North West Shelf Gas Project
Additional Liquefied Natural Gas (LNG) Facilities

Woodside Energy Ltd

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

Woodside Energy Limited (WEL) proposes to construct and operate additional Liquefied Natural Gas (LNG) processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at its onshore gas plant on the Burrup. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors, conditions and procedures relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal, and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

A number of environmental factors were considered by the EPA in the assessment. It is the EPA's opinion that of these, the following are the environmental factors relevant to this proposal, which require detailed evaluation in the report:

(a) marine impacts - effects of construction dredging, spoil disposal and effluent discharges on water quality, marine flora and fauna;

(b) greenhouse gases - increased emissions;

(c) air emissions - discharges to atmosphere, in particular nitrogen oxides;

(d) terrestrial vegetation and fauna - disturbance of new areas;

(e) risk (public health and safety) - introduction of new sources of risk; and

(f) Aboriginal culture and heritage - possible disturbance of sites.

The EPA has also provided other advice in relation to cumulative impacts and decommissioning.

Conclusion

The EPA has considered the proposal by WEL to construct additional LNG processing trains at its onshore plant. A summary of the assessment process and EPA advice is presented in Table 7.

Having regard to the environmental outcomes from previous construction programmes for the LNG plant, the licence conditions under which the plant operates, and the reporting carried out under the State Agreement, the EPA concludes that, subject to the implementation of the recommended conditions and proponent's consolidated commitments, the proposal can be implemented and managed in an environmentally acceptable manner to meet the EPA's objectives for the relevant environmental factors.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is for the construction of additional LNG processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at the WEL onshore plant on the Burrup Peninsula. The additional capacity will be constructed in stages, along with previous approvals, to meet market demand for gas, LNG, LPG, and condensate.

2. That the Minister considers the report on the relevant environmental factors of marine impacts, greenhouse gases, air emissions, terrestrial vegetation and fauna, risk and Aboriginal culture and heritage, as set out in Section 3.

3. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the Recommended Conditions set out in Section 4, including the proponent's commitments.

4. The Minister imposes the conditions and procedures recommended in Appendix 1 of this report.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by WEL to construct additional LNG processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, is approved for implementation. These conditions are presented in Appendix 1. Matters addressed in the conditions include the following:

(a) that the proponent shall fulfil the commitments, taking into account the staging of developments, in the Consolidated Commitments Statement set out in schedule 2 to the recommended conditions in Appendix 1;

(b) that the proponent shall demonstrate, to the requirements of the Environmental Protection Authority, that there is in place an environmental management system;

(c) that prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to ensure that 'greenhouse gas' emissions from the project are adequately addressed and that best available efficient technologies are used;

(d) that at least twelve months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to the requirements of the Environmental Protection Authority, which shall address the removal of plant and infrastructure and the rehabilitation of all disturbed areas to a standard suitable for agreed new land uses; and

(e) that for each six years following the commencement of construction, the proponent shall submit a Performance Review report to the Department of Environmental Protection (DEP) evaluating the outcomes and environmental performance over the six years. (Note: this report may be amalgamated with the Triennial Report as required under the *North West Gas Development (Woodside) Agreement Act, 1979*.)

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1. Introduction and background

This report provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment on the environmental factors relevant to the proposal by Woodside Energy Limited (WEL) to construct additional Liquefied Natural Gas (LNG) processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at its LNG plant on the Burrup Peninsula, in the north west of Western Australia. This expansion will increase the LNG capacity of the plant from 7.5 million tonnes per annum to 15.5 million tonnes per annum.

The Woodside project was developed under the *North West Gas Development (Woodside) Agreement Act 1979,* an agreement between the State and the Joint Venture Partners.

The North West Shelf gas project has been developed in stages since the commissioning of the domestic gas (Domgas) plant in 1984. Two LNG processing trains were added in 1989. In 1993, a third LNG processing train was added to the plant. In 1995, liquefied petroleum gas (LPG) extraction facilities and a new LPG shipping jetty were added (EPA, 1993).

Two recent approvals have been provided by the EPA on further expansions to the project. In September 1997 the EPA assessed the proposal for a Liquids Expansion Project which would expand the propane and butane export potential of the plant. The level of assessment was set at a Works Approval level, to be managed under Part V of the *Environmental Protection Act, 1986*. In July 1998, EPA approval was provided for a second offshore trunk-line and Domgas debottlenecking facility. This expansion was formally assessed at a Public Environmental Review level.

This current proposal to add additional LNG processing trains, Trains 4 and 5, was submitted to the EPA on 24 December 1997. As the project involves environmental issues which fall under both State and Commonwealth jurisdictions, the environmental impact assessment was carried out jointly by the Western Australian EPA and Environment Australia of the Commonwealth Government. A level of assessment was set in January 1998 at a Public Environmental Review (PER) for the State *Environmental Protection Act, 1986*, and a Public Environment Report for the *Commonwealth Environment Protection (Impact of Proposals) Act 1974*. A common four week public review period was set and a common PER document (WEL, November 1998) was produced, for both environmental impact assessment processes. Approval was provided for release of the PER document in September 1998 and the public review period commenced on 2 November 1998 and ended on 30 November 1998. Twenty five submissions were received on the PER document from the public and regulatory agencies.

In compiling this report the EPA has considered the relevant environmental factors associated with the proposal, issues raised by the public, specialist advice from government agencies, the proponents commitments and response to issues raised, and the EPA's own research and expertise.

Further details of the proposal are presented in Section 2 of this report and Section 3 discusses environmental factors relevant to the proposal. Conditions and consolidated commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 presents the EPA's other advice, Section 6, the conclusions and Section 7, the recommendations to the Minister for the Environment.

Appendix 1 states the recommended conditions and consolidated commitments for the project. The proponent's full commitments are provided in schedule 2 of Appendix 1. A list of people and organisations that made submissions is included in Appendix 2. References are listed in Appendix 3. Appendix 4 contains a table of the proponent's proposed management strategies.

Appendix 5 contains a summary of the public submissions and the proponent's responses to them. This summary of public submissions and the proponent's response is included as a matter of information only and do not form part of the EPA's report and recommendations. The EPA has considered issues arising from this process relating to identifying and assessing relevant environmental factors.

2. The Proposal

The WEL proposal is to construct additional LNG processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at the existing LNG plant on the Burrup Peninsula in the North West of Western Australia. This expansion will increase the LNG capacity of the plant from 7.5 million tonnes per annum to 15.5 million tonnes per annum. The export of the additional LNG product will require the construction of an additional LNG jetty with its berthing pocket and six or seven additional LNG ships for export to markets in East Asia.

The key characteristics of the proposal are listed in Table 1 below.

Table 1. Summary of key proposal characteristics

Project Characteristics	Requirements
Project life	30+ years
Reserve source	North Rankin, Goodwyn and other gas fields
Project facilities	• additional LNG processing trains • 1 additional fractionation unit • 2 additional power generation units • 1 additional LNG jetty berth • 1 additional LNG storage tank • Utilities upgrade (nitrogen plant, water treatment facilities, waste heat recovery from the existing power plant) • Relocation of administration complex
Main process	Shell Propane/Mixed Refrigerant (C3/MR) process
Project value	Approximately $6 billion
Additional LNG production	8 Mtpa (existing 7.5 Mtpa)
Additional land disturbance (laydown)	45 ha (existing 231 ha)
Additional power supply	Approx 50 MW for two trains. Existing onshore gas plant – approx 83 MW
Additional CO_2 emissions	2.9 Mtpa
Dredged seabed material for shipping lanes, ship berthing basins and turning circles	2.7 million m^3
Additional permanent workforce	Approximately 40-70 persons
Construction workforce	Approximately 2,000-2,500 persons (peak)
Construction period	Approximately 3 years per train

Natural gas is recovered from subsea reservoirs through the existing off-shore platforms of Goodwyn A and North Rankin A, and is currently piped ashore through one trunkline. This expansion project, when fully constructed, will require the construction of the already approved second offshore trunkline, to be able to supply sufficient natural gas for liquification. The timing of the construction of the trunkline, liquids expansion project and Trains 4 and 5 could be staggered, to suit the market demand for LNG, gas, LPG and condensate.

The plant location map is shown in Figure 1 and Figure 2 shows the LNG expansion facilities and areas. The additional LNG trains will be located to the south of the existing three trains. One new LNG storage tank will be located to the south west of the existing LNG storage tanks. The LNG trains and supporting facilities will be located within the existing WEL leases. However additional areas for the project will be required for the lay down of construction materials and for quarrying. WEL has negotiated the use of a 100m buffer strip to the south of the WEL leases adjacent to the Gorgon LNG project lease area for these purposes, for which a temporary lease will be required. The haul road from the Dampier Port Authority to the south will also be used for transporting construction material from the WEL Supply Base.

For the site preparation works required for the LNG trains, roads and the storage areas, it is recognised that rock and fill will be required from the existing quarry leases south of the plant. Both the quarry and laydown requirements will result in a permanent change in the landscape of these areas. These areas have already been disturbed by previous construction expansions and will be further disturbed by the second trunkline project. This is shown in the aerial photograph in Figure 3.

The additional LNG processing trains will require the construction of additional processing support facilities. The additional power supply of approximately 50 megawatts, will be supplied by high efficiency gas turbines. WEL is proposing to install a Thermal Combustion Unit (TCU) on the vent of the sulfinol column to reduce the global warming potential of the vented gases. One additional fractionating unit, to remove heavier hydrocarbons, will be required. It will be positioned adjacent to the existing fractionating units 1 and 2.

The North West Shelf Venture has been operating its LNG facility since 1989 and the EPA considers that the joint venture already has a good understanding of the natural environment of the Burrup Peninsula. The existing plant is licensed under the Part V of the *Environmental Protection Act 1986* for all emissions and discharges. It is also licensed under the *Explosives and Dangerous Goods Act 1961* as a Major Hazard Facility.

The PER as submitted and reviewed by the public, included two options for the construction of the jetty berth.

Since the release of the PER, WEL advised that jetty berth option 2 will be the chosen option for the expansion project (see Figure 5) and this report is based on this option being assessed. This jetty berth option will require the removal of a portion of Star Rock (1 000 000 m^3), but will require less dredging (2 700 000 m^3 instead of 6 100 000 m^3 for option 1) for the shipping channel. The marine impacts from the construction of the jetty and berthing pocket are described further in Section 3.2 of this Bulletin.

Plant processes

A process flow diagram for a liquefaction unit is shown in Figure 4. The trunklines transporting gas from the offshore platforms come ashore at the northern end of the plant and enter the trunkline onshore terminal, where the gas is separated from the liquids. Natural gas, which consists mainly of methane, heavier hydrocarbons (LPG) and carbon dioxide (3 %), needs to be cooled to minus 161°C by two refrigeration cycles in order to be liquified.

After removal of the liquids (condensate), the natural gas has to be treated in preparation for the cooling process. The first stage of treating the gas is the sulfinol unit where carbon dioxide, hydrogen sulfide and mercaptans are removed. Carbon dioxide (CO_2) liquefies at temperatures higher than methane and its removal is necessary to avoid it freezing out and blocking process tubes and equipment later in the liquefaction process. For this expansion project, WEL will be installing a thermal combustion unit at a cost of $10M, to burn the carbon dioxide, hydrogen sulfide and co-absorbed hydrocarbon offgases emitted from the sulfinol process. This will convert the methane co-absorbed by the sulfinol process, which has a high global warming potential, to carbon dioxide which has a lower potential, thereby reducing the net amount of greenhouse gas equivalent emissions emitted to the environment by the proposed facilities.

