

Appendix D

Blacktip Development Onshore Plant Site and Gas Pipeline Route, Wadeye/Port Keats, Northern Territory: Desktop Assessment of Acid Sulfate Soils prepared by Sinclair Knight Merz



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DESKTOP ASSESSMENT OF ACID SULFATE SOILS

- Version 03
- 5/03/2004



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Contents

1. Introduction	1
2. Background	1
3. Objective	2
4. Desktop Assessment	2
4.1 Land Systems of the Port Keats Area Map (1:250,000)	2
4.2 Australia Geological Survey of Northern Territory Sheet SD 52-11 (1:250,000)	2
4.3 Natural Heritage Trust – Australian Natural Resources Atlas from the Natural Land and Water Resources Audit 2001	2
4.4 Woodside Energy Limited Reports Provided to SKM	3
5. Assessment Criteria	4
5.1 West Australian Guidelines	4
5.2 Northern Territory Government – Risk Categories for Port Keats Land Resource Mapping	5
6. Potential Impacts	6
7. Conclusions	6
8. Recommendations	6

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1. Introduction

Sinclair Knight Merz (SKM) conducted a desktop assessment in order to determine the potential occurrence of Acid Sulfate Soils (ASS) at the proposed Blacktip Development Onshore Plant Site and approximately three kilometres of proposed incoming wet gas pipeline, located at Wadeye/Port Keats, Northern Territory.

The proposed incoming wet gas pipeline extends from the landfall on the northern end of Yelcher beach eastward to the proposed plant site.

2. Background

ASS are soils that contain iron sulfides which, when drained or disturbed, produce sulfuric acid and result in the release of soluble iron, sulfate, aluminium and other toxic metals. The early detection of ASS can provide a useful platform for developing and adopting effective measures to reduce the generation of acidic soils and water during the completion of bulk earth works.

The following guidelines have been used in completing this assessment:

- *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*, Department of Natural Resources, Indooroopilly, Queensland, Australia;
- *Identification and Investigation of Acid Sulfate Soils and Groundwater*, Draft 2003, Acid Sulfate Soils Guidelines Series, Department of Environmental Protection, Water and Rivers Commission, Western Australia.
- *Environmental Guidelines for Reclamation in Coastal Areas*, January 1999, Environmental and Heritage Division, Department of Lands, Planning and Environment, Northern Territory.
- Risk Categories for Port Keats Land Resource Mapping (November 2003) – provided by David Howe, Principal Scientist, Soil and Vegetation, Natural Systems Division of the Northern Territory Government.

It should be noted that the Queensland guideline does not provide guidance on the completion of ASS desktop assessments. The Queensland guideline does however provide information on ASS sampling and analysis procedures. In the absence of any Queensland guideline on the completion of ASS desktop assessments, SKM has adopted both the West Australian guideline and the information provided by the Northern Territory Government.



3. Objective

The objective of this desktop assessment is to conduct a preliminary appraisal of ASS risk associated with the soils in the areas of investigation.

4. Desktop Assessment

4.1 Land Systems of the Port Keats Area Map (1:250,000)

Proposed Plant Site:

According to the land systems map, the proposed plant site is located on the Moyle Land System. This system is described as gently undulating plains with slopes of less than 2.5%. The system consists of deeply weathered sandstone underlying deep red earths and sandy red earths. The system supports an open forest vegetation type.

Proposed Pipeline Route and Landfall:

According to the land systems map, the proposed pipeline route crosses the Moyle Land System (as described above) and the Carpentaria Dune Land System. The Carpentaria Dune Land System is described as dunes and swales, beach deposits and sands supporting woodlands, monsoon thicket, grasslands or is bare of vegetation.

4.2 Australia Geological Survey of Northern Territory Sheet SD 52-11 (1:250,000)

Proposed Plant Site:

The geology map and representative cross section indicated that the proposed plant site is located on sand, soil, colluvium and black soil of tertiary age. This material is underlain by siltstone, silty sandstone, minor limestone, basal conglomerate and diamictite of Permian age.

Proposed Pipeline Route and Landfall:

The geology map and representative cross section indicated that the proposed pipeline route will cross the above material and the dune and beach alluvium formation, which is of Quaternary age. This alluvium is also underlain by the Permian age formation described above.

4.3 Natural Heritage Trust – Australian Natural Resources Atlas from the Natural Land and Water Resources Audit 2001

Several maps of the area were accessed through the Australian Natural Resources Atlas databases.



