing and spraying of pesticides during use Dripping cattle or sheep Spilt pesticides based on past practices	Notification of DERM required where land is not listed on the EMR or CLR for the notifiable activity of livestock dip or spray race operations	Low	Complete removal of the dip and spray race structure. Assessment of the area of impact and remediation and validation of the impacted area as per DoE draft guidelines. Remediation via an appropriate DERM accepted method Management of contaminated areas through the placement of a suitable capping material as per an approved DERM SMP DERM Suitability Statement is obtained in accordance with EP Act.	Negligible
		Construction activities could disturb impacted area resulting in a greater area being impacted by contaminants	Medium		Negligible
Arsenic and organochlorine pesticide contamination of underlying groundwater from dips or spray races (note: no detailed	Leaking dip structures Splashing and spraying of pesticides during use Dripping cattle or sheep Spilt pesticides based on past practices	Notification of DERM required where land is not listed on the EMR or CLR for the notifiable activity of livestock dip or spray race operations Migration of contaminated groundwater off site could result in abatement order issued by DERM	Low	Containment of impacted groundwater based on extraction techniques and/or cut-off walls (or other DERM accepted method) but this should only be necessary where contaminant concentrations are significant and there is an imminent risk to a sensitive receptor (i.e. groundwater bores or	Negligible

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
groundwater investigations conducted during PSI)		and placement of the land on the CLR Impact to private groundwater bores (note: no assessment of private bores conducted during the PSI but this has been recommended during site specific Stage 2 investigation)		surface water bodies), or migration of impacted groundwater off site (i.e. across an adjacent property boundary)	
		Low to moderate contaminant concentrations with no off-site impacts	Negligible	Where remedial measures are not necessary due to low contaminant concentrations, on-going monitoring of the impacted groundwater may be required through a network of strategically placed groundwater monitoring bores to monitor concentrations and assess the effects of natural attenuation	Not required
Arsenic and organochlorine pesticide contamination of surface waters from dips or spray races	Leaking dip structures Splashing and spraying of pesticides during use Dripping cattle or sheep Spilt pesticides based on past practices	No surface water bodies were identified near suspected dips or spray races	Negligible	Not applicable	Not applicable

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
Unauthorised landfills, unlawful disposal waste and creation of scrap yards	Disposal of private household wastes, construction and demolition wastes, disused equipment, machinery and vehicle.	Possible presence of asbestos products, minor volumes of fuels, oils, paints, solvents, abrasive blasting material and fill material, Notification of DERM required where land is not listed on the EMR or CLR for the notifiable activities of landfilling, engine reconditioning, scrap yards, waste storage	Low	Assessment of the area of impact and remediation and validation of the impacted area as per DoE draft guidelines DERM Suitability Statement is obtained in accordance with EP Act. Management of contaminated areas through the placement of a suitable capping material as per an approved DERM SMP	Negligible
		Construction activities could disturb impacted area resulting in a greater area being impacted by contaminants	Medium		Negligible

6.3 Potential impacts and mitigating measures

Overall there are potential environmental effects on land contamination due to gas pipeline activities; however these should be readily managed with the implementation of sound and standard construction practices and adherence with DERM guidelines.

6.3.1 Potential impact

An assessment was carried out to identify activities that could potentially cause land contamination during construction, commissioning, operation and decommissioning activities. These potential impacts are summarised below as follows:

Construction Impacts

- Unidentified contaminated soils may be encountered during earthworks which could lead to contamination being spread across the site, impacting environmental receptors or being removed from site.
- Uncontrolled releases of leachate from construction waste, waste at depots and waste construction camps has the risk to cause contamination of site soils and groundwater. Similarly compost or recyclable materials could also result in leachate production and subsequent contamination.
- Uncontrolled releases of chemicals and fuel have the potential to cause contamination of soil and groundwater. Spills can occur particularly during maintenance activities and refuelling. There will also inevitably be fuel drips from plant\vehicles in storage areas and in parking area.
- Fires involving chemicals and fuels as well as other engineered materials and liquids, could result in significant land contamination.
- Saline groundwater from extraction or from dewatering during pipeline construction may affect soil and groundwater chemistry. Extracted groundwater should meet surface water discharge criteria prior to release.

Commissioning, operations and decommissioning

- Leachate from waste storage has the potential to cause contamination of site soils and groundwater.
- Fuel and chemical spills and fire have the potential to cause contamination of site soils and groundwater.
- During commissioning, hydrotest water is required to test the integrity of the pipelines. Hydrotest water contains additives such as biocides which may cause changes to the chemistry of soil and groundwater. Hydrotest water should meet surface water discharge criteria prior to release.

Given the proposed waste management controls to be established for the Project, the risk of significant land contamination occurring is low and potential impacts are therefore low.

6.3.2 Mitigation measures

Mitigation measures to reduce the risk of land contamination during construction, commissioning, operation and decommissioning activities and requirements for remediation are provided in Table 6.2.

Table 6.2 Mitigation Measures

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
Contamination of soil and groundwater	Encountering pre-existing contamination no previously identified	During construction works, contamination is spread to sensitive areas causing serious environmental harm Notification of DERM required where land is not listed on the EMR or CLR	Medium	Assessment of the affected area in accordance with DoE Draft guidelines Management or remediation, if required, undertaken via an appropriate DERM accepted method	Low
Contamination of soil and groundwater	Waste storage	Putrescible waste and leachate could cause soil and groundwater contamination.	Medium	Develop a waste management plan. No waste disposal on site. Composting and recycling implemented to minimise waste, if feasible. All putrescibles and leachable waste (which is not recycled) will be stored in impermeable containers (e.g. skips). Contamination will be assessed and where appropriate remediated or managed in accordance with relevant legislation and guidelines.	Low
Contamination of soil and groundwater	Chemical and fuel leaks/spills from tanks, compressors, storage areas. Pipes and tank failures resulting in loss of chemicals, fuel, lubricating	Spills and leaks from tanks, piping, refuelling of plant and vehicles could cause soil and groundwater contamination.	Medium	Conduct maintenance inspections of plant, equipment and vehicles Implement control measures to prevent spills during construction,	Low