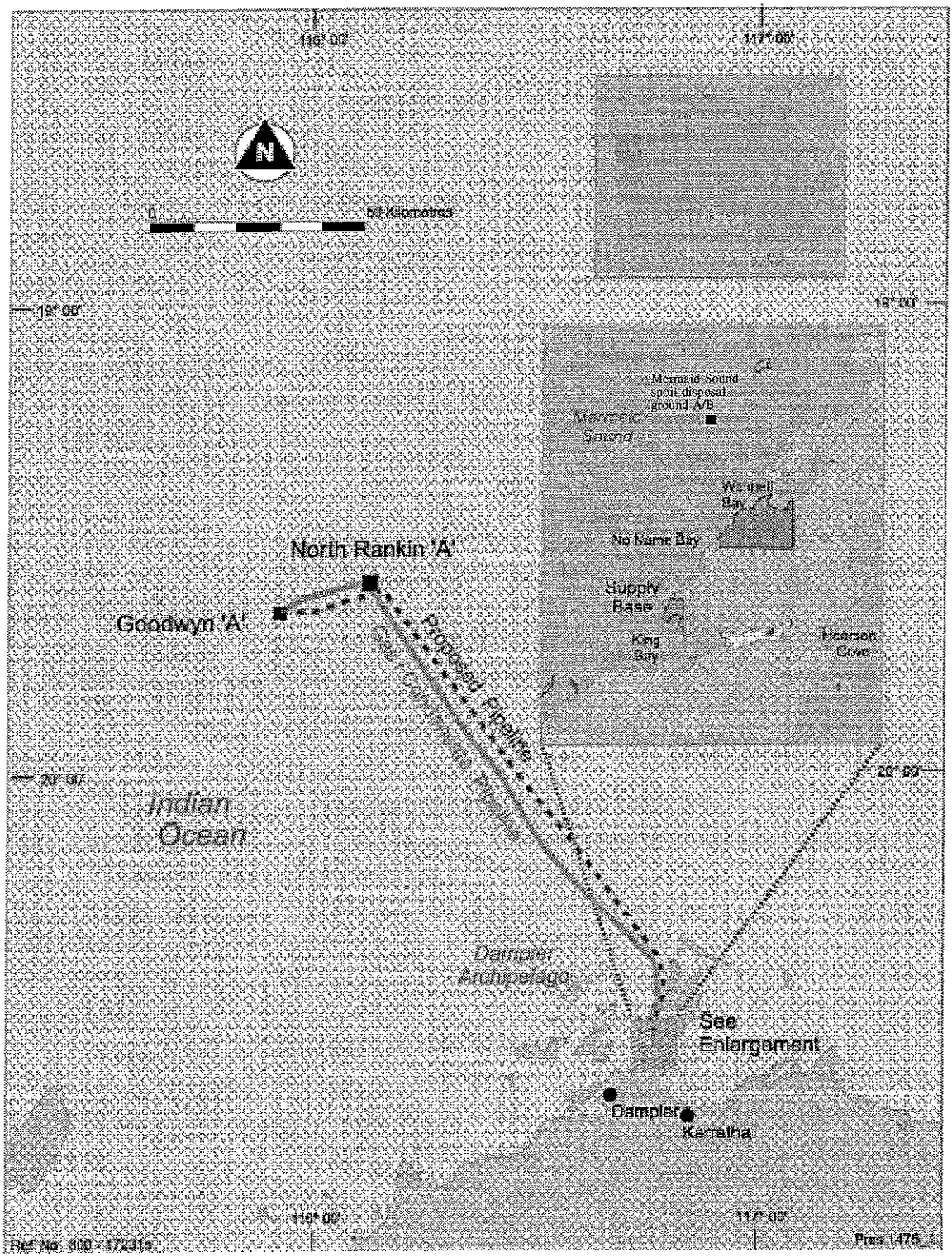

Figure 1. Project Location Map

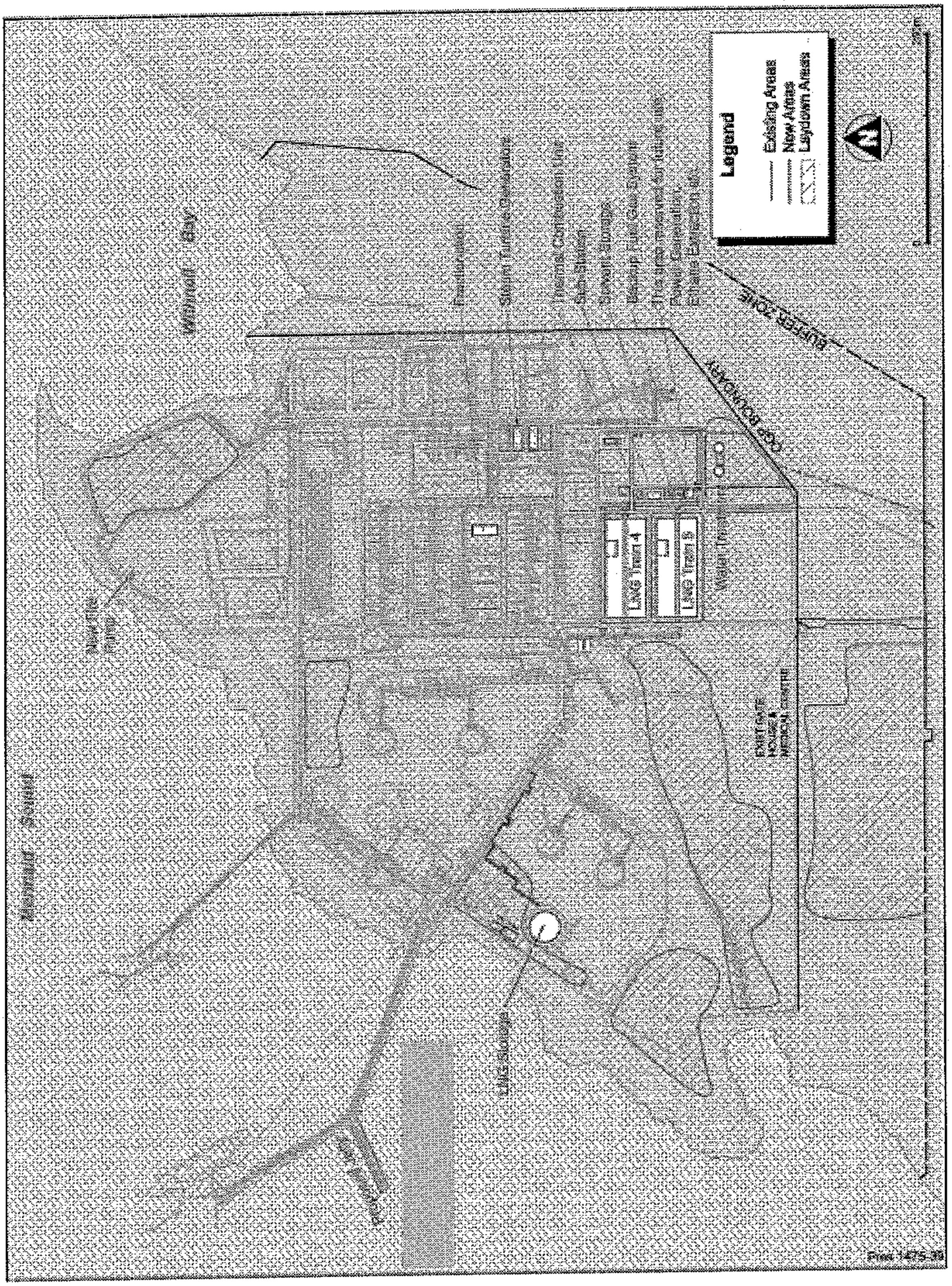

Figure 2. LNG Expansion Project Plan

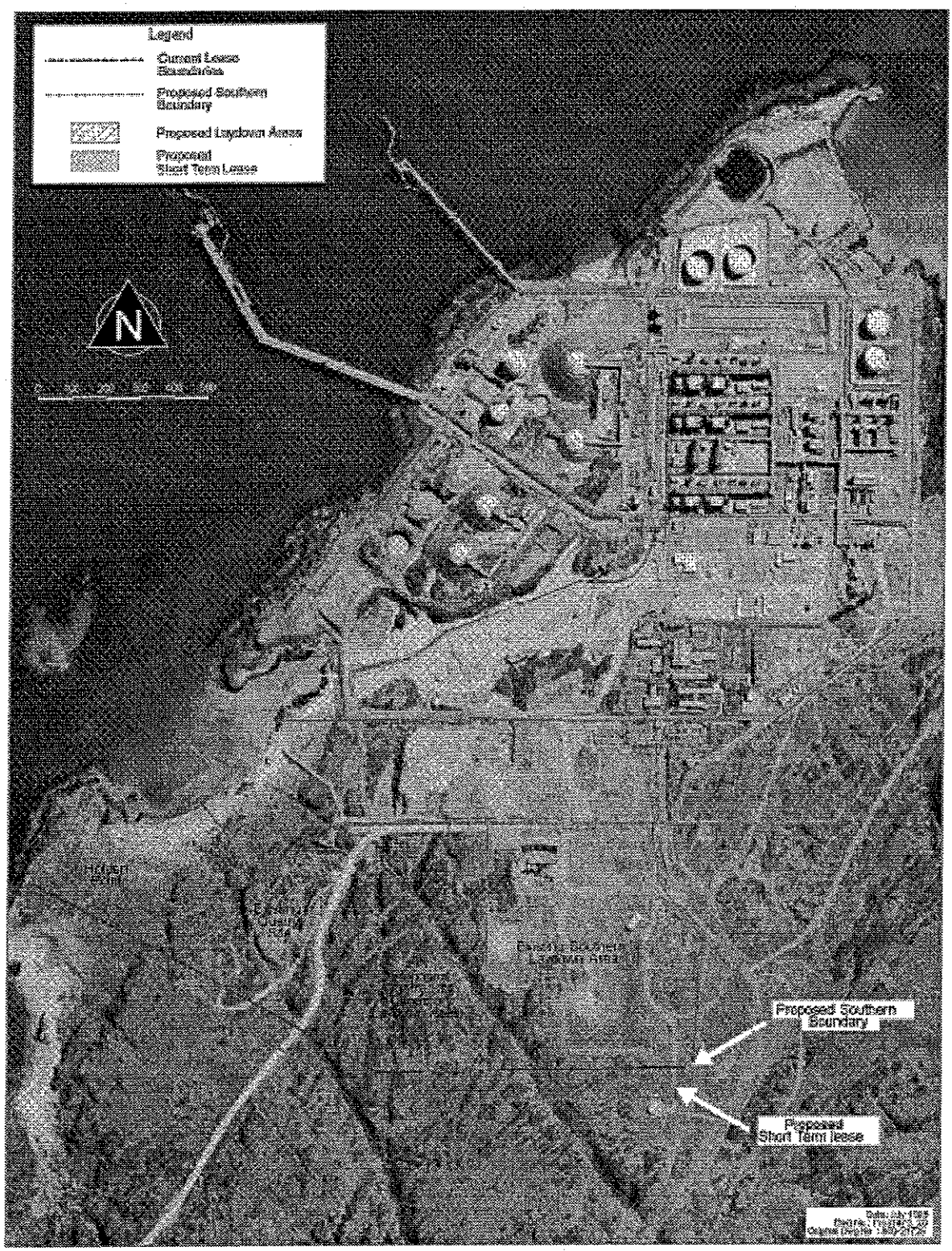

Figure 3. Project location aerial photograph

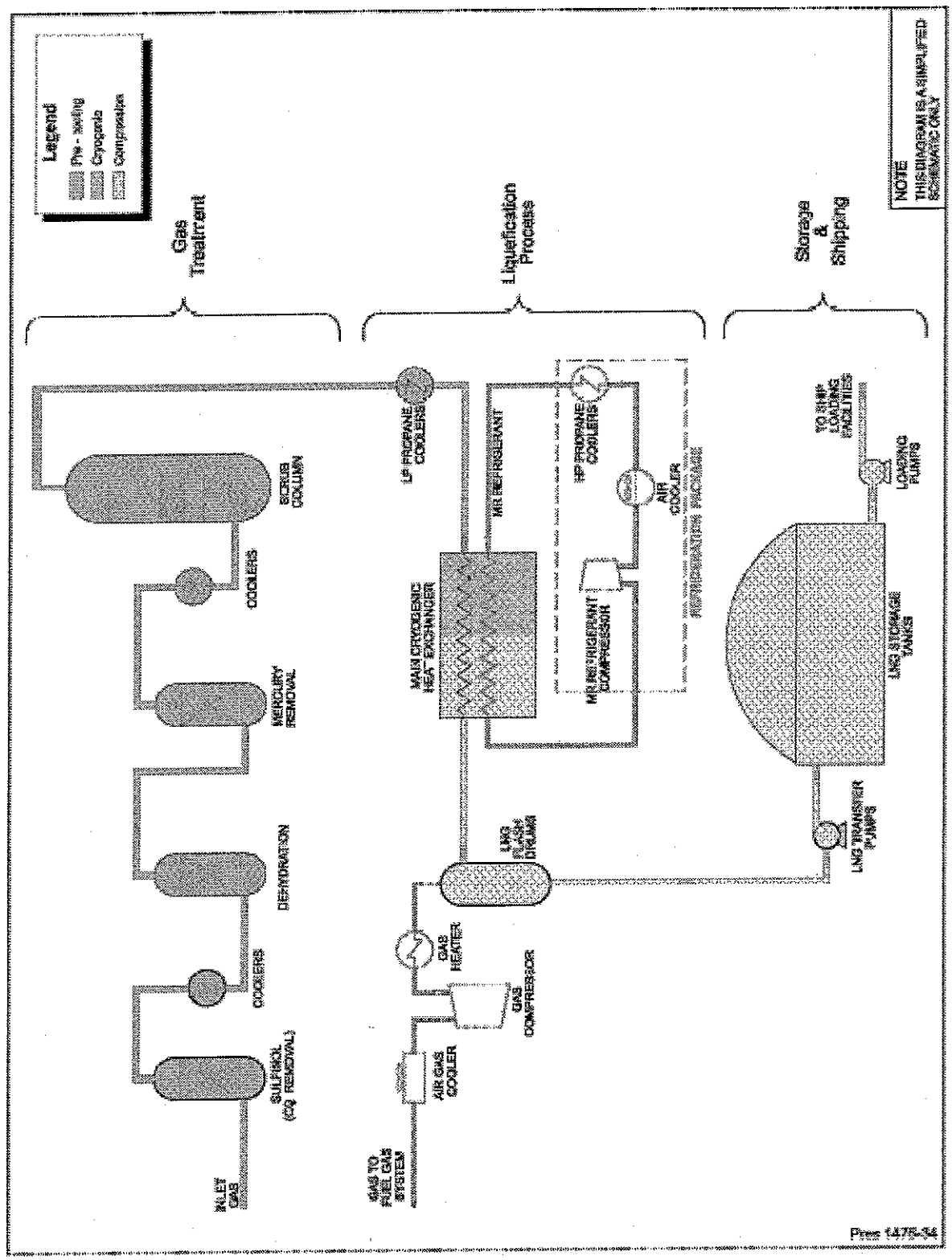

Figure 4. LNG Plant Process Flow

The natural gas proceeding from the sulfinol unit has the remaining water removed by the dehydration unit to prevent it freezing out later on in the cooling process. In the dehydrating units, the gas is cooled to minus 21°C and water is removed by molecular sieve drying beds. The molecular sieve beds are regenerated by a slip stream of dehydrated gas which is heated using waste heat recovered from the propane compressor gas turbine exhaust. The water removed is then recycled as make up water in the sulfinol unit.

The next stage is to remove the very small but detectable quantities of mercury in the gas which is highly corrosive to the aluminium tubing in the cryogenic heat exchanger. The mercury is removed in mercury removal beds. Mercury removal is a non-regenerable process and the projected bed life is in excess of 10 years. At the end of this period the beds are returned to the manufacturer for treatment.

After dehydration and mercury removal, the treated gas enters the cold end or cryogenic part of the LNG process. In this process liquefaction is achieved by cooling the gas progressively against propane and then a mixed refrigerant. The refrigeration process uses a similar principle to that used in the domestic refrigerator.

Prior to entry to the liquefaction step, the feed gas is cooled against propane to minus 33°C before entering the scrub column. The function of the scrub column is to remove the heavier hydrocarbon components of the gas (mainly propane and butane) that could freeze out in the downstream equipment. Liquid hydrocarbons removed in the scrub column proceed to the fractionation unit, where the fractions of propane and butane are separated out for separate storage and export.

The propane and mixed refrigerant compressors for each new LNG train will be driven with a single shaft General Electric type frame 7EA gas turbine equipped with a steam driven starter helper motor. It is proposed that waste heat be recovered from these gas turbine exhausts to generate steam for the helper motors.

The natural gas is then fed into the main cryogenic heat exchanger and cooled to a temperature of minus 144°C using mixed refrigerants as a cooling medium. Gas exiting the cryogenic heat exchanger is first cooled in a heat exchanger against flash gas to minus 158°C and then depressurised through a LNG expander turbine. The power produced through this expander turbine will be fed into the plant wide power grid. LNG is further depressurised by flashing into the nitrogen rejection column where the natural gas which is now liquefied (LNG), is further cooled to minus 163°C.

For this expansion, one new 120,000m^3 storage tank will be constructed, which is nearly twice the size of the four existing 65,000m^3 tanks. The new tank will be of a double containment type with a pre-stressed concrete outer shell and nickel steel inner shell. The tank will be located within the existing LNG tank farm, but due to recent technological improvements, will not require an earthen or rock berm as in the case of the existing LNG tanks.

With the LNG expansion project there will have to be upgrades of the utilities which supply the support systems to the LNG trains. The systems which will be upgraded are the nitrogen system, the instrument air facilities, demineralised water plant, fuel gas systems and fire and gas protection systems. In addition the administration building, laboratories and sewer system will be relocated to an area further south to make room for the new LNG trains.

Associated Project Impact Factors

For construction of the new LNG jetty, a Dredging and Blasting Environmental Management Plan will be prepared before the commencement of construction, to the satisfaction of the DEP, on advice from the Department of Conservation and Land Management (CALM) and Environment Australia (EA).

In the expanded facilities, the segregation and disposal of contaminated drainage differs from that in the existing plant. For areas where there is a higher risk of accidental oil contamination (e.g. around pumps), spillage will be collected and reprocessed or disposed of at a DEP approved liquid disposal site. Rain ingress to these areas will be minimised. For other plant

areas where there is a negligible risk of oil contamination, rainwater flowing into these areas will be collected in the existing stormwater disposal system. This change in philosophy will in effect separate out the areas where there is a high risk of contamination, and will therefore improve the overall quality of stormwater and effluent exiting the site.

For the LNG expansion project, rock fill will be required for filling, road construction and slope protection. WEL proposes to use the quarry sites to the south of the plant, which are within the existing WEL leases. The total quantity of rock which will be required for project purposes has not been accurately assessed, but requirements are likely to be of the order of 100,000m^3. This represents only a small increase in the rock quantity that will be required to be removed as part of the approved Domgas debottlenecking and second trunkline installation project, which requires rock fill of the order of 0.8 to 2.0 m^3 for rock armour protection of the trunkline.