Proposed Plant Site:

Information collected for the proposed plant site is summarised below.

- Topsoil texture is described as sand, with pH ranges from 4.9 to 5.6.
- Subsoil texture is described as loam with pH ranges from 4.9 to 7.0.
- No data was available for vegetation groups.

Proposed Pipeline Route and Landfall:

There is no data available for the proposed pipeline route.

4.4 Woodside Energy Limited Reports Provided to SKM

Proposed Plant Site:

- The proposed plant site is located between 10 metres Australian Height Datum (mAHD) and 20 mAHD.
- Exploration for oil and coal has been conducted in the area to the east of the proposed site, between the proposed site and Wadeye/Port Keats.
- The following observations were made during limited soil profile investigations at the proposed plant site at the end of the dry season.
 - The soil profile consists of well-consolidated sandy clay to clayey sand.
 - Moisture was observed at 0.3 meters below grade (mbg).
 - Below 0.3 mbg, no free water was observed to the maximum depth of the investigation (9 mbg).
 - Anecdotal evidence suggests the area at and around the proposed plant site may become inundated with water during heavy rainfall events but drains quickly.

Proposed Pipeline Route and Landfall:

- The proposed pipeline route will range from 0 mAHD at the landfall location (ie. northern end of Yelcher beach) to 20 mAHD.
- Yelcher beach extends approximately 200 m from the dune system at low tide.
- Marine sediments associated with Yelcher beach and dune land system may be disturbed during excavation works conducted during construction of the proposed pipeline.
- The depth of marine sediments associated with Yelcher beach may be limited by shallow hard rock.
- The following observations made during limited soil profile investigations along the proposed pipeline route at the end of the dry season.
 - The soil profile along the proposed pipeline route becomes sandier as it approaches the beach and dune system.



- A laterite layer was observed at the surface underlain by sandy clay on the immediate landward side of the dune system.
- Plastic clay was observed at 1.2 mbg at the proposed pipeline beach crossing location.

5. Assessment Criteria

5.1 West Australian Guidelines

The West Australian guidelines recommends the use of 7 geomorphic or site description criteria to determine if ASS are likely to be present on a site. These criteria are detailed in the tables below including their association with the site.

Proposed Plant Site and Portions of the Proposed Pipeline Route (Moyle Land System)

Criteria		Association w/ Site
1	Land with an elevation less than 5 metres AHD.	NO
2	Soil and sediment of recent geological age (Holocene).	NO
3	Marine or estuarine sediments and tidal lakes.	UNLIKELY*
4	Low-lying coastal wetland or black swamp areas, waterlogged or scaled areas, stranded beach ridges and adjacent swales, interdune swales or coastal sand dunes.	NO
5	Coastal alluvial dunes.	NO
6	Areas where the dominant vegetation is tolerant of salt, acid and/or waterlogging conditions (eg. mangroves, saltcouch, swamp-tolerant reeds, rushes, paperbarks (<i>Melaleuca</i> spp.) and swamp oak (<i>Casuarina</i> spp)).	NO
7	Areas identified in geological description or in maps as: bearing sulfide minerals, coal deposits or marine shales/sediments, and deep older estuarine sediments below ground surface of either Holocene or pre-Holocene age.	UNLIKELY*

* The association of this criterion to the area is possible but unlikely. Limited information is currently available to confirm the association.



Landfall and Beach Crossing Portion of the Proposed Pipeline Route (Carpentaria Dune Land System)

Criteria		Association w/ Site
1	Land with an elevation less than 5 metres AHD.	YES
2	Soil and sediment of recent geological age (Holocene).	YES
3	Marine or estuarine sediments and tidal lakes.	YES
4	Low-lying coastal wetland or black swamp areas, waterlogged or scaled areas, stranded beach ridges and adjacent swales, interdune swales or coastal sand dunes.	YES
5	Coastal alluvial dunes.	YES
6	Areas where the dominant vegetation is tolerant of salt, acid and/or waterlogging conditions (eg. mangroves, saltcouch, swamp-tolerant reeds, rushes, paperbarks (<i>Melaleuca</i> spp.) and swamp oak (<i>Casuarina</i> spp)).	YES
7	Areas identified in geological description or in maps as: bearing sulfide minerals, coal deposits or marine shales/sediments, and deep older estuarine sediments below ground surface of either Holocene or pre-Holocene age.	YES

Based on the above criteria the proposed plant site and portions of the proposed pipeline route, associated with the Moyle Land System has a low potential for ASS. The landfall and beach crossing portion of the proposed pipeline route, associated with the Carpentaria Dune Land System, has a high potential for ASS.