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
	oils, waste oils			commissioning, operations and decommissioning Chemical and fuel stores will be established in accordance with relevant standards and including bunding. Construction, commissioning and operation inductions will include spill kit awareness information. If chemical and fuel stores are removed, investigate area for residual contamination. Where appropriate remediate or manage contamination in accordance with relevant legislation and guidelines, This work must be performed under the supervision of a suitably qualified person as per Section 381 of the EP Act and be in accordance with DoE draft guidelines.	
Contamination soil	Fire	Hazardous chemicals and substances released to ground	Medium	Affected are will be assessed and where appropriate remediated or managed in accordance with relevant legislation and guidelines	Low
Contamination of	Fuel leaks in maintenance	Hazardous chemicals and	Medium	Maintenance of plant done on	Low

Potential impact	Possible causes	Potential consequences	Potential Risk	Control measures	Potential Residual risks
soil and groundwater	department, plant storage areas and car parks	substances released to ground		concrete pads, plastic sheets or other low permeability surface to prevent oil, fuel, hydraulic fluid or other liquids infiltrating the ground. Wastes from pads collected and disposed off-site by licensed operators. Plant used at site should have maintenance records and complete a site walk through noting potential signs of contamination	
Contamination of soil and groundwater	Disposal saline groundwater	Saline groundwater can affect soil and groundwater chemistry	Medium	Water should be assessed for contaminants to meet surface water criteria prior to release.	Low
Contamination of soil and groundwater	Hydrotest water	Hydrotest water can affect soil and groundwater chemistry	Medium	Hydrotest water should be assessed for surface water discharge criteria prior to release contamination.	Low

7. Conclusions and recommendations

7.1 Conclusions

Based upon the results of the PSI, the following is concluded:

- Current land use of the study area included undeveloped land and pastoral land that was used for livestock grazing. Agricultural land use (mainly broad acre cropping) was also present and more prevalent in the northern half of the study area, which was probably related to improved climate conditions. No historical land uses were determined during this PSI.
- There is a potential for hazardous contaminants and notifiable activities to be pre-existing within the 200m wide pipeline corridor. There were five areas where potential notifiable activities have occurred and one area of disturbed land identified within the 200m pipeline corridor along the alignment. The area of disturbed ground was inferred to be a former dam but potentially also a site of a notifiable activity which would need to be confirmed through additional investigation.
- The areas having potential notifiable activities identified included:
  - One potential waste dump located within the road easement of Warrego Highway.
  - Lot 5 DW390 which contains a suspected waste dump and a former dip.
  - Lot 4 CTN406 which contained a disused dip, which was confirmed by site inspection.
  - Lot 3 DW464 which contains a dip.
  - Lot 9 DW19 which contains a former dip and current dip.
  - Lot 9 SP200837 which contains a suspected dip or spray race.
- No areas with hazardous contaminants were identified within proposed locations of construction camp sites, laydown areas and scraper locations. What appeared to be a sand and gravel storage area was present in one of these areas but it was unlikely the site use involved hazardous materials.
- The site history indicated that there was a potential for other cattle yards and dips to be disused or buried within the pipeline corridor. These locations may become known upon further investigation. If buried, then this may not be identified until the area is encountered during site investigations being undertaken ahead of construction works.
- Several cattle yards were identified in proximity to the proposed pipeline route and located 100-500m from the centre line of the proposed pipeline. As a result, it is unlikely that these cattle yards will be disturbed by construction activities and therefore do not pose a significant environment or human health risk to the Project.
- The site history indicated that there have been crops grown within sections of the pipeline corridor. Potentially fertilisers, herbicides and insecticides may have been applied to the fields. It is considered unlikely that these contaminants would be present in concentrations that would exceed environmental or human health guidelines. Therefore, these fields represented a low risk of containing hazardous contaminants and therefore are not considered a major concern but should be investigated further through site inspections and landholder interviews.
- Groundwater resources in the area have the potential to be of beneficial use as stockwater, irrigation water and possibly some domestic purposes. The groundwater in most locations is

expected to be relatively fresh with low levels of salinity, except near Gladstone where it should be more saline.

- There is a potential for groundwater contamination to exist within the study area if certain site conditions exist. Such site conditions include permeable soils that would allow migration of contaminants from the surface; the presence of a shallow water table (i.e. <5m below surface) and a source of contamination such as dips and spray races or buried wastes. These sources of contamination would likely result in a localised area of groundwater contamination, however further detailed investigation would be required to confirm these details. It is therefore important that the beneficial uses of groundwater are retained during gas pipeline activities and able to be restored following the decommissioning of gas pipeline infrastructure.

7.2 Recommendations for management of existing contamination

There is sufficient site history to recommend that prior to construction of high-pressure LNG gas pipeline:

- There should be discussions with landholders to confirm current site use and historical land use for each property within the study area. Historical aerial photographs and land titles should be reviewed and site inspections conducted where interviews identify any potential notifiable activity.
- Stage 2 investigations should be conducted in the six areas identified by this PSI and any other areas identified through additional landholder interviews and site inspections to determine if hazardous contaminants are present within the study area. The interviews with landholders should be followed by field investigations in areas where contamination is likely to be present. The investigations would include laboratory testing and interpretation of soil concentrations to assess the lateral and vertical extent of the hazardous materials and contaminated groundwater that could be intercepted by construction. These assessments should be carried out in accordance with Appendix 5 of the Draft 1998 guidelines. Investigations should be undertaken by a person that is suitably qualified under Section 381 of EP Act.
- Consideration should then be given to moving the pipeline to avoid ground disturbance in the area of confirmed soil contamination as a risk mitigation strategy.
- If the pipeline cannot be moved, then management and/or remedial strategies are to be developed if construction activities are likely to disturb contaminated areas. Management options should include capping or containment of contamination in accordance with a DERM-approved SMP. Remedial measures should be carried out to minimise adverse environmental or human health impacts. The remediation criteria that would be acceptable to DERM and minimise residual adverse environmental or human health impacts, include NEPM HILs for Residential A-settings and DERM phyto-toxicity guidelines for copper and zinc. These are the generally accepted remediation criteria to remove a contaminated property from the EMR and to deem land to be free from contamination.
- Measures to protect the environment and human health during remediation activities will depend on the nature of the activities and concentration of contaminants identified, but are likely to include:
  - Noise control
  - Odour control
  - Use of water trucks or other means to control dust generation.

  - Drainage and bunding to divert stormwater away from remediated areas.
  - Control of sediment discharge into nearby waterways.
  - Wheel wash and/or vehicle washdown to minimise the spread of soil and/or potentially contaminated soil to other parts of the study area, as well as public roads.
  - Use of only suitably qualified and experienced contractors and environmental consultants.