The design of the LNG expansion facilities will be in accordance with all appropriate Australian and International Design Codes, including the Design and Engineering Practice Standards of the projects technical advisers, Shell International Oil Products (SIOP). To achieve the best safety management outcome for the project, WEL has incorporated the health, safety and environmental aspects into its key decision making processes. The existing WEL plant operates under a Safety Report regime which is approved under the *Explosives and Dangerous Goods Act 1961*. WEL will update its safety report for the expansion project. The safety report includes both a full risk assessment of the possible outcomes of possible hazardous events and a safety management system for the ongoing maintenance of integrity of the safety systems.

WEL has recently established an Aboriginal Heritage Management Committee, which includes members from the Aboriginal Community and the Aboriginal Cultural Materials Committee, to manage site disturbance and curation of heritage material associated with this expansion project.

The potential impacts of the proposal initially predicted by WEL in the PER document dated November 1998 and its proposed management strategies are summarised in Appendix 4.

3. Environmental Factors

3.1 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The identification process to determine which of the preliminary environmental factors are deemed relevant to this project is summarised in Table 2.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal which require detailed evaluation in this report:

(a) marine impacts - effects of construction dredging, spoil disposal and effluent discharges on water quality, marine flora and fauna;

(b) greenhouse gases - increased emissions;

(c) air emissions - discharges to atmosphere, in particular nitrogen oxides;

(d) terrestrial vegetation and fauna - disturbance of new areas;

(e) risk (public health and safety) - introduction of new sources of risk; and

(f) Aboriginal culture and heritage - possible disturbance of sites.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the PER document and the submissions received, in conjunction with the proposal characteristics (including significance of

the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management processes which ensure that the factors will be appropriately managed.

On this basis, the EPA considers that the preliminary factors of National Estate and historic ship wrecks, noise, mangroves, mercury regeneration, solid waste, surface water, ground water and other issues raised in the submissions can be adequately managed and do not require further evaluation by the Environmental Protection Authority in this report. Table 2 summarises the identification process of the relevant factors.

Details on the relevant environmental factors and their assessment are contained in Sections 3.2 - 3.7. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

3.2 Marine Impacts; Water Quality, Marine Flora and Fauna

Description

Potential marine impacts from the jetty and shipping channel construction, and from the operation of the LNG plant can be broadly categorised into the following areas:

- Dredging impacts
- Blasting impacts
- Dredge spoil disposal impacts
- Plant construction, shipping and operational impacts

1. Dredging

The construction of jetty berth option 2, which is the preferred jetty option, will require the removal of a total of 2 700 000 m^3 of dredge spoil from dredging the jetty berthing pocket, the widening of the existing shipping lanes, and the extension of the shipping turning basin (see Fig 5). In addition to a trailer hopper dredge to remove the softer material, WEL proposes to use a cutter suction dredge to cut and remove the hard calcareous substrate rock and therefore reduce the need for blasting of this material.

Marine benthic assemblages will suffer disturbance as a result of the dredging activities. The unconsolidated carbonate sands over bare muds, which have sparsely distributed communities of gorgonians, sponges, soft and hard corals, will be affected. The predominant fauna in these areas includes burrowing polychaetes, crustaceans and echinoderms and molluscs.

Dredging operations will result in the formation of sediment plumes causing temporary and localised increases in water turbidity and sedimentation. There is a potential for deaths of corals on the adjacent boulder shores and limestone due to the increased sediment plumes. However, findings from the 1995 LPG dredging marine monitoring programme (Le Provost Dames and Moore, 1995), and subsequent annual monitoring programs (Woodside Offshore Petroleum, 1997 and September 1998), indicate a high level of tolerance of these inshore corals to sediment loads. It is therefore expected that coral mortality, due to dredging plumes, will be minor.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Global Level Factors			
Greenhouse Gases	Proposal will result in an increase in greenhouse gases emission from 4.8 to 7.7 Mtpa (CO_2 equivalent) for a doubling of the plant's LNG production capacity. WEL intends to install thermal combustion of sulfinol gases and other greenhouse gas reduction measures that are expected to result in an 18 % reduction from the 'business as usual' case.	**Government:** • Support from the Australian Greenhouse Office for the general framework of the EPA assessment strategy. • Possibility of a regional greenhouse gas reinjection proposal. • Action plan needed for disposal or offset options. • How much can be credited to 'beyond no regrets'?	**Greenhouse gases is considered to be a major relevant environmental factor.**
Ozone layer	Most ozone depleting substances have been phased out in the plant.	No comments received.	Factor does not require further EPA evaluation.
National Level Factors			
Endangered Species	There are no endangered species in the project areas.	No comments received.	Factor does not require further EPA evaluation.
National Estate	Project will not impact on any areas listed on the Register of the National Estate. The plant expansion will be within the existing WEL lease and mainly include previously disturbed areas.	**Public:** • Aboriginal rock art should be listed as part of Australia's National Heritage.	Factor does not require further EPA evaluation.
Increased demand for natural resources	The North West Shelf contains Australia's most prospective and productive hydrocarbon province and reserves are estimated to be around 62 Trillion cubic feet of recoverable gas. The North Rankin, Goodwyn and Perseus fields hold approximately 17 Tcf.	No comments received.	Factor does not require further EPA evaluation.
Offshore Factors			
Oil (from onshore or shipping accidents)	Oil spills onshore are contained in the bunded areas, which enter the Oil Contaminated Water System (OCWS), if they are not reprocessed. All ships will require a Ship Board Oil Response Plan as required by the Marine Pollution Convention (MARPOL).	No comments received.	Factor does not require further EPA evaluation.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Sea floor, marine flora, and fauna	WEL has chosen Jetty Option 2 which will require the dredging of less material (2 700 000 m^3 as opposed to 6 100 000 m^3 for option 1), but will require the blasting of 1 000 000 m^2 of the north east corner of Star Rock. This will result in an increase in sedimentation from the dredging programme which lasts around six months, with the potential to affect corals on the adjacent shoreline. Blasting has the potential to affect fish and marine mammals. There are aqueous discharges to the marine environmental during plant construction, and operation. WEL has previously constructed two ship loading jetties and the effect from the construction of these jetties on the marine environment has been monitored and reported.	**Public:** • What is the effect of the removal of Star Rock on silt movement? • What are the long term effects on marine habitats from sedimentation from shipping and blasting? **Government:** • The effect on the nearby corals during times of stress need to be monitored. • What are the details of discharges from shipping and operational activities? • What type of antifoulant paint is used on the LNG ships? • The present Chemical and Ecological Monitoring of Mermaid Sound (CHEMMS) program is adequate to assess marine impacts around the LNG plant.	**Marine flora and fauna is considered to be a major relevant environmental factor.**
Dredging and disposal of dredge spoil	Dredge spoil from the dredging programme will be disposed of in two previously used areas, A and B, which were established in 1986 and used on three previous occasions.	**Government:** • Proponent should examine the effect of the disposal of dredge spoil on the recruitment, size distribution and species shift in the neighbouring coral communities. • WEL will have to apply for a sea dumping permit under the *Environmental Protection (Sea Dumping) Act 1981.*	**Dredging and the disposal of dredge spoil is considered to be a relevant environmental factor.**
Ballast Water	The discharge of ballast water from LNG ships has the potential to introduce exotic organisms.	**Government:** • Can boiler pipes be run through ballast tanks to destroy organisms?	WEL states that the LNG tankers will comply with the Australian Quarantine Inspection Service guidelines. Further methods of eliminating organisms will be considered when proven. Factor does not require further EPA evaluation.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Historic ship wrecks	Possible damage to listed shipwrecks (if any) from the dredging of the shipping channel.	No comments received.	WEL states the selection of the shipping channels has been chosen to avoid any listed historic shipwrecks. It will liaise with the Western Australia Maritime Museum to identify any wrecks prior to construction. Factor does not require further EPA evaluation.
Hydrotest fluids/pickling liquors	It is estimated that up to a total of 500 000m^3 of hydrotest fluids (water) will require discharge into Mermaid Sound. WEL states that some 1000 m^3 of pickling liquors will be disposed of offsite by the supply contractor in a manner acceptable to WEL and DEP.	**Government:** • Will there be a disposal plan for hydrotest fluid? • What is the composition and toxicity of hydrotest fluid?	**The disposal of hydrotest fluids is considered to be a relevant environmental factor.**
Shipping traffic (risks)	The number of ships will double with the doubling of production to between 240 to 263 ships pa.	No comments received.	The risk assessment of the additional LNG ships at the jetty will be included in the final Quantified Risk Assessment required for the plant. The loading and unloading of ships is covered in the plant Safety Management System. Factor does not require further EPA evaluation.
Onshore Factors			
Site selection	The two new LNG trains will be located to the south of the existing three trains. There is no option of the LNG trains being located on an alternative site because of the connections required with the existing plant.	No comments received.	All the disturbed ground will be in WEL's leased area and the adjacent 100m buffer area. Factor does not require further EPA evaluation.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Noise	Elevated noise levels have the potential to be generated during construction activities and during marine blasting.	**Government:** • Will the noise from the blasting of Star Rock impact on Dampier? • Because of the 10 km distance to Dampier, noise levels are unlikely to be of concern to residents.	From previous construction and blasting activities it is unlikely that blast noise will be noticed in Dampier. Compliance is required with noise regulations. Factor does not require further EPA evaluation.
Dust	Dust will be generated from rock quarrying and ground preparation.	No comments received.	WEL has stated that it will use dust suppression to minimise impacts during construction. With the 10 km distance to Dampier, dust levels are unlikely to impact the township. Factor does not require further EPA evaluation.
Air Emissions	The main air emission is oxides of nitrogen (NO_x) generated during the combustion process in gas turbines. Other minor emissions are sulfur oxides (SO_x) hydrocarbons, particulates, and smoke from flares.	**Government:** • No formal commitment from WEL to be involved in the Pilbara Air Study. • WEL commitment to investigate dark smoke is not mentioned in the PER.	**Air Emissions is considered to be a relevant environmental factor.**
Mercury regeneration	The natural gas contains very small amounts of mercury which must be removed prior to cooling, The catalyst beds which are used to remove the mercury are returned to the contractor when spent, for reprocessing, after about six years.	No comments received.	Factor does not require further EPA evaluation.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Solid Wastes	Solid wastes, scrap steel, packaging, spent consumables etc. will be generated for the construction phase.	**Government:** Has WEL considered the Ruggies recycling scheme? (WEL answer: Yes, however the transport costs make this impractical)	WEL has undertaken at least three major construction phases and has previously dealt with the disposal of solid wastes appropriately. WEL has stated that it will recycle materials if possible and dispose of other solid wastes in accordance with the requirements of the Shire of Roebourne and Department of Environmental Protection. Factor does not require further EPA evaluation.
Surface Water	The main newly disturbed area will be to the east of the existing quarry (around No Name Creek) and along the 100m southern buffer. The changes to surface water will be confined to the disturbed areas.	No comments received.	WEL states that the modified areas will be left in a condition that does not compromise existing surface drainage patterns. Factor does not require further EPA evaluation.
Groundwater	There is a potential for process spillage and the contamination of groundwater.	No comments received.	WEL states that areas around new facilities will be bunded, where there is the potential for process spills. Groundwater monitoring is reported to the DEP on an annual basis and will continue. Any additional monitoring will be decided on completion of the current groundwater study. Factor does not require further EPA evaluation.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Terrestrial Fauna	The Pilbara Olive Python is the only rare fauna species known to exist on the Burrup Peninsula. Seven priority listed bird species are found in the area. The plant expansion will be within the existing WEL lease and mainly include previously disturbed areas. A number of individuals of priority species may be killed as a result of construction activities.	No comments received.	**Terrestrial fauna is considered to be a relevant environmental factor.**
Terrestrial vegetation	No rare flora exist on the Burrup Peninsula. Five species declared as priority species, are known to exist. Approval has been previously granted to disturb the land in the new quarry area and near Holden Point for the second trunkline project. (which was approved by the Environmental Protection Authority in 1998)	**Government:** • The 1979 vegetation and flora study conducted for the Burrup Peninsula is dated and does not provide a good understanding of the conservation status of vegetation communities. • The disturbance of new areas and use of construction vehicles from other areas, will continue the propagation of weeds on the Burrup Peninsula. • The sandplain disturbance at Holden Point will reduce the already small number of these sandplain areas. • Acid precipitation from SO_2 could have an effect on aquatic systems (freshwater pools).	**Terrestrial vegetation is considered to be a relevant environmental factor.**

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Social/ Heritage Factors			
Risk (Human Health and Safety)	Operating two additional LNG Trains will introduce new sources of risk onto the existing gas plant.	**Government:** • Construction safety plan should be prepared prior to the commencement of construction. • Detailed Quantified Risk Assessment and Safety Management System should be prepared prior to commissioning the plant. • Common mode failures should be considered. **Private:** Domino effect in the existing and new trains needs to be considered.	**Risk is considered to be a relevant environmental factor.**
Social Impacts	The construction of the project will see the introduction of 2000 - 2500 temporary employees, with the concomitant provision of accommodation and social pressures on the neighbouring towns.	**Shire:** • Transport of construction materials through Karratha, and of workers to and from work, needs to be addressed to minimise impacts. • Access of the public to the Burrup Peninsula needs to be reviewed. • Shire does not have the capacity to service the social infrastructure needs associated with the project..	This factor has been included in the Guidelines because of the Commonwealth Government's requirements under the *EP(IP) Act 1974*. This factor can be adequately addressed in Environment Australia's environmental impact assessment process.