5.2 Northern Territory Government – Risk Categories for Port Keats Land Resource Mapping

The Northern Territory government provided SKM with a list of map units and corresponding ASS risk categories based on land systems mapping for the Port Keats area.

The following risk categories apply to land systems mapping for the Port Keats area.

- 1) High risk of ASS conditions.
- 2) Moderate risk of ASS conditions.
- 3) Low to nil risk of ASS conditions.

Based on this information the proposed plant site and portions of the proposed pipeline route, associated with the Moyle Land System has a “low to nil risk of ASS conditions” and the landfall and beach crossing portion of the proposed pipeline route, associated with the Carpentaria Dune Land System has a “moderate risk of ASS conditions”.



6. Potential Impacts

ASS when drained or disturbed produce sulfuric acid that can result in adverse impacts to the environment and consequently human endeavours including fishing, recreation, tourism and human health. As defined in the above referenced guidelines, impacts that may occur include:

- soil acidification;
- adverse changes to the water quality of the soil, groundwater, surface water, wetlands, watercourses and estuaries;
- degradation of water dependant ecosystems and ecosystem services;
- loss of habitat and biodiversity;
- loss of plant yield;
- corrosion of metallic and concrete structures (concrete cancer) such as roads, bridges, pumps, pipes and foundations;
- invasion of and dominance of wetlands and waterways by acid tolerant water plants, plankton and pathogens; and
- increased human health risks associated with arsenic, aluminium and other heavy metal contamination of soil, groundwater and acid dust.

7. Conclusions

Based on the results of the desktop assessment, SKM conclude the following:

- There is a low to nil risk of ASS conditions in soils associated with the proposed plant site and portions of the proposed pipeline route.
- There is a moderate to high risk of ASS conditions in soils associated with the landfall and beach-crossing portion of the proposed pipeline route.

8. Recommendations

Based on the results of the desktop assessment and communications with David Howe, Principal Scientist, Soil and Vegetation, Natural Systems Division of the Northern Territory Government, soil investigations will be required for the proposed plant site and along the proposed pipeline route including the landfall. These investigations need to be conducted prior to bulk earthworks to ensure correct handling and treatment of soils disturbed during the construction works.



Discussions with personnel from the Department of Heritage and Environment - Northern Territory have confirmed that site investigations should be conducted in accordance with *Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in Queensland 1998*. However results of the desktop assessment indicate that the sampling of soils at the proposed plant site and portions of the proposed pipeline route can be completed at a reduced density than the sampling of soils at the landfall and beach crossing portion of the proposed pipeline route.

The sampling of soils at the landfall and beach crossing portion of the proposed pipeline route (identified as a moderate to high risk of ASS conditions associated with the Capentaira Dune Land System) should be conducted at 50 m intervals along the proposed pipeline route. The approximate extent of the Capentaira Dune Land System includes the beach from the low tide through the dunes to the tree line.

The sampling of soils at the proposed plant site and portions of the proposed pipeline route (identified as a low to nil risk of ASS conditions associated with the Moyle Land System) should be conducted in areas that will be disturbed as a result of the development and at a reduced sampling density of say 2 sample points per hectare.

As stated above, all sampling and analysis should be conducted in accordance with *Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in Queensland 1998*. A generalised work scope is summarised below.

- Field samples should be collected at 0.25m intervals or at a change in soil horizon, to depth of 1m below the maximum expected depth of the excavation or until hard rock is encountered.
- Samples should be collected for laboratory analysis at a minimum of 0.5m intervals or at a change in horizon to depth of 1m below the maximum expected depth of the excavation or until hard rock is encountered.
- Laboratory samples should be frozen immediately to prevent oxidation before being transported to the laboratory.
- Laboratory analysis should include Peroxide Oxidation Combined Acidity and Sulphate (POCAS), Total Oxidizable Sulphur (TOS) and grain size analysis.
- The results of the laboratory analysis should be compared to the action criteria included in the adopted guidelines.
- The action criteria are used to ascertain the need for a detailed management plan.
- All field-testing and laboratory analysis should be carried out by suitably qualified personnel.



Sampling for ASS could be completed in conjunction with the geotechnical survey provided a suitable sampling frequency could be established. SKM recommends that the appropriate NT authorities approve all proposed sampling regimes before site works commence.