- Any notifiable activities or contamination from hazardous contaminants that are identified on land where Australia Pacific LNG is the land manager, must be notified to DERM, in accordance with Section 371 of EP Act.
- The site history review indicated a risk exists in relation to whether unknown buried dips and dismantled spray races may be revealed during site stripping or other gas pipeline activities. Where excavation works uncover unexpected contamination, all work must cease. An investigation must be undertaken to determine the nature and extent of the impact. The investigation and any subsequent management and/or remedial strategies must be undertaken by a person that is suitably qualified under Section 381 of EP Act.

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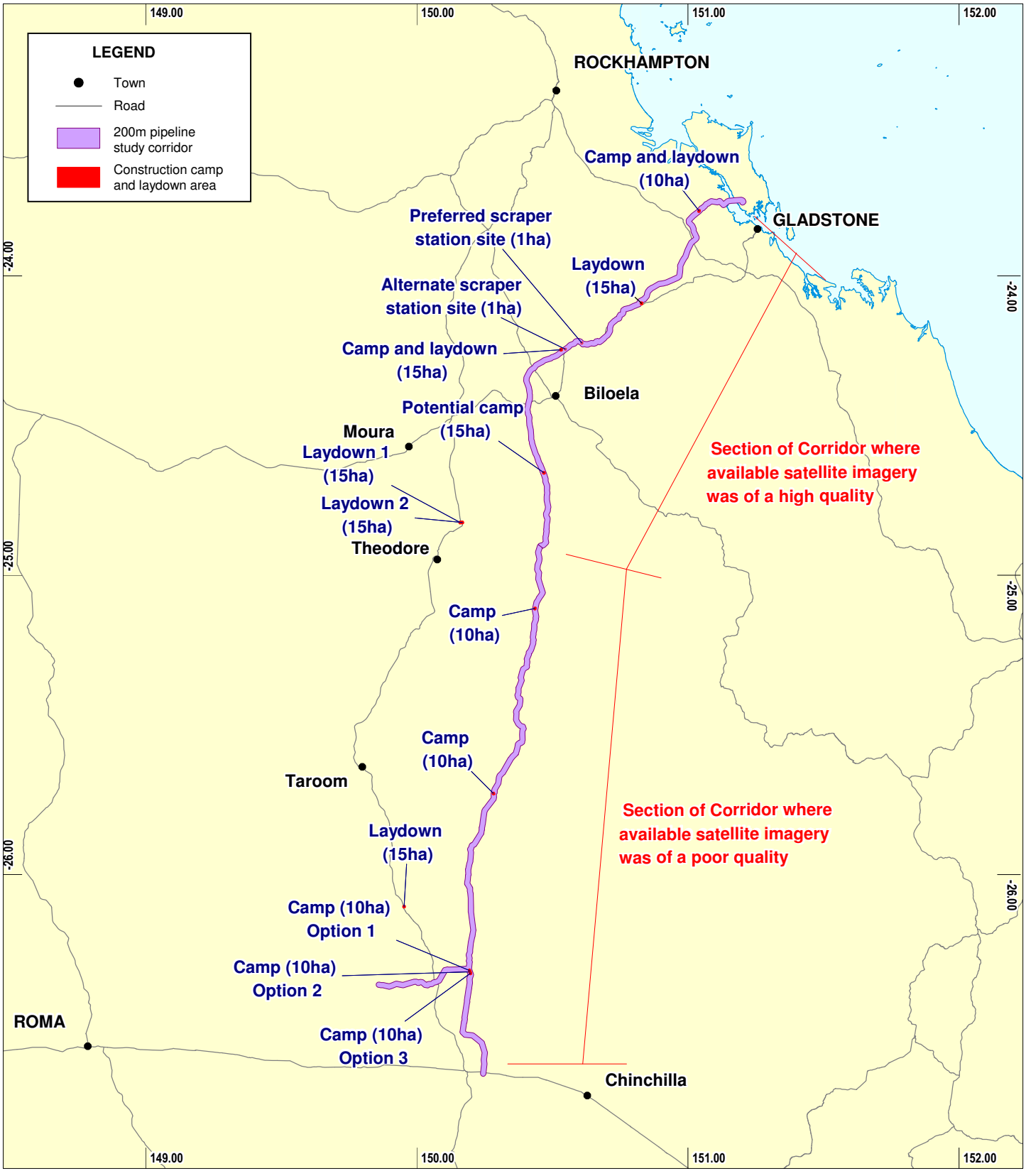
Figures



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Gas Pipeline Corridor Route 3F provided by Origin Energy 03/11/2009

0 25 50km

Scale 1: 2,000,000 (at A4)

Latitude/ Longitude
Geocentric Datum of Australia 1994

N W E S

Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
0	02/11/2009	Issued for use	JM	DH		

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AUSTRALIA PACIFIC LNG PROJECT EIS