FACTOR	PROPOSAL COMPONENT AND POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Heritage	The plant expansion will be within the WEL site leases. Some Aboriginal sites will need to be disturbed within the project areas.	**Government:** • Security of heritage sites during construction, needs to be managed. • There should be community consultation on heritage and other issues during construction. **Private:** Assessment and long term management of significant Heritage materials needs to be strengthened.	**Heritage is considered to be a relevant environmental factor.**

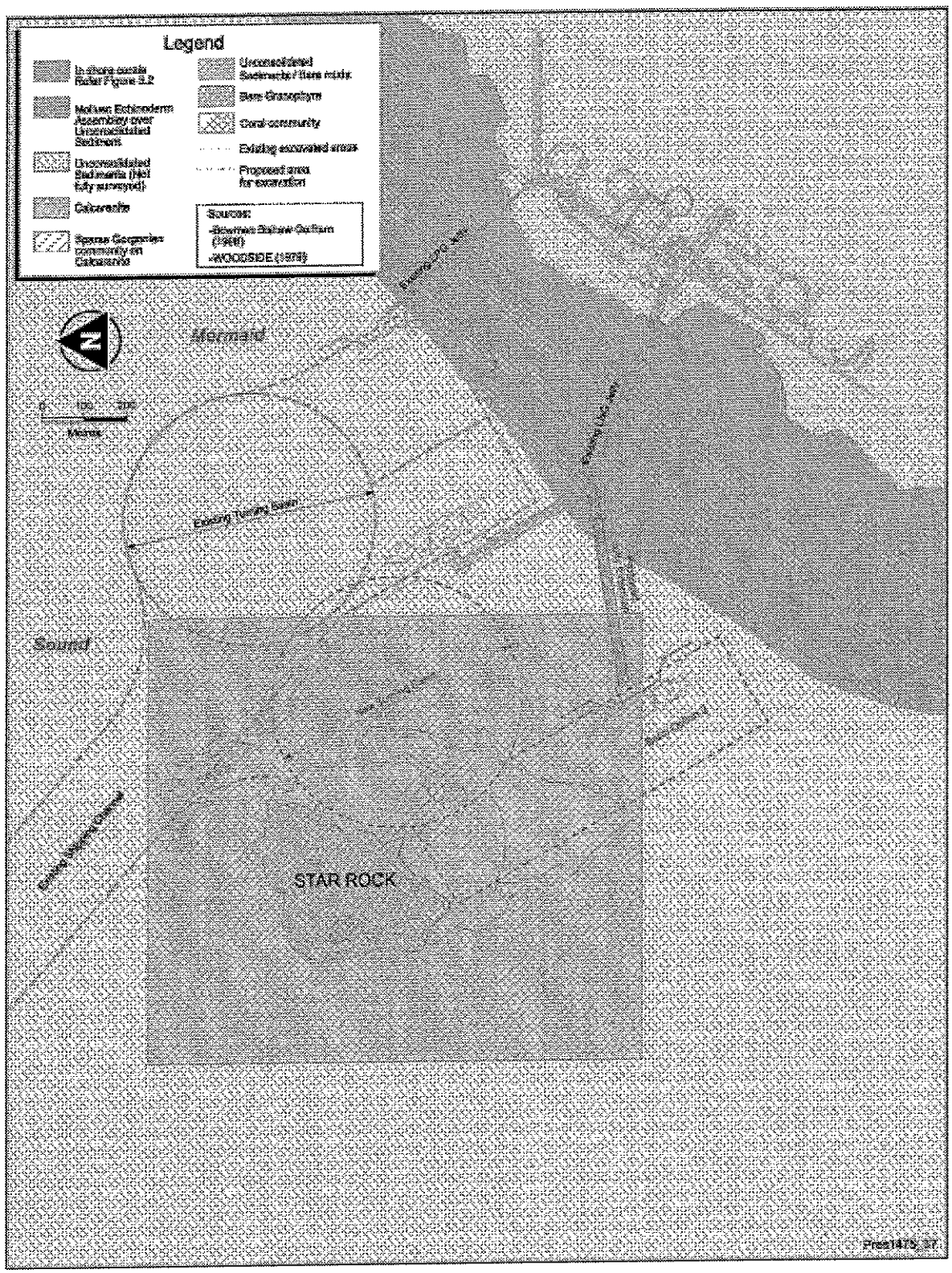

Figure 5. Jetty Berth Option 2 - Habitat Distribution

2. Blasting

Approximately 1 000 000 cubic metres of rock from the north eastern section of Star Rock will need to be removed to a depth of minus 12.5 metres in the construction of jetty berth option 2. Coral cover on Star Rock occurs on the opposite south western end, that is on the shallowest part of Star Rock, and it is not expected that any significant coral communities will be directly affected by the blasting.

It is also expected that limited marine blasting may be required during the dredging of the shipping lanes, turning basins and jetty berths. WEL has stated that it will most likely use packaged explosives made for marine blasting, which minimise residual toxic effects. Detonation processes are usually complete, but a small portion of wax and the plastic coatings from the explosives may remain.

The extent of mortality and injury from blasting to marine fauna depends on the size, depth and composition of the explosive used. Death and injuries will be sustained to fish from marine blasting, as well as any marine mammals that happen to be within the blast effect zone. Birds might also be at risk from the marine blasting, but the injury would be confined to diving species.

Estimates of lethal ranges and safe distances for fish and other marine animals can be determined using a method used by the Canadian Department of Fisheries (ECOS Consulting, 1992). Figures 6 and 7 show the estimated blast effect zones for 10 kg fish and marine mammals, respectively.

3. Dredge spoil disposal

The Mermaid Sound spoil disposal grounds A and B, 5 km north west of the plant site (refer Figure 1), were established in 1986 to accommodate WEL's original shipping channel dredging program. WEL obtained a sea dumping permit for the disposal of dredge spoil in this area because it was defined as a natural sink and fairly stable with respect to sediment re-suspension. These spoil grounds have been subsequently used by WEL on two occasions in 1989 and 1994 for construction of the LPG shipping berth. Some 700 000 m^3 of spoil was deposited from the LPG jetty and ship basin dredging program (compared to 2 700 000 m^3 for this expansion).

4. Plant Construction, Shipping and Operational Impacts

Hydrotesting of pipework and tanks during construction will require the discharge of large volumes of hydrotest fluid (up to 500 000m^3 may be required to be discharged in total) in a number of events. WEL states that where possible, corrosion inhibitors and oxygen scavengers will be avoided. WEL will submit the program of hydrotest discharges, detailing the volume, toxicity and time period of each discharge, for DEP acceptance with notification to DEP prior to each day's hydrotest discharge activities.

It is estimated that in total, 1 000m^3 of pickling liquors (weak acids with some neutralisers) will be required to clean the mill scale off pipework and tanks. This liquor is toxic to the marine environment and WEL states that none will be released into the marine environment. The supply contractor will dispose of the spent liquor offsite, in a manner acceptable to WEL and DEP.

There is an increased risk of spills and non-operational releases from the extra construction and operational vessels servicing the project. The public risk from a non-operational release and incident, from the extra shipping, will be assessed in the Quantified Risk Assessment being conducted for the project. For the spills which pose a risk to the environment, WEL has an existing oil spill contingency plan to satisfy the requirements of the Marine Pollution Convention (MARPOL) and WEL, which WEL states will be upgraded, to the satisfaction of the Department of Minerals and Energy (DME) and Dampier Port Authority (DPA).

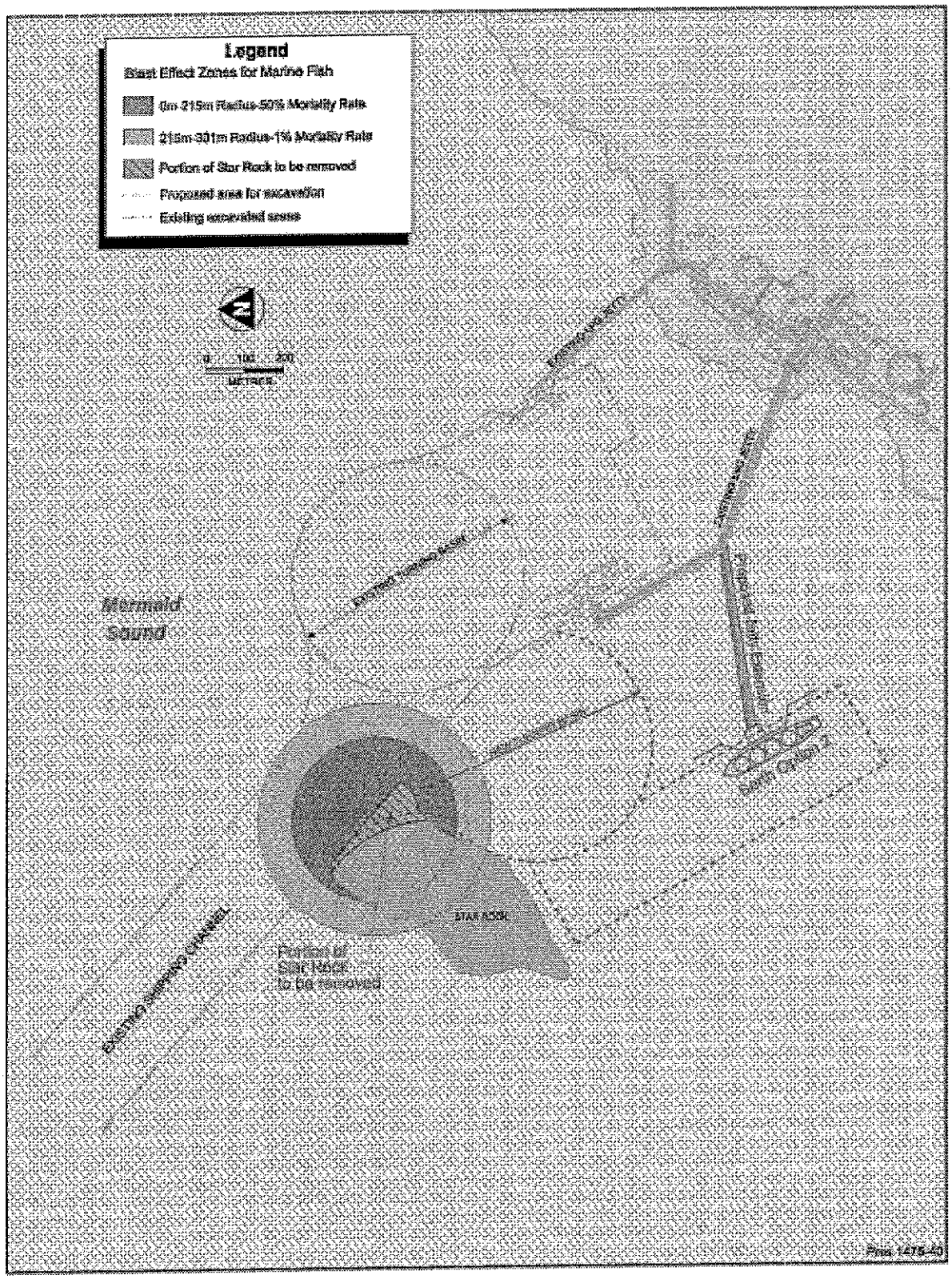

Figure 6. Estimated Blast Effect Zones for 10 kg Fish

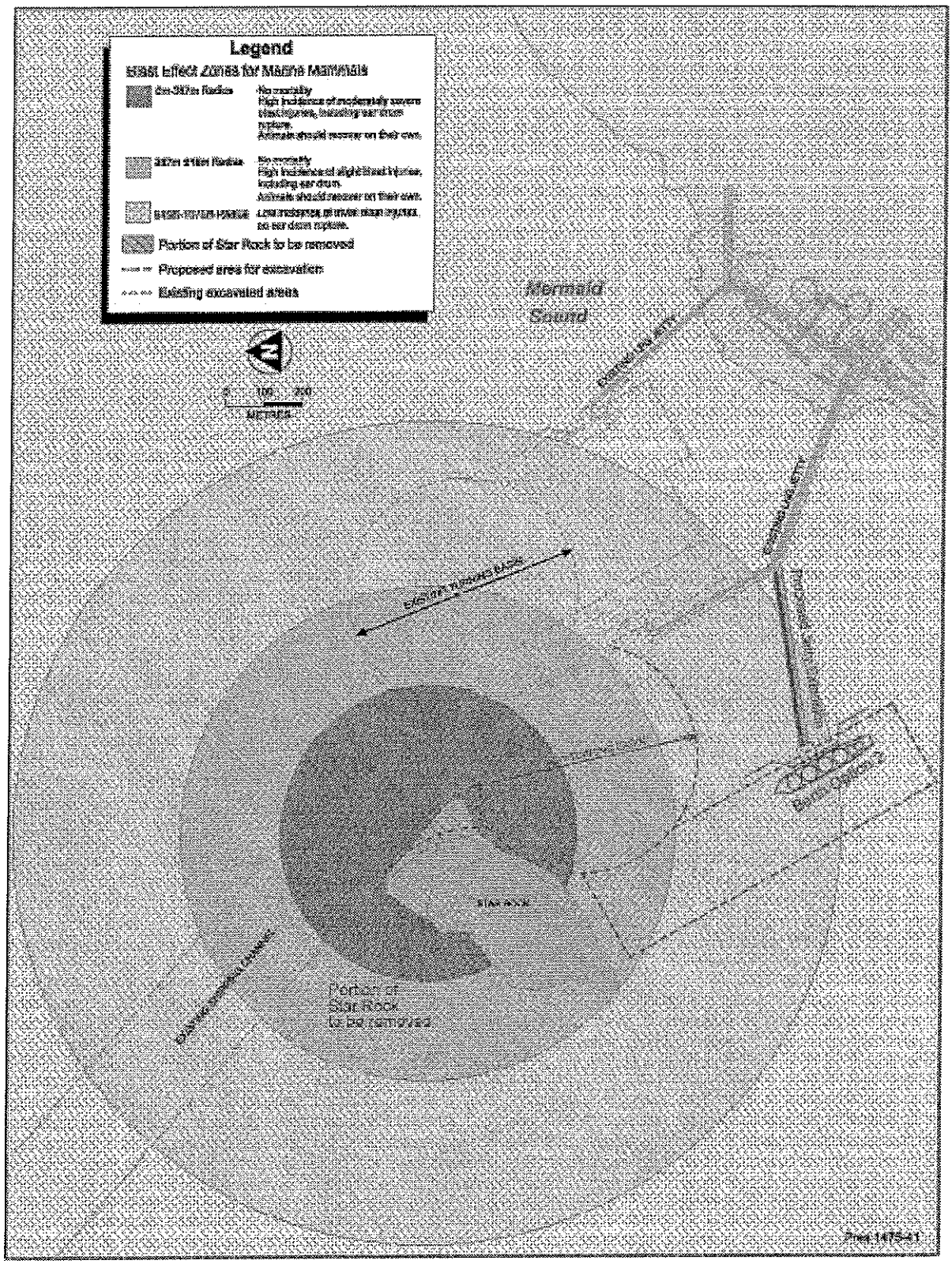

Figure 7. Estimated Blast Effect Zones for Marine Mammals

The dredges, construction ships and operational LNG ships will have the potential to introduce exotic organisms through the discharge of ballast water and contamination by sediment remaining on the dredge from dredging outside Australia.

A small increase in sedimentation is also expected from the increased shipping as a result of increased LNG exports.

For the operational phase of the project, the two current liquids effluent discharge points into Mermaid Sound will continue to be used, ie. the pipe discharge at the end of the LNG jetty and the waste water culvert discharging into No Name Bay. No new liquid disposal points will be constructed for the expansion project. Liquid effluent discharging into the marine environment essentially comes from three sources; rainwater run off from the paved plant areas, process discharges (sulfinol spills, firewater and hose water) and sewage effluent.

The proposed expanded facilities will have improved segregation of stormwater from potentially contaminated catchments and, as a result of this separation and better process controls over sulfinol spills, the discharge of sulfinol and oil into the marine environment will not increase in proportion to the increase in production.

Submissions

Submissions received on marine impacts mainly required further information from WEL, which has been provided in the proponent's response to submissions (Appendix 5). Types of information requested included the jetty option chosen, the exclusion zones required, the activities on Holden Point foreshore, the composition and toxicology of the antifoulant used on LNG ships, the composition and toxicity of hydro-test fluids, the type of loads in the oil contaminated water system and cumulative impacts, the evaluation of the quarantine reports from ships on exotic organisms and the results from the marine monitoring program.

Three of the main marine issues raised in the submissions were:

1. the specific measures required to minimise, monitor and manage turbidity from the dredging and blasting of the shipping channels, and the impacts on the neighbouring coral communities;
2. the effect of the disposal of dredge spoil in Grounds A/B on the recruitment, size distribution and species shift on the neighbouring coral communities; and
3. the effect of the blasting of Star Rock and the resulting change to silt movement. The long term effects to marine habitats further along the coast due to changes in the silt distribution from blasting Star Rock and the increased sedimentation from shipping.

Assessment

The EPA's objectives in regard to marine water quality, marine flora and fauna are to:

(1) Protect sensitive environments and species from hydrocarbon spills.

(2) Maintain the biodiversity of the sea floor and ensure that any impacts on locally significant marine communities, including turtles, are avoided.

(3) Ensure dredging and blasting in inshore areas during jetty construction are managed so as to avoid impacts on corals, particularly during coral spawning times.

(4) Protect the environment from significant impacts consistent with the *Environment Protection (Sea Dumping) Act 1981* and the *London Dumping Convention 1981*.

(5) Protect the adjacent marine environment from any impacts associated with foreign organisms and chemical constituents contained in discharged ballast water (or attached to hulls of vessels), consistent with current AQIS guidelines on ballast water.

(6) Ensure that there will be no significant impacts from disposal of hydrotest fluids or pickling liquors.

This assessment of the impacts on the marine water quality, flora and fauna is broken down into four areas as laid out below and evaluates the impacts from dredging the shipping channels,

impacts from blasting, impacts from spoil disposal and impacts from construction, shipping and operation of the additional LNG facilities.

Since public release of the PER, WEL has advised the EPA that it has chosen jetty berth Option 2 for the expansion of the LNG facilities. This option requires less dredge material (2 700 000 m^3 as opposed to 6 100 000 m^3) to be removed, but will however require the blasting of 1 000 000 m^3 of material from Star Rock. Jetty berth Option 2 involves a spur from the existing LNG jetty and as a result does not require any additional shoreline interference with the marine life in that area. Jetty berth Option 2 also requires a shorter jetty extension and therefore will result in a reduced exclusion zone and area of disturbance.

Environmental parameters of Mermaid Sound are assessed annually by WEL in the Chemical and Ecological Monitoring of Mermaid Sound (CHEMMS) program, which has been ongoing since 1986. CHEMMS has provided valuable baseline information on corals, intertidal organisms, heavy metal accumulation in molluscs, mangrove dynamics, sedimentation of coral communities and increases in Tri-Butyl Tin (TBT). Annual monitoring of the intertidal and subtidal marine environment is carried out, including monitoring of oysters and sediments for metals and hydrocarbons, and monitoring of corals, mangroves and rocky shores. Total effluent pollutant loads and monitoring results are also provided. The CHEMMS report is provided annually to the Department of Resources Development under the *North West Gas Development (Woodside) Agreement Act 1979*, with copies provided to DEP and CALM.

Dredging

WEL has committed to prepare a Dredging and Blasting Environmental Management Plan (DBEMP) to the satisfaction of DEP, on advice from CALM and EA, prior to jetty construction.

Dredging operations for the new jetty, which could last up to six months, will result in the formation of sediment plumes which move with the tides and cause localised increases in water turbidity and sedimentation on the adjacent corals. The corals in adjacent areas are species which are tolerant to moderate levels of sedimentation from tidal flows and are not ecologically significant (pers. comm. with C Simpson, CALM). Extensive monitoring of these assemblages during construction of the LPG jetty and turning basin in 1995, found that coral mortality due to dredging plumes, was minor.

Recent studies suggest that the effects of sediment on coral spawn are significant. WEL has therefore undertaken not to dredge for a suitable time, as determined in consultation with CALM, around coral spawning events.

However, during the months when the water temperature is high, the coral is under increased stress and in response to submissions, WEL made additional commitments to; monitor the neighbouring coral before and after dredging; minimise sediment generation by the use of appropriate dredging methods; seek to manage dredge position to minimise sediment dispersion to the shoreline; and in the event of significant mortality attributable to sedimentation, implement a suitable programme of enhancing coral recruitment in the area.

The marine assemblages affected by the project in the construction of the shipping channel, are sparsely distributed in the potentially affected area and widespread in Mermaid Sound. The localised loss of these areas during the dredging is considered by the EPA to be of minor impact.

Blasting

In the blasting of Star Rock, coral cover on Star Rock on the south western corner will not be significantly affected by the blasting activities on the north east corner. There will however be some increase in sedimentation from the blasting activities on these marine communities. The blasting of Star Rock will largely involve the removal of calcarenite from below the sea bed and a small quantity of granophyre from the rock itself. WEL states that it is unlikely that the longshore movement of sediment will be changed.

Limited marine blasting will be required during the dredging of shipping lanes turning basins and jetty berths. It is WEL's intention to minimise blasting activities with the use of a cutter suction dredge wherever possible, for the excavation of the sea bed. However specific blasting of igneous rock will occur around Star Rock for jetty berth Option 2.

In regard to the impact of the blasting on marine life and mammals, the primary control will be under the Dredging and Blasting Environmental Management Plan (DBEMP), which will require DEP acceptance, on advice from CALM, prior to the commencement of the blasting and dredging operations. The DBEMP will include procedures for a whale and turtle watch to be maintained during blasting activities, the control of the release of plastic coatings into the environment after each blast charge, the removal of fish subsequent to a blast, and the control of overpressure impacts by the blast pattern.

The EPA considers that, provided the blasting is conducted under an agreed plan, the impacts would be of a temporary nature and the marine environment has the capacity to recover.

Dredge Spoil Disposal

Prior to the LPG expansion and the construction of the LPG jetty in 1994, the recolonisation of spoil grounds A/B was assessed by examining the sediments and benthic fauna which has colonised the substrate since the last use in 1986. The findings of this study were that the range of abundance, taxonomic richness and composition of the benthic fauna collected from the spoil ground was very similar to that of the undisturbed control sites. Surveys of the coral communities adjacent to nearby islands were conducted between 1993 and 1994 and no detectable coral mortalities were found soon after, or seven months after, the spoil disposal operations.

Prior to disposal of dredge spoil, WEL will have to apply for a sea dumping permit which will be assessed under the *Environmental Protection (Sea Dumping) Act 1981* administered by the Commonwealth Government.

The EPA considers that on the basis of monitoring results from previous spoil disposal operations and the further assessment required for a permit, this current proposal for spoil disposal is acceptable.

Plant Construction, Shipping and Operational Impacts

In its response to submissions, WEL has stated that it will obtain DEP acceptance of its hydrotest water discharge management plan, prior to the disposal of any hydrotest water. There will be no release of pickling liquor into the marine environment, which will be disposed of by the pickling contractor in a manner acceptable to both WEL and DEP.

A quarantine inspection report will be prepared for any dredge, prior to arriving in Pilbara waters. The report will ensure that the vessel has a current de-ratting certificate and is free of exotic organisms, and that there is minimal residual sediment contamination from previous dredging operations. WEL will audit this process internally.

The disposal of liquid wastes from ships will not be permitted within the waters of the Dampier Archipelago unless they are treated in accordance with the requirements of MARPOL, Annexe IV, or pumped to the onshore gas plant's waste management system. All construction vessels will be required to have oil spill response plans which will be reviewed by the Department of Minerals and Energy prior to commencement of the project. All vessels will also be required to carry oil spill control equipment. Dredges arriving in Australia will be required to comply with the Australian Quarantine Inspection Services (AQIS) controls as to the discharges of ballast water and sediment.

The NW Shelf LNG vessels have been using TBT free paint since they were constructed. The six extra LNG ships required for this plant expansion will also be TBT free and probably utilise a lower toxicity copper based paint or other improved equivalent available at the time the ships are built.

For the plant operational areas WEL has improved the bunding of areas where there is a possibility of oil contamination. For areas where there is a higher risk of oil contamination, for example around process pumps, the ingress of rain will be minimised. As a result, rainwater runoff from bunded areas will generally be of a higher quality than at present and will be disposed of through the stormwater system.

A small increase in sedimentation is also expected from shipping and high use areas around the LNG load out berths.

The issue of the effects of light from the plant on turtle nesting and hatchlings was raised in submissions. The closest nesting beach is 8-10 km away and WEL has stated that its activities are expected to have a negligible effect on turtle nesting or hatching.

Fisheries Western Australia advises that it considers the approach set out in the PER to avoid or mitigate harmful impacts from the project on the offshore environment, involving the preparation of reporting, monitoring and management programmes, to the satisfaction of DEP, is adequate. It also states that since the proposed addition is virtually a duplication of the existing project, most of the environmental effects have already been observed and this should facilitate future environmental management by the proponent.

Summary

Having particular regard to the:

(a) preparation of a Dredging and Blasting EMP (DBEMP) to manage impacts on corals, fish and sea mammals, WEL's commitments, and WEL's previous experience in the construction of two jetties;

(b) disposal of dredged spoil in grounds A/B, the previous use of this area and the requirement of a permit to do so;

(c) disposal of hydrotest fluids and the agreement of a hydro test water discharge management plan; and

(d) that the LNG plant operates under a DEP licence and WEL reports annually on the CHEMMS monitoring programme,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for marine impacts.

3.3 Greenhouse Gases

Description

The context for Greenhouse gas emissions is global. The Greenhouse effect is a natural phenomenon that warms the earth and enables it to support life. Greenhouse gases are those gases which contribute to the Greenhouse effect. Over the past 200 years, human activity has dramatically increased the amount of Greenhouse gases in the atmosphere and this increase continues today. While there is dissension within the scientific community over the climatic and environmental effects of increasing levels of Greenhouse gases, the view of the Intergovernmental Panel on Climate Change is that the balance of evidence suggests a discernible human influence on global climate.

Australia's Greenhouse Gas Targets

In response to the predicted impact of increasing levels of Greenhouse gases, International and National targets limiting the increases in emissions have been set. At the Kyoto Climate Change Conference in December 1997, the developed countries agreed to a collective target of at least a 5% decrease in Greenhouse gas emissions from 1990 levels by the years 2008 -2012. Australia has particular national circumstances whereby it is a major net exporter of energy, it's industries are energy intensive and it has a high industrial growth rate. Within this agreement, Australia was to limit its increase to no more than 8% over the same timeframe.

In the absence of any measures to reduce emissions of Greenhouse gases, Australia's emissions are expected to increase by 43% from the 1990 levels. This is the figure which is shown in Table 3 below as the 'business as usual' case. It is also expected that companies producing Greenhouse gas will accept the Greenhouse Challenge and implement 'no regrets' improvements in their emissions, which will reduce the increase to 28% from the 1990 levels. 'No regrets' is a term used for measures that can be implemented by a company which are

effectively cost neutral to a company, in other words it provides the company with returns in savings which offset the initial capital expenditure that can be incurred.

In the Prime Minister's statement prior to the Kyoto meeting and with the approval of the Commonwealth Cabinet, he states "We are prepared to ask industry to do more than they may otherwise be prepared to do, that is, to go beyond 'no regrets', minimal cost approach where this is sensible in order to achieve effective and meaningful outcomes". This can be achieved by taking action both on-site and off-site.

The six Greenhouse gases which are covered by the Kyoto Protocol are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

Table 3. National Greenhouse Targets (estimated influence of response measures to attain the initial Kyoto target for Australia)

National Greenhouse Strategy Target	Factored Increase (based on 100 for no change) for the Year 2010	Reduction Percentage
'Business as Usual'	143	
Implementation of 'no regrets'	128	10.5%
PM Statement of beyond 'no regrets'	118	17.5%
Inclusion of land use and trading - Kyoto target	108	24.5%
No change on 1990 emission level	100	

The National Greenhouse Strategy (Commonwealth of Australia, 1998) provided some information as to the implementation of the Kyoto Protocol strategy. There are no State or project specific requirements in the National Strategy, although the strategy does detail responsibility for measures for the Commonwealth, State and Ministerial Councils. Implementation plans are to be developed by States and Territories as subsidiary documents to the National Strategy. These plans are to be guided by the same principles which have guided the National Strategy, namely:

- the need to have a Greenhouse response which is tailored to Australia's national interests;
- the need to integrate Greenhouse considerations with other government commitments;
- the pursuit of Greenhouse action consistent with equity and cost effectiveness and with multiple benefits;
- recognition of the importance of partnerships between governments, industry and the community in delivering an effective Greenhouse response; and
- the need for action to be informed by research.

In the assessment of the environmental factor of 'greenhouse gases' for the proposal, the EPA considered the agreement reached by the Australian Government at Kyoto in December 1997 and the subsequent Kyoto Protocol which was signed on 29 April 1998. It also considered the National Greenhouse Strategy (Commonwealth of Australia, 1998) which was released by the Australian Greenhouse Office in November 1998 and endorsed by the WA Cabinet on 5 August 1998 subject to four qualifications, which include: maintenance of international competitiveness, differentiation within Australia, the ongoing nature of the basis for Greenhouse Strategy and the cost of achieving greenhouse targets.

Greenhouse gas emissions from the proposed Additional LNG Facilities

The major emissions of Greenhouse gases from the existing onshore gas plant are carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). CO_2 and N_2O are emitted as combustion products from the various gas turbines and heaters which are used to power the processing facilities. CH_4 is emitted from the process and the venting of natural gas. CO_2 comes onshore with the plant feed gas and comprises of approximately three per cent by volume. All this CO_2 is removed from the gas stream prior to cooling to avoid blockage of later sections in the cryogenic part of the LNG processing train.

CO_2 and other unwanted gases are removed from the process gas by the sulfinol unit in the LNG trains. In this process, CO_2 is physically and chemically absorbed from the gas by the sulfinol. The sulfinol solvent is regenerated for reuse and in this regeneration the carbon dioxide and other gases are vented off in a separate vessel. For this expansion project WEL proposes to recycle this off gas back into the sulfinol unit and to burn the final off gas which comes out from the reflux drum, to convert the unburnt CH_4 into CO_2 and therefore reduce the total global warming potential. (The Intergovernmental Panel on Climate Change has stated that the global warming potential of methane is twenty one times that of carbon dioxide.)

The break down of the current and expanded gas plant greenhouse emissions is shown in Table 4. It can be seen from this table that most (60%) of greenhouse gas emissions from the plant come from products of combustion, ie. exhaust gas from the gas turbines and burners. WEL considers that it is currently technically and practically impossible for these exhaust gases to be cooled, compressed and disposed of in any energy efficient way. The only greenhouse gas source where there is a possibility of recovery and reinjection into the ground, is the CO_2 which comes from the sulfinol regeneration unit. The feasibility of this option is discussed in the 'Assessment' section.

Table 4. Expected Greenhouse Gas Emissions (Mtpa CO_2 equivalent)

Source	Current LNG Plant	Current Plant Plus LNG Expansion and LEP (no emission reduction)	Current Plant Plus LNG Expansion and LEP (with emission reduction)
Emissions from Products of Combustion	2.9	5.6	4.8
Existing CO_2 from feed gas ex Sulfinol	0.7	1.5	1.5
Co-absorbed/vented HC from Sulfinol	0.9	1.8	1.0
Seal oil co-absorbed/vented gas.	0.08	0.16	0.1
Flaring	0.2	0.3	0.3
Total	**4.8**	**9.4**	**7.7**

(LEP = Liquids Expansion Project)

For the LNG expansion project WEL has included three major improvements which will reduce the Greenhouse gas emissions from what they would have been had no emission reduction measures been implemented. Table 4 shows the breakdown of Greenhouse gas emissions in carbon dioxide equivalents from the current gas plant plus the expansion with no emission reduction measures, and from the proposed expanded plant with the emission reduction measures in place. This Table shows that had no emission reduction measures been implemented, a total of 9.4 million tonnes per annum (Mtpa) of carbon dioxide would have been emitted. With the emission reduction measures in place this has been reduced to a total of 7.7 Mtpa of carbon dioxide. The emission reduction measures being proposed by WEL for this expansion project are in three major areas.

The first new area is in the generation of additional power for the LNG compressors. Frame 7 gas turbines (GTs) will be used instead of the current Frame 5's. These Frame 7 GTs operate at a higher thermal efficiency of 33% instead of the 21% for the Frame 5's. The PER proposed the retrofitting of waste heat recovery units to the existing power generation gas turbines, with some co-firing for steam power generation. Due to a market driven scale reduction of LNG demand, the proponent has since advised that this part of the project has been revised to use high efficiency aeroderivative GTs for power generation, instead of steam generation and steam turbines. Greenhouse gas emissions from the project will however still be equivalent to that proposed in the PER.