Figure 1 - Pipeline study area

Project No: 301001-00448	Figure: 00448-00-EN-DAL-00283	Rev: 0

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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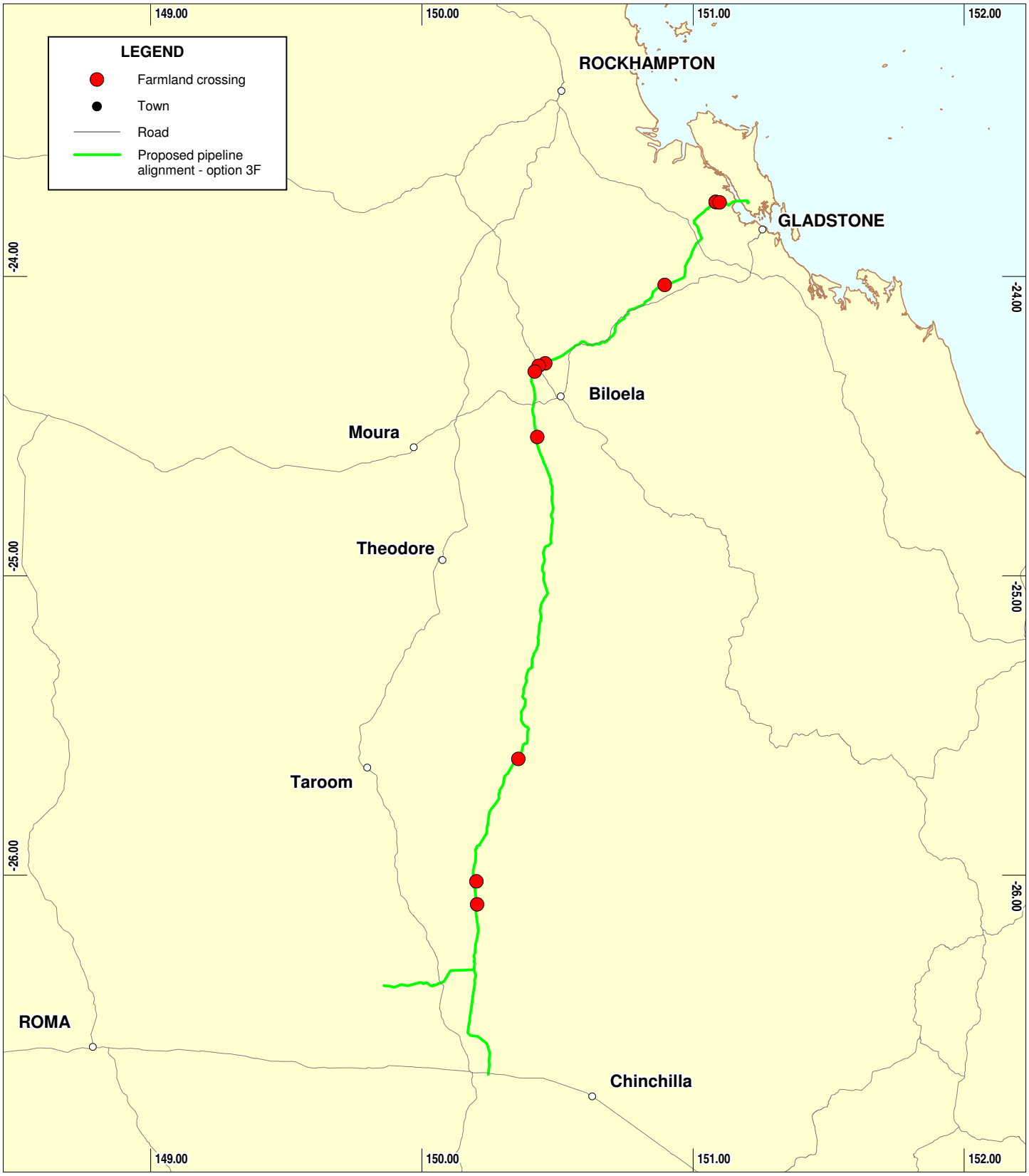

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Gas Pipeline Corridor Route 3F provided by Origin Energy 03/11/2009

0 25 50km

Scale 1: 2,000,000 (at A4)

Latitude/ Longitude
Geocentric Datum of Australia 1994

N
W E
S

Rev	Date	Revision Description	ORIG	CHK	ENG	APPD
1	09/03/2010	Re-issued for use	GSB	MZ		RB
0	02/11/2009	Issued for use	JM	DH		

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AUSTRALIA PACIFIC LNG PROJECT EIS

Figure 2 - Crop Land Traversed by Proposed Pipeline

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0282	Rev: 1

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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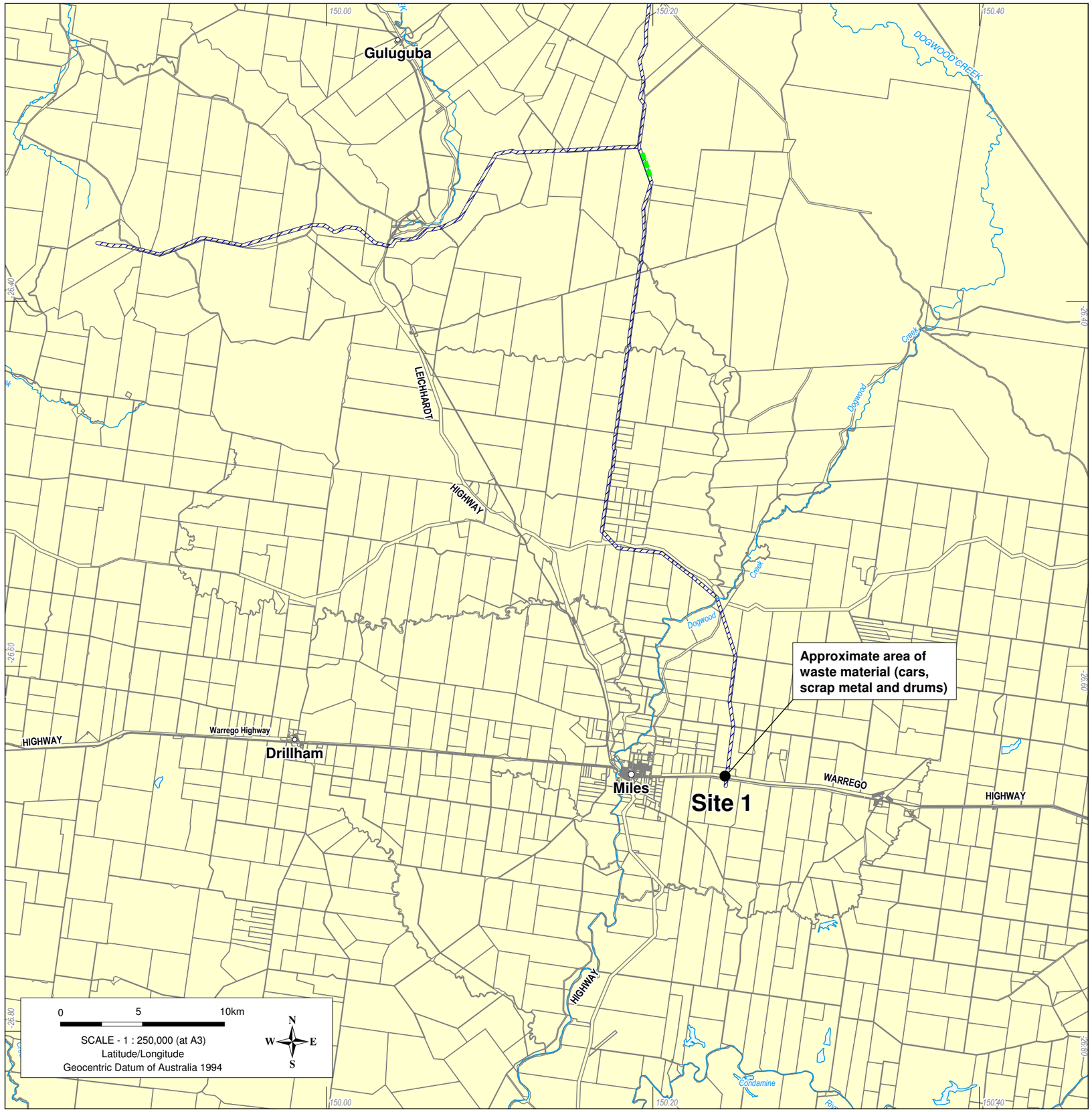