The second area where there is an emission reduction is in the flash gas that comes off from the sulfinol unit. The flash gas will be recycled back into the sulfinol unit and any off gas from the reflux drum, which still contains some methane gas, will be burnt to convert the methane which has a high global warning potential, into carbon dioxide which has a lower potential.

The third area is in the installation of low emission seal assemblies in the main gas compressors to reduce the leakage of methane into the circulating seal oil system. WEL will also be continuing to monitor the methane emissions from other parts of the plant and flares with a view to reducing fugitive emissions.

The Greenhouse gas emission reduction measures proposed by WEL were to add an additional $50 million of 'beyond no regrets' measures to the project. WEL has advised that because of the scaled reduction of the project since the release of the PER, this cost will now only be $15 - 20 million.

WEL signed a Greenhouse Challenge agreement with the Commonwealth Government on 18 November 1997. The Agreement covers a number of emission abatement techniques for implementation in this and future projects.

Submissions

The submissions on Greenhouse gas relate mainly to the extent to which the additional capital expenditure by WEL goes toward measures which are regarded as beyond 'no regrets'.

The other comment which was received was that the proponent needed to provide an action plan of mitigation measures including forestry, re-injection and industrial processes which would contribute to meeting the Greenhouse gas targets proposed in the Kyoto meeting in 1998.

The Australian Greenhouse Office supports the general framework for assessment proposed by the EPA (see below) and recommended a strengthening of the requirements. The Office expressed a strong interest in the option of reinjection of gases and requested that Western Australia look at a regional approach for reinjection of carbon dioxide, encompassing other proposed plants in the Pilbara region.

Assessment

The EPA considers this proposal to be a significant contributor to Western Australia's Greenhouse gas emissions, and its objectives in regard to this environmental factor, consistent with the National Greenhouse Strategy, are to:

(1) Estimate the carbon dioxide equivalent emissions from the existing and the proposed new plant.

(2) Mitigate Greenhouse gases emissions in accordance with the Framework Convention on Climate Change 1992, and in accordance with established Commonwealth and State policies. (Environmental Protection Authority Interim Guidance #12 'Minimising Greenhouse Gas Emissions', (EPA, 1998c)).

(3) Minimise Greenhouse gas emissions in absolute terms and reduce emissions per unit product to as low as reasonably practicable with comparisons to other LNG processes.

(4) Estimate the gross amounts of Greenhouse gases that may be soaked up from sink enhancement programmes.

The EPA has also considered fuel efficiencies of the WEL LNG process in relation to the other LNG processes used in other plants.

One of the stated objectives of WEL's environmental policy is to seek continuous improvements in energy efficiency and WEL has stated that this expansion project will improve the fuel efficiency of its plant from 92.9% to approximately 94%. This puts it ahead of the four other commercially available LNG processes as shown in Table 5 below.

Table 5. Fuel Efficiencies of WEL's LNG Process for 2 Trains, Utilities, General Facilities, Storage and Loading in comparison to other LNG Processes (1997)

Parameter Measured	C3/MR Process (LNG Expansion Project)	C3/MR Process (Existing Plant Process)	CASCADE Process	DMR Process	PRICO Process	N2-Expansion Process
Fuel efficiency *	94% (approx)	92.9%	91.2%	93.5%	92.6%	90.4%

* *HHV products/HHV feed*

Also considered is the view that where LNG is used to replace coal or oil fired power generation in East Asia, there is a net reduction in global Greenhouse gas contribution. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has conducted studies for WEL to quantify the life cycle advantages of natural gas over coal and oil (CSIRO, 1996a, 1998a). These studies concluded that for fuels burnt to produce electricity in Japan, the use of LNG resulted in 493 kg CO_2 per Mega Watt hour (MWh) generated compared with 728 kg CO2 per MWh (i.e. 48% more emissions) and 865 kg CO_2 per MWh (i.e. 75% more emissions) generated for oil and coal respectively. This implies a substantial global benefit from the use of LNG as a substitute fuel.

WEL states in its PER that it has signed the cooperative agreement with the Commonwealth Government as part of the Greenhouse Challenge Program. As part of the Agreement WEL has made commitments to address its greenhouse gas emissions in the existing and future facilities by measures which monitor greenhouse gas emissions, set standards in the design and operation of existing and future facilities, seek continuous improvements in energy efficiency, and provide an annual report to the Commonwealth Government on the progress of the action plans and an update of the inventory of emissions.

From Table 4 it can be seen that the main contributor (60%) of greenhouse gas emissions from the plant is the products of combustion from the gas turbines which provide general power and power to the LNG compressors. It is not currently feasible to collect the hot turbine exhaust gas, cool it, compress it for transportation and dispose of it in an energy efficient way. The only gas from the LNG plant where there is a possibility of collection, compression and disposal is that gas which is emitted from the regeneration of the sulfinol unit.

WEL has also looked at alternative methods of disposing of the CO_2 generated by the sulfinol unit. It investigated the collection, compression and transmission for reinjection of carbon dioxide gas from the sulfinol recovery and combustion unit. WEL looked at reinjection of the gas into two disused gas fields, on the North West Shelf. The cheaper of the two options is to compress the CO_2 and pipe it 220 km down the coast to gas fields owned by third parties at Tubridgi at a cost of A$270 million. Reinjection is not totally effective as the power required for compression and transmission will require the generation of further greenhouse gases.

WEL also looked at the use of biomass offsets (CSIRO, 1996b), (such as the planting of forest trees) which sequester CO_2. It identified that the most effective and efficient method for the utilisation of offsets in the planting of forests was in the use of wood from the forests for the generation of energy in place of fossil fuel.

WEL is currently undertaking a more detailed feasible study on plantation establishment for use as a greenhouse gas sink. The issue of Greenhouse credits given to companies investing in forestry projects has not been determined by the Australian Greenhouse Office as a matter of policy and therefore WEL is not able to determine its most cost effective Greenhouse mitigation strategy until these offsets have been determined. As a result no commitments have been made by WEL as to reinjection or tree planting.

However, notwithstanding the energy efficiencies and recovery systems planned for the expansion project, the increase in CO_2 emissions will be 2.9 Mtpa which would increase the total emissions for the LNG plant to 7.7 Mtpa. This total emission figure is not insignificant in the scale of Australia's total greenhouse gas emissions and it represents a figure of 1.4% of the total Australian emissions.

Summary

The EPA commends WEL for providing a categorisation of its greenhouse gas emissions and estimates of efficiencies, and investigating the option of reinjection, all of which aided its decision making.

The EPA also commends WEL on the improvements proposed in the recovery and combustion of sulfinol gas, and reduction of fugitive emissions of methane. These measures along with waste heat recovery will greatly reduce greenhouse emissions.

The proposed expanded LNG facilities will be incorporated into WEL's existing Greenhouse Co-operative Agreement. WEL has also undertaken to conduct a more detailed study of forestry options as part of its ongoing greenhouse gas reduction strategy.

Having particular regard to:

(a) the total amount of Greenhouse gas emitted by the expanded LNG plant which will make it a significant (1.4%) contributor to Australia's total Greenhouse gas production;

(b) WEL's commitment to include energy efficiency improvements and greenhouse gas reduction measures, which will result in an 18% reduction in greenhouse gas emissions; and

(c) the incorporation of the expanded LNG facilities into the Greenhouse Challenge program,

the EPA considers that WEL has met the EPA's objectives of estimating, monitoring and minimising the emission of greenhouse gases for this proposal.

It is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for greenhouse gases, provided that WEL, as part of its ongoing greenhouse gas reduction strategy, undertake a study of forestry and other offsetting or reduction measures to

reduce its total greenhouse gas emissions. It should report progress on these investigations as part of its reporting process to the Greenhouse Challenge Office.

3.4 Air Emissions

The main air emissions from the onshore gas plant with a potential to cause an offsite impact are oxides of nitrogen (NO_x) which are generated during the combustion processes in gas turbines, process furnaces and flares. The potential environmental impacts are health effects associated with NO_2 and photochemical smog formation at the nearby towns and public areas as a result of NO_x and hydrocarbons emissions. Other minor emissions are sulfur oxides (SO_x), hydrogen sulphide, hydrocarbons (benzene, odour), particulates and dark smoke (visual) from the flares.

WEL is a participant in the Pilbara Air Quality Study (PAQS) currently being undertaken, under the coordination of the DEP, to provide meteorological and air quality data to enable the development of models for the purpose of assessing the individual and cumulative air emission impacts from industrial development. The data and models were not available in time for this assessment. The DEP recommended the use of a 'best estimates' modelling approach (see below) to provide pollutant concentrations, on the understanding that WEL will undertake further modelling as part of the PAQS to confirm the estimates.

Photochemical Smog

The potential to form nitrogen dioxide and photochemical smog in the townships of Karratha and Dampier is assessed in the PER. Photochemical smog is characterised by high concentrations of ozone (O_3) at ground level. It forms when air pollutants, principally nitrogen oxides and reactive organic compounds, react together for a few hours under the influence of sunlight and high temperatures. Ozone at high concentrations can reduce lung function and exacerbate asthmatic conditions in people.

To improve the understanding of the effect of NO_x, ozone and airborne particles as a result of the LNG expansion project on the regional air quality, WEL commissioned the CSIRO to perform air pollution modelling to evaluate the ground level concentrations in the townships of Karratha and Dampier (CSIRO, 1998b). The cumulative impact from the expanded LNG plant and the Hamersley Iron power station was modelled. The results of the modelling of emissions from the expanded LNG plant are shown in Table 6 below.

Table 6. Comparisons of the air quality modelling results (1-hour averages) at Dampier and Karratha with DEP(WA) accepted air quality criteria (one hour average unless stated)

Parameter	NOx(ppb)	NO_2 (ppb)	Ozone (ppb)	Particles less than 10 microns in diameter
Dampier (maximum level)	32	21	36	2
Karratha (maximum level)	11	8	39	2
Maximum ground level concentration	48	28	47	6
Ambient Air National Environment Protection Measure (NEPM)	-	120	100	50 (24 hour)

The results indicate that the NO_2, ozone and particulate levels from the expanded gas plant are well within the hourly average ambient air criteria defined in the National Environment Protection Measure (NEPM). Note that the modelled particles are 'secondary particles' formed by atmospheric reaction and do not include primary particle emissions like smoke, which is addressed below.

WEL also conducted further modelling to include the potential gaseous emissions from three possible chemical plants which could locate on the Burrup Peninsula. The results show that, with the addition of other potential sources of NO_x and reactive organic compounds currently planned for the region, ground level concentrations of pollutants will only be marginally increased at the town sites (assuming that natural gas is the main fuel used in these possible plants). The use of steam generation for power instead of installing gas turbines will see only a 22% increase in NO_x emissions for a doubling of plant output.

WEL has undertaken to install low NO_x burners on all new gas fired equipment to meet the normal operational level of no greater than 70 mg/Nm^3 NO_x, which is the level prescribed in EPA Guidance Statement No 15 for ' Emissions of Oxides of Nitrogen from Gas Turbines' (EPA, 1998a).

Sulfur Oxides (SO_x)

North West Shelf gas produces negligible sulfur dioxide emissions when combusted. However, the current sulfinol regenerator vent gas contains approximately 40 mg/m^3 of hydrogen sulphide (licence allows 100 mg/m^3). For the expansion project this hydrogen sulphide will be converted to sulphur dioxide (SO_2) with the thermal combustion of the sulfinol vent gas. Whilst reducing the emissions of hydrogen sulphide, the emissions of SO_2 will increase to close to the licence limit of 100 mg/m^3. The total SO_2 airshed load will be about 0.108 tonnes per day per train, or a total annual load of 79 tonnes from the two additional trains. WEL considers that the increase in sulphur dioxide emissions will not cause any significant increases in ground level concentration of SO_2 at Karratha or Dampier (pers. comm S Waller) and will not result in airshed concentrations above applicable Australian ambient standards.

Other Emissions

The expansion of the LNG plant will not include the construction of any new flares. The generation of dark smoke from process upsets can be expected to increase with the addition of two trains. Dark smoke emissions from the plant are regulated and monitored under the plant's licence conditions. Under this licence, WEL has committed to investigate dark smoke reduction technologies, e.g. use of steam. The expanded plant will continue the monitoring of dark smoke emissions and reporting of exceedances. In general, flaring is associated with stabiliser compressor trips, the Goodwyn platform trips, LPG extraction, plant shutdowns and start-ups.

The majority of hydrocarbons discharged from the sulfinol regeneration vent are atmospherically unreactive alkanes. A small quantity of reactive hydrocarbons, mainly aromatic e.g. benzene, toluene and xylene, are also emitted. WEL states that, on the basis of modelling performed, the levels of benzene in the surrounding region will be well below those considered acceptable for residential areas. WEL further states that the installation of a thermal combustion unit for the expansion project will effectively eliminate emissions of aromatic hydrocarbons from the sulfinol regeneration vent.

WEL has been proactive in removing ozone depleting substances from the plant site in accordance with the requirements of the *Commonwealth Ozone Protection Act 1989* and the *WA Environment Protection (Ozone Depletion) Policy 1993*. As a result, most hard ozone depleting substances have already been phased out of the gas plant.

Dust will be generated from rock quarrying and ground preparation activities, with the potential to affect native vegetation and adjoining land users. WEL has stated that it will use dust minimisation methods, e.g. water trucks and sprays, to minimise impacts during construction.

Submissions

The two main submissions on air emissions were:

1. WEL designing its plant to allow for progressive reductions in air emission limits to allow for a best practice license, and
2. a commitment by WEL to be involved in the Pilbara Air Quality Study currently being undertaken by the DEP and to validate the preliminary modelling with data from the air quality studies.

Assessment

The EPA's objectives in regard to air emissions are to:

(1) Protect the ozone layer in accordance with policies and requirements of *Commonwealth Ozone Protection Act 1989* and the *WA Environment Protection (Ozone Depletion) Policy 1993*.

(2) Protect the surrounding land users, such that dust emissions will not adversely impact upon their welfare and amenity or cause health problems.

(3) Ensure that emissions of NOx, SOx, hydrocarbons, toxics, particulates and smoke are assessed and meet acceptable standards and requirements of the *Environmental Protection Act 1986*.

(4) Ensure that all reasonable and practicable measures are taken to minimise discharges of NOx, SOx, hydrocarbons, toxics, particulates and smoke.

(5) Ensure that conditions which could promote the formation of photochemical smog are managed to minimise the impact.

WEL has committed to install low NO_x burners to all the new gas fired equipment installed in the expansion project in order to meet the AEC/NHMRC guidelines (AEC/NHMRC, 1985) of 70 mg/Nm^2 NO_x for gas turbines greater that 10 MW.

The results of the preliminary modelling carried out show the predicted levels of nitrogen dioxide, ozone, particulates (<10 microns) at the townships of Karratha and Dampier will meet established ambient standards for the project. It should be noted that this preliminary modelling was based on 'best estimates' and needs to be validated when the current collection of local airshed data is complete. In its response to submissions, WEL states that it will provide operational and capital support to PAQS and confirm the predictive air modelling results as part of PAQS.