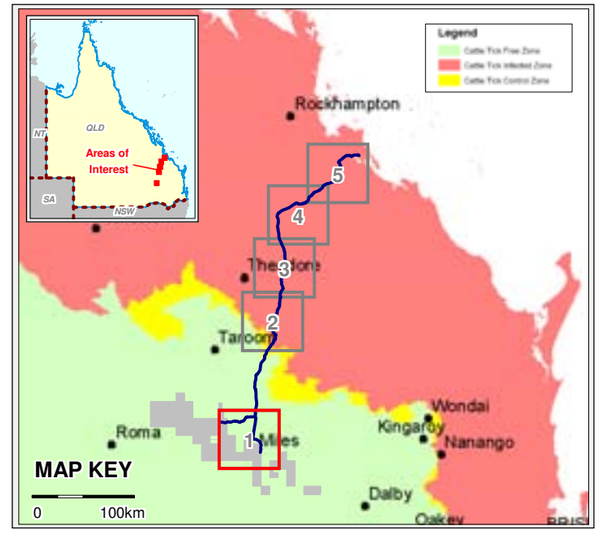

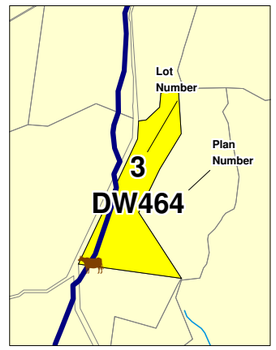

LEGEND

- Town
- Preferred pipeline alignment
- Major drainage
- Reservoir
- Temporary accommodation facilities and laydown areas
- Cattle yard and possible cattle dip or spray race
- Pipeline study corridor
- Cadastral boundary

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0	16/02/2010	Issued for use	JM	DH	AK	RB

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AUSTRALIA PACIFIC LNG PROJECT EIS
Figure 3 - Contaminated Land Investigation Areas (Map 1 of 5)

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0277	Rev: 0

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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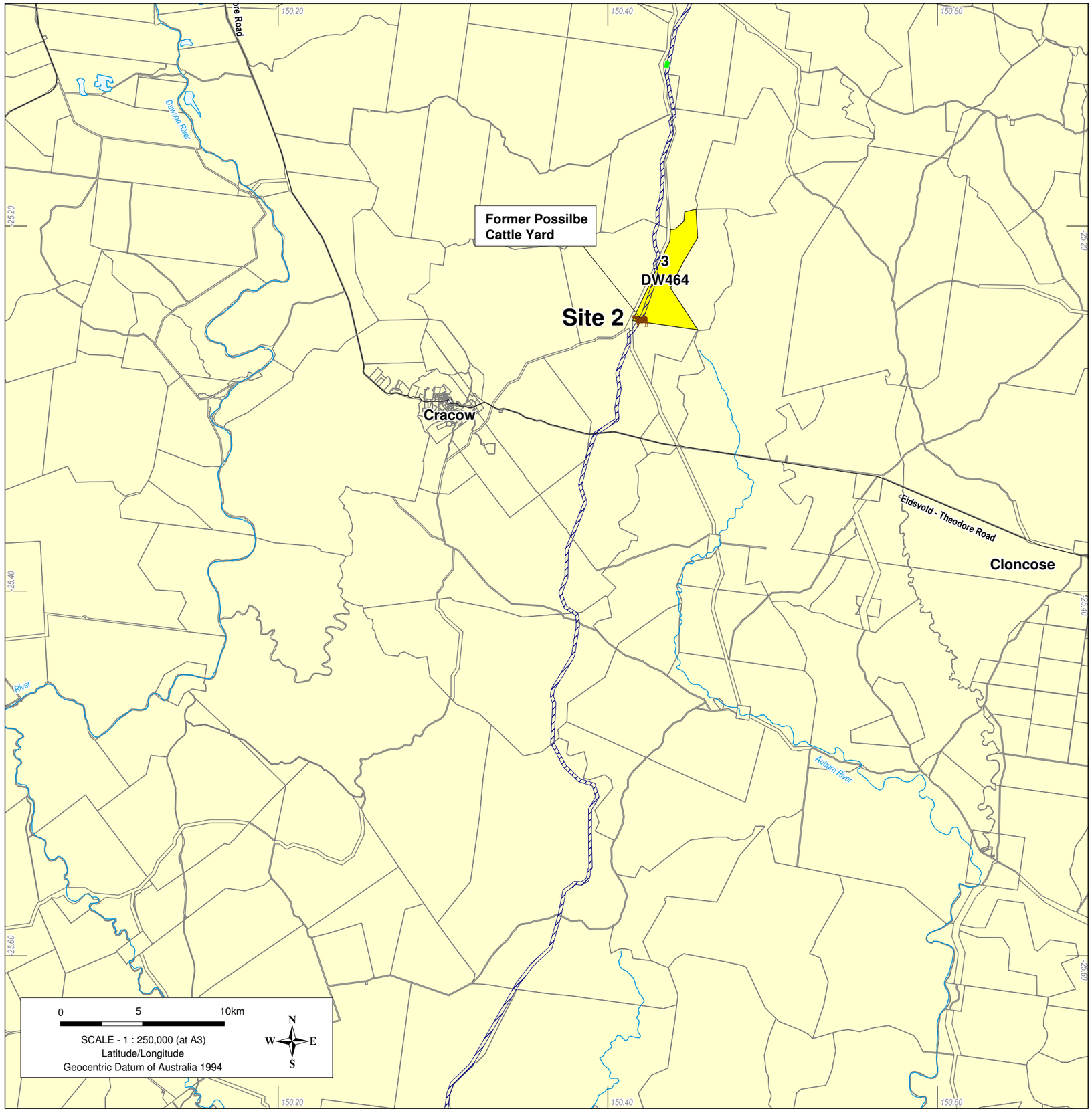

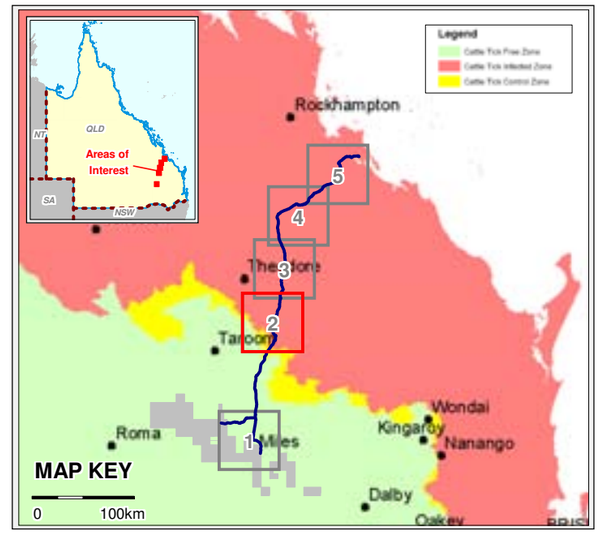

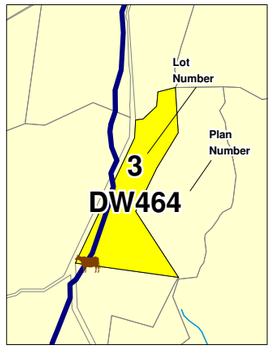

LEGEND

- Town
- Preferred pipeline alignment
- Major drainage
- Reservoir
- Temporary accommodation facilities and laydown areas
- Cattle yard and possible cattle dip or spray race
- Pipeline study corridor
- Cadastral boundary

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AUSTRALIA PACIFIC LNG PROJECT EIS
Figure 4 - Contaminated Land Investigation Areas (Map 2 of 5)

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0278	Rev: 0

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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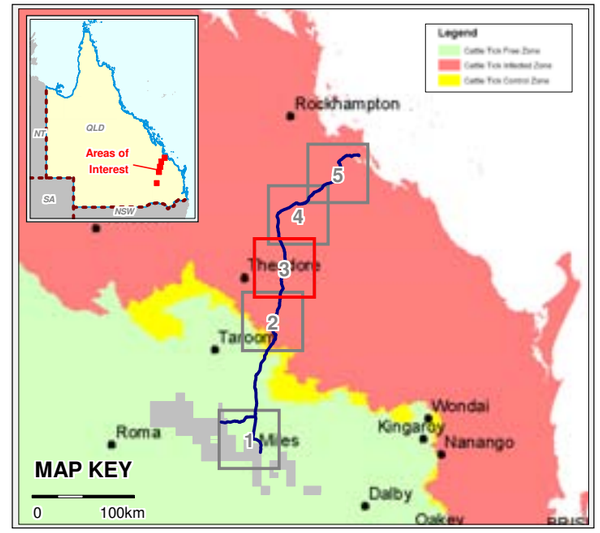

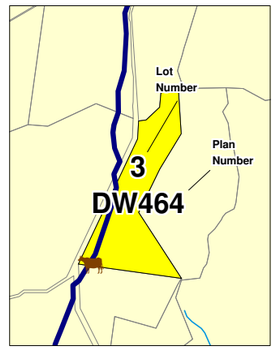

LEGEND

- Town
- Preferred pipeline alignment
- Major drainage
- Reservoir
- Temporary accommodation facilities and laydown areas
- Cattle yard and possible cattle dip or spray race
- Pipeline study corridor
- Cadastral boundary

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Figure 5 - Contaminated Land Investigation Areas (Map 3 of 5)

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0279	Rev: 0

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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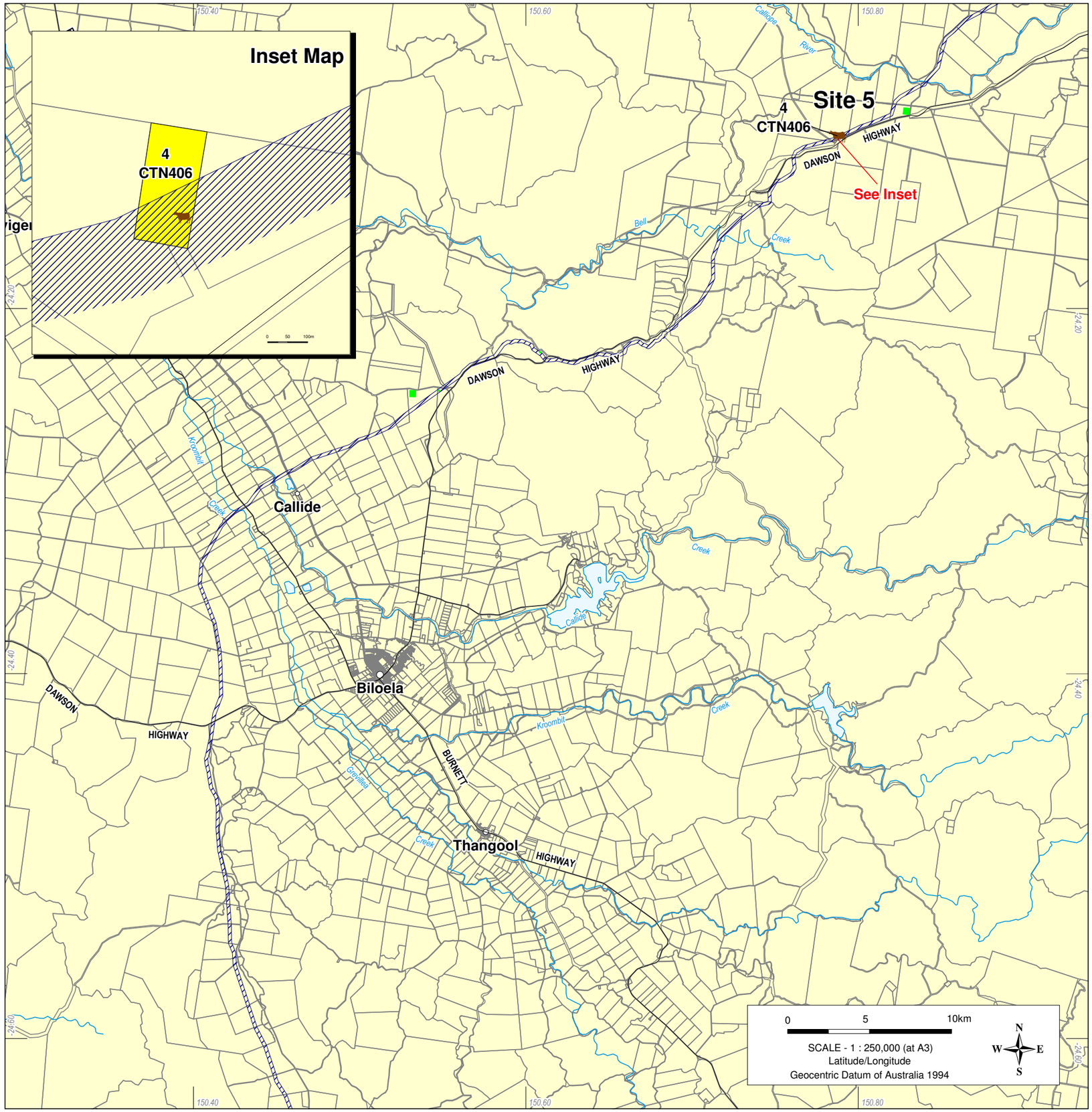