WEL submits annual reports pursuant to section 11(2) of the *North West Gas Development (Woodside) Agreement Act 1979* on its environmental investigations and monitoring carried out during the preceding year. Gaseous emissions from exhaust stacks and process vents are reported, along with exceedances of the emission licence limits, including dark smoke and flaring.

Summary

Having particular regard to:

(a) WEL currently operating its plant within its licence limits;

(b) predictive air modelling which indicates that the levels of nitrogen dioxide, ozone and particulates (<10 micron) at Dampier and Karratha are well within NEPM standards;

(c) WEL undertaking to install commercially available low NOx burners on all new gas fired equipment; and

(d) WEL utilising dust minimisation methods during construction,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objectives for air emissions.

3.5 Terrestrial Vegetation and Fauna

Description

Vegetation

The Burrup Peninsula has a rugged topography dominated by steep bare rock piles and narrow valleys. The main topographic feature to be disturbed by the proposed expansion are rock piles and scree slope formations within the existing lease areas, adjacent to the existing quarry area and in the adjoining buffer area. The vegetation of the Burrup Peninsula has been previously described and mapped in a study by Blackwell and Cala (1979), as reported in the original NWS development project draft environmental impact statement (Woodside, 1979).

No Declared Rare Flora under the *Wildlife Conservation Act 1950 (WA)* have been recorded on the Burrup Peninsula. However five species of Priority Flora are known to exist on the Peninsula, which is also known to have a very diverse flora for its size (Astron Environmental, 1997)

Vegetation surveys have been conducted in all areas where land disturbance is to take place. These surveys have been undertaken to ascertain existing vegetation units, and whether any Priority Flora, or restricted or unique communities could be affected. The areas to be disturbed also support several introduced weed species eg. Buffel grass, Kapok bush and Ruby Dock.

The existing leases south of the gas plant have been used in previous expansion projects for laydown areas. As a result, these areas have been cleared and any further impact on vegetation will be minor. The existing quarry to the south west of the plant will be used mainly as sources of rock for road construction and slope protection.

The main new area of disturbance will be the areas between the existing quarry site and the existing southern laydown area (see Figure 3). This area includes rocky hills and drainage gullies, and there is a diverse range of plant species over this area including two Priority Flora species (*Brachychiton acuminatus* and *Terminalia supranitifolia*). It is anticipated that most of this area will have to be quarried for rock for the second trunkline project which was approved by the EPA in May 1998 (EPA, 1998d).

Another area that will be disturbed is the sand plain at Holden Point. This area was proposed to be disturbed by the second trunkline project and used as a loadout area for the rock for pipeline cover. This area contains two basic vegetation types, grasses in the sandplain area on the seaward side and low scrub further up in soil pockets. It is expected that further invasion of weed species into the disturbed areas may occur.

WEL has undertaken to liaise with CALM prior to the destruction of Priority Flora. Any area modified for laydown purposes will be left in a condition that does not compromise the existing surface drainage patterns. WEL has also undertaken to prevent the spread of weeds by the washing down of construction vehicles if they leave formed roads. WEL will continue the existing flora surveys over its lease areas and report the findings in the annual flora study as part of its reporting obligations under Section 11 of the *North West Gas Development (Woodside) Agreement Act 1979*.

Terrestrial Fauna

A total of eight fauna surveys have been undertaken between 1979 and 1997 on the Burrup Peninsula (Woodside Offshore Petroleum Pty Ltd, 1997). From these surveys it is considered that the fauna on the Peninsula is relatively well known. The Pilbara Olive Python (POP), protected under the Wildlife Conservation Act 1950, is the only rare fauna species known to exist on the Burrup Peninsula. However recent unpublished work by CALM (pers com. M Trudgeon) has recorded undescribed snail species, some of which are very localised.

Seven priority listed bird species are found on the Burrup Peninsula. The Burrup is among the furthest South recorded breeding sites of the Jabiru, or Black Necked Stork, and is near the southern limit of the Brown Booby. The domestic pigeon is the only recorded exotic bird species.

Submissions

Comments received on terrestrial vegetation centred on four main areas:

1. That the previous Blackwell and Cala (1979) vegetation and flora study was dated and did not provide WEL with a good understanding of the conservation status of vegetation communities and that further industrialisation will cause a loss of the overall integrity of the Burrup biological systems.
2. With respect to the introduction and control of weeds on the plant lease area, that there needed to be a coordinated weed survey on the Burrup Peninsula, and that a management strategy was required to prevent the propagation of weeds further along the Peninsula.
3. With respect to the use of the sandplain area at Holden Point, that only 0.8 hectares of sandplain existed on the Burrup Peninsula and that an alternative to disturbing Holden Point should be sought.
4. With respect to acid precipitation from SO_2 emissions from the plant site, that there would be possible effects on aquatic systems eg. freshwater pools and crustacean fauna.

Assessment

The assessment area is the newly disturbed areas within the WEL lease area and the 100m metre buffer strip to the south.

The EPA's objectives in regard to the assessment of this environmental factor are to:

(1) Maintain the abundance, species diversity and geographical distribution of terrestrial fauna.

(2) Protect threatened fauna and their habitats, consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Commonwealth Endangered Species Protection Act 1992*.

(3) Maintain the abundance, diversity, geographical distribution and productivity of vegetation communities.

(4) Protect Declared Rare Flora consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Commonwealth Endangered Species Protection Act 1992*.

The EPA provided advice to Government in Bulletin 801 (EPA, 1995) on the Burrup Peninsula Draft Land Use and Management Plan. This plan proposed that conservation areas, terrestrial and marine, be set aside on the Burrup Peninsula and areas allocated for industry. The EPA recognised that the Burrup Peninsula has a range of outstanding conservation and human values that require protection and management, and also acknowledged the importance of the area to the future economic development of the region.

The Draft Plan was revised and the Final Burrup Peninsula Land Use Plan and Management Strategy (BPMAB, 1996) was produced in September 1996. This project proposal is considered to be consistent with land identified for industrial use in this Final Plan.

The EPA recognises that the previous 1979 vegetation and flora study is now dated and does not provide a good understanding of the conservation status of vegetation communities. It will support any proposal by DRD and CALM to coordinate vegetation and weed surveys for the Burrup Peninsula. WEL has undertaken to participate in an appropriate study and to contribute its knowledge to these surveys, to increase knowledge of vegetation communities and distribution. WEL will continue the existing flora surveys over its lease areas and report the findings, as mentioned earlier.

The EPA previously assessed the disturbance of the sand plain at Holden Point where a new loadout jetty will be required and the new rock quarry area to the east of the existing quarry for the second trunkline expansion, and found the impacts to be manageable under an environmental management plan (EMP). The additional area disturbed for this expansion project will not be significantly different to laydown and quarry areas previously approved. On the basis of the commitments by WEL to liaise with CALM prior to the destruction of Priority Flora, the EPA believes that the impacts can be managed under WEL's existing EMP.

In regard to the control of weeds on the Burrup Peninsula, the EPA sees the response to submissions by WEL to institute a weed management strategy within the project area, and to continue to monitor weed introductions and where possible, control weeds on all project areas, as an appropriate response. As to a weed survey for the whole Burrup Peninsula, the EPA recognises that wind and other factors are responsible for the dispersal of weeds along the Peninsula. WEL has stated that it will consider participation in appropriate joint industry/government weed survey or weed research, and the EPA sees this as appropriate.

On the issue of acid precipitation, WEL has subsequently advised that the low levels of SO_2 in the gas emissions (79 tonnes per annum for two trains) and the highly ephemeral nature of the rainfall, will result in almost negligible levels of acidity in any precipitation as a result of the high dilution rate. The EPA is aware that the aquatic systems, e.g. freshwater pools and crustacean fauna, comprise a minor part of the terrestrial environment on the Burrup Peninsula and concurs with WEL's advice on the possible effects of acid precipitation.

WEL monitors the levels of abundance of native fauna adjacent to, and at some distance from, the LNG plant , to determine any changes in levels and reports the findings as part of its reporting obligations under Section 11 of the *North West Gas Development (Woodside) Agreement Act, 1979*. The surveys of reptiles, mammals and frogs are conducted by trapping and spotlighting. Notwithstanding the variability and complexity of fauna distributions, WEL has found few statistically significant effects from the operation of the plant.

Summary

Having particular regard to:

(a) the utilisation of previously disturbed areas for this project;

(b) WEL's performance on previous expansions; and

(c) the proposed expansion of the LNG plant is consistent with the Burrup Peninsula Land Use Plan and Management Plan (BPMAB, 1996),

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objectives for terrestrial vegetation and fauna. It recommends that joint industry/government vegetation and weed surveys be coordinated for the Burrup Peninsula.

3.6 Risk (Public Health and Safety)

Description

A preliminary risk assessment (PRA) was conducted by WEL for this expansion project. This assessment built on previous risk assessments which have been conducted for the plant since its start up, and which have been previously accepted by the Department of Minerals and Energy as representing the risks from the plant.

The individual risk levels were modelled so as to determine whether they met the EPA Interim Guidance Statement No. 2 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', (EPA, 1998b). The resulting individual risk contours and the public exclusion zone are shown in Figure 8. Societal risk is not addressed as the adjacent area is zoned industrial or conservation, and large numbers of people are not encouraged into the area.

WEL operates under a Safety Report and Safety Management System (SMS) regime, which is approved pursuant to the *Explosives and Dangerous Goods Act 1961*, and meets the National Standard for the Control of Major Hazard Facilities (NOHSC, 1996).

WEL has stated that it will prepare a Project Risk Management Plan which will outline the processes to be applied in the assessment and reduction of risks. WEL has committed to updating the PRA into a final quantitative risk assessment (QRA), to include the additional LNG facilities being constructed for this expansion, as part of the update of its Safety Report. The SMS will also be updated to include the additional facilities, as part of the update of the Safety Report.

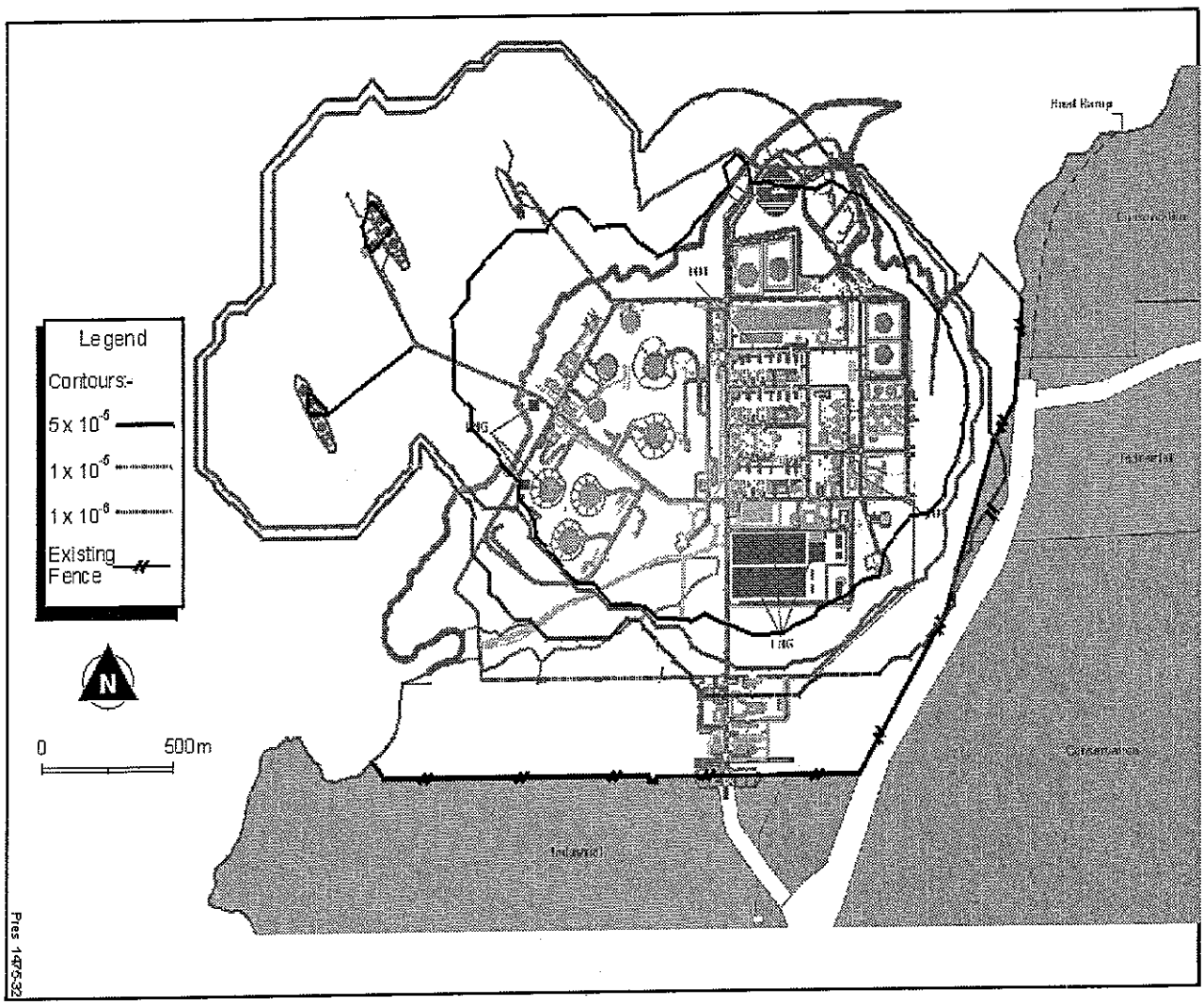

Figure 8 -Individual Risk Contours of the expanded plant

Submissions

Two items on risk were raised in the submissions to the PER. The first item was that WEL should assess and manage the additional risks from activities during construction. This is as a result of the introduction of large numbers of contractors onto the operating plant site, and plant tie-ins, which will increase the risk of an incident.

The second item was that as part of the detailed QRA and update to the SMS required prior to plant commissioning, WEL should look at the knock-on effects between trains, common mode failures and threats to the domestic gas supply.

Assessment

The EPA's objectives in regard to the assessment of this environmental factor are to ensure that:

1. Risk is assessed and managed to meet the EPA's criteria for off-site individual fatality risk in EPA Bulletins 611 and 627, the Interim Guidance #2 for 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant' (EPA, 1998b), and the DME's requirements in respect of public safety.
2. Public risk associated with implementation of the project is 'as low as reasonably practicable' (ALARP), and in compliance with the criteria.

3. The Safety Management System for the expanded plant includes the additional plant operations and complies with the National Standard for the Control of Major Hazard Facilities (NOHSC, 1996).

The EPA's individual risk criteria which apply to the LNG plant are the risk to neighbouring industry (proposed Gorgon LNG plant to the south), and to the adjacent public areas in the buffer zones (road to Withnell Bay). Criteria as stated in the EPA Guidance #2 (EPA, 1998b), which apply are as follows:

(a) *Risk levels from industrial facilities should not exceed a target of fifty in a million per year at the site boundary for each individual industry, and the cumulative risk level imposed upon an industry should not exceed a target of one hundred in a million per year.*

(b) *A risk level for any non-industrial activity located in buffer zones between industrial facilities and residential zones of ten in a million per year or less, is so small as to be acceptable to the Environmental Protection Authority.*

The individual iso-risk contours for the expanded LNG plant, and including the previously approved expansions, are shown in Figure 8. They show that the individual risk level at the fenceline with the proposed Gorgon Project is much less than the $50x10^{-6}$ fatalities per annum criterion, and the risk level at the neighbouring public road is less than the $10x10^{-6}$ fatalities per annum criterion.