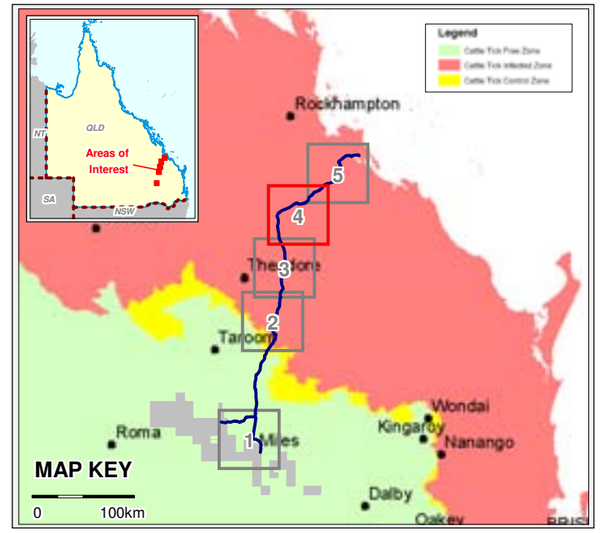

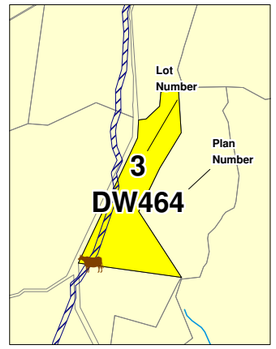

LEGEND

- Town
- Preferred pipeline alignment
- Major drainage
- Reservoir
- Temporary accommodation facilities and laydown areas
- Cattle yard and possible cattle dip or spray race
- Pipeline study corridor
- Cadastral boundary

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Figure 6 - Contaminated Land Investigation Areas (Map 4 of 5)

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0280	Rev: 0

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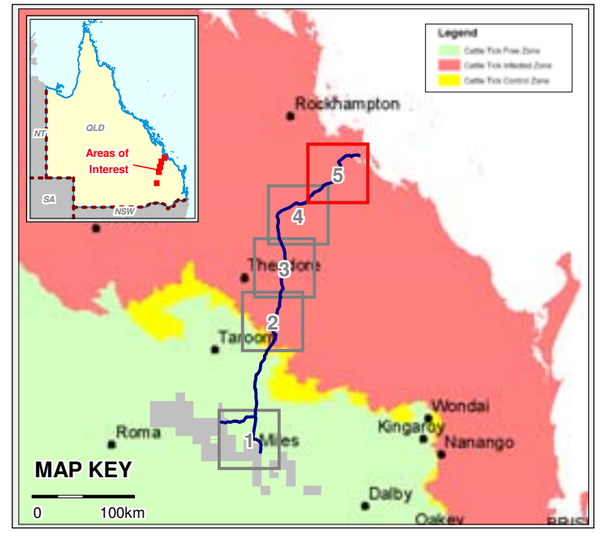

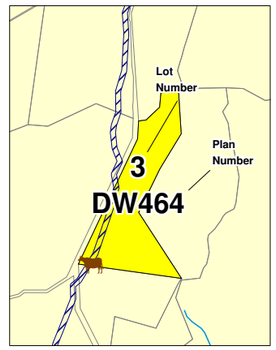

LEGEND

- Town
- Preferred pipeline alignment
- Major drainage
- Reservoir
- Temporary accommodation facilities and laydown areas
- Cattle yard and possible cattle dip or spray race
- Pipeline study corridor
- Cadastral boundary

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0	21/10/2009	Issued for use	JM	DH		

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AUSTRALIA PACIFIC LNG PTY LIMITED

AUSTRALIA PACIFIC LNG PROJECT EIS
Figure 7 - Contaminated land Investigation Areas (Map 5 of 5)

Project No: 301001-00448	Figure: 00448-00-EN-DAL-0281	Rev: 0

Compiled by BRISBANE INFRASTRUCTURE GIS SECTION

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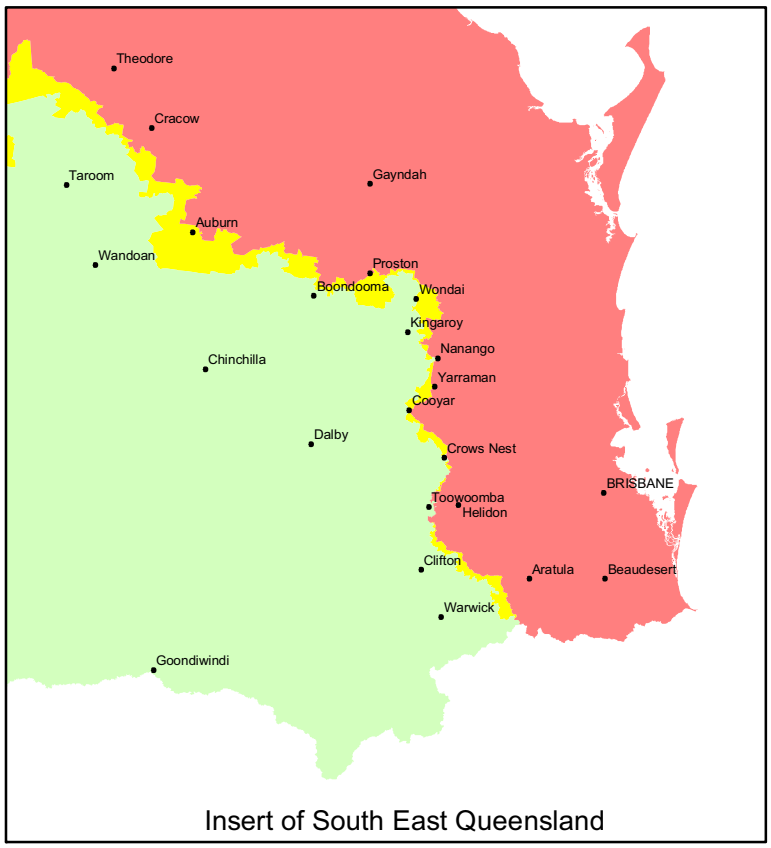
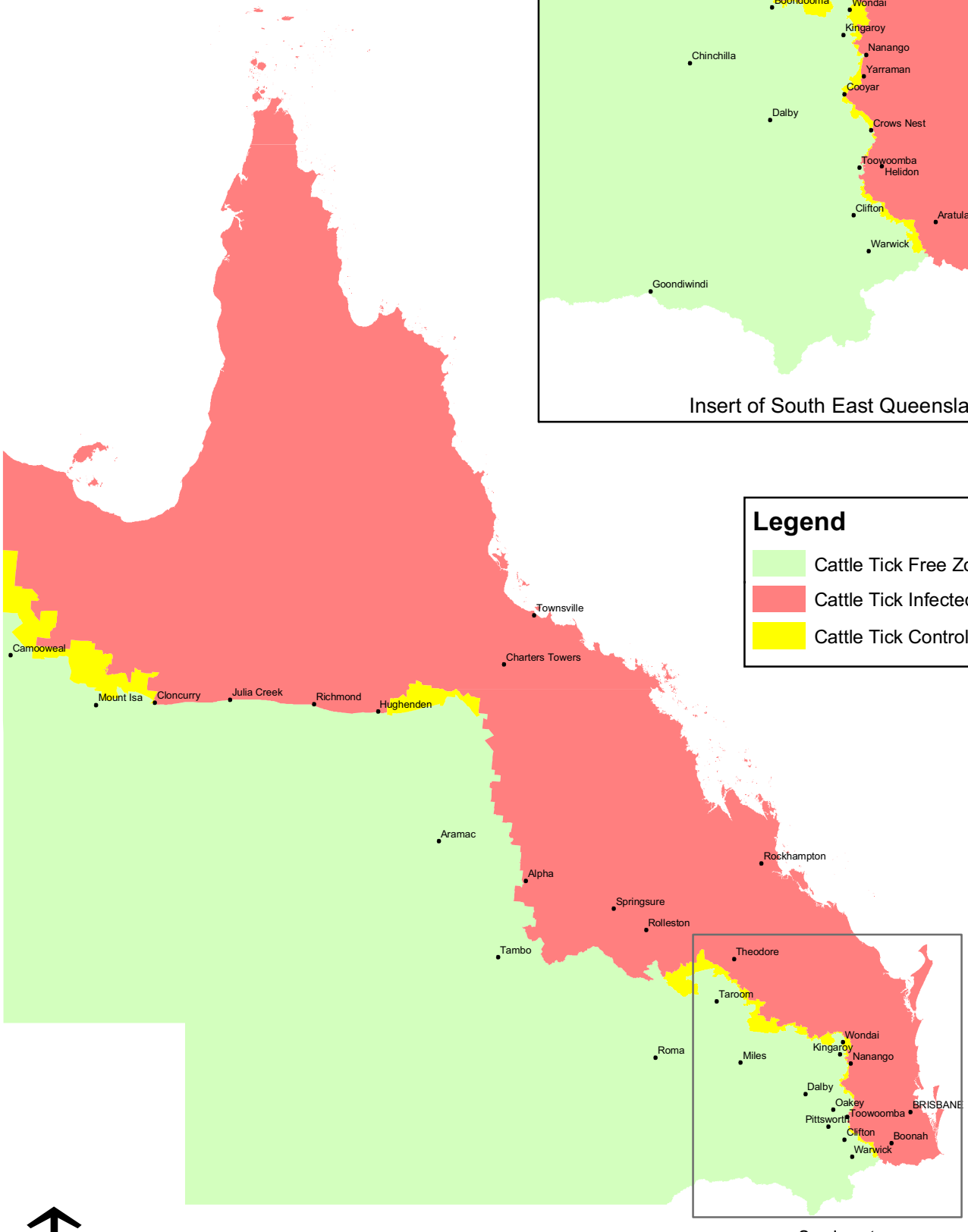
Appendix A Tick-free Zones

QUEENSLAND CATTLE TICK ZONES

As at 7 December 2005





Legend

- Cattle Tick Free Zone
- Cattle Tick Infected Zone
- Cattle Tick Control Zone

N

Queensland Government
Department of Primary Industries and Fisheries
Biosecurity

Appendix B EMR/CLR search results

QLD ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Transaction ID: 1182256 EMR Site Id: 17 November 2009
This response relates to a search request received for the site:
Lot: 9 Plan: SP200837

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through the State Government Website www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5687.

Lindi Bowen
Registrar, Contaminated Land Unit

QLD ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Transaction ID: 1182254 EMR Site Id: 17 November 2009
This response relates to a search request received for the site:
Lot: 9 Plan: DW19

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

EMR/CLR Searches may be conducted online through the State Government Website www.smartservice.qld.gov.au or Citec Confirm www.confirm.com.au.

If you have any queries in relation to this search please phone (07) 3330 5687.

Lindi Bowen
Registrar, Contaminated Land Unit

QLD ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Transaction ID: 1182253 EMR Site Id: 17 November 2009
This response relates to a search request received for the site:
Lot: 5 Plan: DW390

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

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Lindi Bowen
Registrar, Contaminated Land Unit

QLD ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Transaction ID: 1182255 EMR Site Id: 17 November 2009
This response relates to a search request received for the site:
Lot: 4 Plan: CTN406

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

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If you have any queries in relation to this search please phone (07) 3330 5687.

Lindi Bowen
Registrar, Contaminated Land Unit

QLD ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL MANAGEMENT REGISTER (EMR)
CONTAMINATED LAND REGISTER (CLR)

Transaction ID: 1182246 EMR Site Id: 17 November 2009
This response relates to a search request received for the site:
Lot: 3 Plan: DW464

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

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Registrar, Contaminated Land Unit