The EPA considers that the additional risk from the LNG Trains 4 and 5 has been assessed in the PRA, and that the resulting cumulative iso-risk contours for the expanded plant meet the individual risk criteria as stated in Guidance Statement No. 2, as to industrial plant and public areas. Residential risk is not an issue because of the distances to the nearest town.

WEL has committed to finalising the QRA, Safety Report and SMS prior to start-up, to the satisfaction of the Department of Minerals and Energy. In its response to submissions, WEL has stated that it will look at common mode failures as part of the QRA.

As a result of the added activity around an operating plant during the construction period, WEL has agreed to include the risks from construction in its Risk Management Plan, prior to the commencement of construction.

The EPA also has the objective of reducing plant risks to ALARP, and the use of hazard identification during the process design and project specification stages, should ensure ALARP is implemented.

Summary

Having particular regard to:

(a) the increase in risk from the addition of two LNG trains;

(b) the PRA showing that the expanded LNG plant meets the EPA risk criteria;

(c) the robustness of the safety report and management systems already in place for the existing LNG plant;

(d) the undertaking of a full QRA and updating of the SMS by WEL prior to commissioning; and

(e) the commitment by WEL to include the risks from construction in its Risk Management Plan,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for risk (public health and safety).

3.7 Aboriginal Culture and Heritage

Description

Aboriginal rock art sites on the Burrup Peninsula are recognised as being of international importance. These sites have both an archaeological and ethnographic value. A comprehensive Aboriginal site survey was conducted over a wide area of the Burrup Peninsula by the WA Museum in 1979.

Following the completion of an archaeological survey report (McDonald Hales and Associates, 1997), WEL made a submission to the Aboriginal Cultural Material Committee (ACMC) for the purpose of making an application under section 18 (2) of the *Aboriginal Heritage Act 1972*, to disturb Aboriginal sites on the proposed additional lease areas. The Minister for Aboriginal Affairs granted WEL conditional permission in May 1998 to disturb Aboriginal sites within the project land areas and has endorsed WEL's site management plan.

An Aboriginal Heritage Management Committee has been established to oversee the development and implementation of the site management plan, in conjunction with WEL. This committee has involvement from the Aboriginal community, the Registrar of Aboriginal Sites and a representative from the ACMC.

Submissions

One of the submissions received suggested that during the construction period there should be community consultation and updates on a regular basis, on heritage developments and other community issues. WEL has considered the suggestion and has stated that there will be a number of community consultations during the construction period.

On Aboriginal heritage issues, a comment was made that there is no information on what will be done with the culturally significant heritage materials on the Burrup Peninsula, and that a panel of eminently qualified persons be appointed to consider the best way to create a government sanctioned heritage museum for the whole Burrup Peninsula.

There was also the question of the culturally significant heritage materials in the area and the issue of security during the construction period.

Assessment

Social impacts associated with the construction workforce, insofar as it does not directly affect the biophysical environment, cannot be considered as a relevant factor under the definition of 'environment' of the *Environmental Protection Act 1986*. Social impacts were included in the Guidelines to enable an assessment under the *Commonwealth Environment Protection (Impact of Proposals) Act 1974*. The EPA's objectives in regard to the assessment of this environmental factor are to comply with the *Aboriginal Heritage Act 1972* and other statutory requirements in relation to areas of cultural or historical significance, and to ensure that changes to the biological and physical environment resulting from the project do not significantly affect cultural associations with the area.

WEL has established an Aboriginal Heritage Management Committee to oversee the implementation of a site management plan for site disturbances on the lease area and the proper curation of cultural materials removed. The Aboriginal Affairs Department has advised that WEL has satisfactorily addressed Aboriginal heritage issues.

As to the potential impact on Aboriginal rock carvings from construction workers visiting sensitive areas, WEL has stated that all construction workers will be educated concerning the nature of, and regulations protecting, heritage sites on the Burrup Peninsula.

Summary

Having particular regard to the Aboriginal heritage issues in the removal and curation of materials, and to the establishment of the Aboriginal Heritage Management Committee and a site management plan, it is the opinion of the EPA that the proposal can be managed to meet its environmental objective for Aboriginal culture and heritage.

4. Conditions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit (Section 7).

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide commitments to ameliorate the impacts of the proposal on the environment. WEL has provided a number of commitments for this project which have been consolidated in Appendix 1. These commitments were considered by the EPA as part of its assessment of the proposal, and following discussion with the proponent the EPA and WEL agreed on three additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for and commitment to continuous improvement in environmental performance. The commitments have been consolidated to ensure enforceability, and form part of the Conditions to which the proposal should be subject if it is to be implemented.

Having considered the proponent's proposed management strategies as attached in Appendix 4, and the information provided in this report, the EPA has developed a set of conditions which it recommends be imposed if the proposal by WEL to construct additional LNG processing trains at its onshore plant, is approved for implementation. These conditions are presented in Appendix 1. Matters addressed in the conditions include:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments Statement set out as Schedule 2 to the recommended Conditions in Appendix 1;

(b) that the proponent shall demonstrate to the requirements of the Environmental Protection Authority, that there is in place an environmental management system;

(c) that prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to ensure that "greenhouse gas" emissions from the project are adequately addressed and that best available efficient technologies are used;

(d) that at least twelve months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to the requirements of the Environmental Protection Authority, which shall address the removal of plant and infrastructure and the rehabilitation of all disturbed areas to a standard suitable for agreed new land uses; and

(e) that for each six years following the commencement of construction, the proponent shall submit a Performance Review report to the DEP evaluating the outcomes and environmental performance over the six years. (Note: this report may be amalgamated with the Triennial Report as required under the *North West Gas Development (Woodside) Agreement Act, 1979*.)

5. Other Advice

The EPA sees the assessment of cumulative impacts for this expansion project and other projects on the Burrup Peninsula, both in terms of air quality and in protecting the terrestrial and marine environment from significant impacts, as an important aspect to be considered in the development of industries on the Burrup Peninsula in accordance with the Burrup Peninsula Land Use Plan and Management Strategy (BPMAB, 1996). It supports the coordination of the assessment of cumulative air modelling studies, and vegetation and weed surveys for the Burrup Peninsula, by joint industry/government actions.

The EPA also sees the decommissioning of industrial plant and rehabilitation of areas, both offshore and onshore, as an important part of ongoing operational plans and becoming increasingly important as projects and reserves near the end of their economic life. As a result, the EPA has required as a condition of this expansion, the preparation of a Decommissioning and Rehabilitation Plan at least twelve months prior to decommissioning. Consideration of decommissioning plans should occur as early as possible and the plans should be continuously revised to ensure best practice at the time of plant closure.

6. Conclusions

The EPA has considered the proposal by WEL to construct additional LNG processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at its onshore plant. A summary of the assessment process and EPA advice is presented in Table 7.

Having regard to the environmental outcomes from previous construction programmes for the LNG plant, the licence conditions under which the plant operates, and the reporting carried out under the State Agreement, the EPA concludes that, subject to the implementation of the recommended conditions and proponents consolidated commitments, the proposal can be implemented and managed in an environmentally acceptable manner to meet the EPA's objectives for the relevant environmental factors.

7. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is for the construction of additional LNG processing trains, the current proposal being for two trains with a total additional capacity of 8 Mtpa, at the WEL onshore plant on the Burrup Peninsula. The development will be constructed in stages, along with previous approvals, to meet market demand for LNG, gas, LPG and condensate.
2. That the Minister considers the report on the relevant environmental factors of marine impacts, greenhouse gases, air emissions, terrestrial vegetation and fauna, risk and Aboriginal culture and heritage, as set out in Section 3.
3. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the Recommended Conditions set out in Section 4, including the proponent's commitments.
4. The Minister imposes the conditions and procedures recommended in Appendix 1 of this report.

Table 7. Summary of Assessment of Relevant Factors

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
BIOPHYSICAL				
Marine • Water Quality • Marine Flora • Marine Fauna	Mermaid Sound	Maintain the biodiversity of the sea floor and ensure that any impacts on locally significant marine communities, including turtles, are avoided. *Note*: jetty construction, dredging and blasting in inshore areas should be managed so as to avoid impacts on coral spawning. Protect environment from significant impacts consistent with the *Environment Protection (Sea Dumping) Act 1981* and the *London Dumping Convention.* *Note:* Excavation in inshore areas should be managed so as to avoid impacts on coral spawning. Protect the adjacent marine environment from any impacts associated with foreign entrained organisms and chemical constituents contained in discharged ballast water, consistent with current AQIS guidelines on ballast water. Demonstrate that there will be no significant impacts from disposal of hydrotest fluids / pickling liquors.	The EPA notes: • Jetty Berth Option 2 is the chosen jetty extension option. This will require the removal of 2 700 000 m^3 of dredge spoil and the blasting of 1 000 000m^3 of Star Rock; • Dredging will generate sediment plumes with the potential to impact neighbouring corals, noting that the corals are not environmentally significant within the context of the total corals in the Dampier Archipelago area; • Blasting has the potential to impact fish and marine mammals in the area at the time of the blast; • The disposal of dredge spoil has the potential to affect the benthic communities at spoil grounds A/B; • The disposal of aqueous effluent during construction (hydrotest fluids) and operation (spillage, sewage and rain water run off) has the potential to affect adjacent marine communities; • WEL has previously constructed two jetties; • Monitoring before and after previous dredging programmes has shown minimal impact on the neighbouring corals on shoreline reef slopes; • Benthic surveys of the spoil disposal grounds A/B and neighbouring corals after the 1987 dredging programme, show that the dredge spoil areas become recolonised and that there is little effect on neighbouring corals on shoreline reef slopes; • WEL surveys neighbouring corals in the Sound annually and reports to the Government. It also reports on metallic accumulation in sediments, oysters and molluscs as part of its annual report under the *North West Gas Development (Woodside) Agreement Act 1979*; and that • WEL monitors and reports to the DEP on liquid discharges to the Sound, under its licence conditions. The proponent has made commitments to:	Having particular regard to: • WEL commitment to prepare a DBEMP to manage dredging and blasting impacts, for acceptance by DEP, prior to the commencement of dredging; • the operational history of the LNG plant and monitoring results from previous construction programmes; • WEL operating within the MARPOL and AQIS Guidelines; and • WEL continuing to operate within its DEP pollution licence, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for marine impacts.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• Develop a detailed Dredging and Blasting Environmental Management Plan (DBEMP) to be accepted by DEP, prior to the commencement of construction.; • Not dredge during coral spawning periods; • Monitor the neighbouring corals before and after dredging; • Apply for a Sea Dumping Permit prior to spoil disposal; • In the event of significant (>50%) mortality attributable to dredging turbidity, implement a suitable program of enhancing coral recruitment in the area; • Minimise sediment generation by the use of appropriate dredging methods; • Seek to manage dredge position to minimise sediment dispersion to the shoreline; • Dispose off wastes from ships in accordance with MARPOL Annex IV; • Develop ship board oil spill response plans as required by MARPOL; • Require dredges arriving in Australia to comply with quarantine regulations, AQIS guidelines; • Ensure that ship de-ballasting is consistent with AQIS guidelines; • Ensure that the discharge of hydrotest water into the Sound is subject to a Hydrotest Water Discharge Management Plan, to be agreed with DEP, prior to discharge; • Ensure that no pickling fluids will be discharged into the Sound; and • Ensure that aqueous discharges from the operating LNG plant are in accordance with the DEP pollution licence conditions.	
Vegetation communities	Burrup Peninsula	To maintain the abundance, species diversity and geographic distribution and productivity of vegetation communities.	The EPA notes: • That the plant expansion will utilise areas previously disturbed for previous construction programmes; • The second trunkline project, which has been approved by the EPA, will cause prior disturbance of the quarry and Holden Point areas; • The expansion utilises area identified as industrial in the Burrup Peninsula Land Use Plan;	Having particular regard to: • the relatively small area of newly disturbed land required for this project; • WEL instituting a weed management strategy to control weed

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• WEL has surveyed the proposed expansion areas and no rare flora were identified; and • The DEP's advice that the previous vegetation surveys conducted in 1979 do not provide a good understanding of the conservation status of vegetation communities on the Burrup Peninsula. The proponent has made commitments to: • Liaise with the Department of Conservation and Land Management on any destruction of the two identified priority species; • Ensure that modified areas in the quarry and buffer area will be left in a condition that does not compromise existing surface drainage patterns; • Report annually under its State Agreement, on the flora and fauna surveys carried out; • Participate in appropriate joint industry/government weed and vegetation surveys; and • Institute a weed management strategy to control weed introduction and propagation on project areas.	introductions on project areas; • WEL continuing to report annually its fauna and flora surveys; • the DEP's understanding of the conservation status of vegetation communities on the Burrup Peninsula, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for vegetation communities.
POLLUTION				
Greenhouse Gases	Global	Mitigate greenhouse gases emission in accordance with the Framework Convention on Climate Change 1992, and in accordance with established Commonwealth and State policies. (Environmental Protection Authority Preliminary Guidance #12 'Minimising Greenhouse Gas Emissions'). Estimation of carbon dioxide equivalent emissions from the existing and the proposed new plant. Minimise greenhouse gases emission in absolute terms and reduce emissions per unit product to as low as reasonably practicable with comparisons to other LNG processes.	The EPA notes: • The total amount of greenhouse gases emitted from the expanded plant of 7.7 Mtpa will make it a significant contributor (1.4%) to Australia's total greenhouse gas production; • WEL's commitments to include substantial energy efficiency improvements and greenhouse gases reduction measures, including 'beyond no regrets' measures.; and • WEL studies into reinjection and reforestation. The proponent has made commitments to: • Continue its participation in the Greenhouse Challenge Program.	Having particular regard to: • the substantial commitment by WEL to Greenhouse gas reduction measures, including implementing 'beyond no regrets' measures; • its commitment to the Greenhouse Challenge Program; • the proponent's commitments; and

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• Recover and combust sulfinol gases to reduce the total greenhouse gas emission; and • Undertake a study of forestry and other options as part of its ongoing greenhouse gases reduction strategy.	• the National Strategy for greenhouse gas reductions. it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for greenhouse gases, subject to WEL committing to an ongoing programme of research and reporting of further practicable and feasible measures to reduce its total greenhouse gas emissions.
Air Emissions	Regional, Dampier and Karratha	Ensure that emissions of NOx, SOx, hydrocarbons, toxics, particulates and smoke are assessed and meet acceptable standards and requirements of Section 51 of the Environmental Protection Act 1986. (See the Air Quality and Air Pollution Modelling Guidelines) Ensure that all reasonable measures are taken to minimise discharges of NOx, SOx, hydrocarbons, toxics, particulates and smoke. Ensure that conditions which could promote the formation of photochemical smog are managed to minimise the frequency of smog events.	The EPA notes that: • The results of the predictive air modelling show that the cumulative impacts of the WEL expanded plant and Hamersley Iron's operations on the towns of Dampier and Karratha, are well below NEPM guidelines; and • the plant operates under a DEP pollution licence and monitors its emissions and reports annually. The proponent has made commitments to: • Install low NOx burners on all new gas fired equipment; • Thermally combust hydrocarbon vent gas from the sulfinol unit; • Continue to monitor its emissions and report annually; • Continue to operate under the DEP pollution licence. • Confirm the predictive air modelling results as part of the Pilbara Air Quality Study.	Having particular regard to: • the previous operating experience of WEL; • the proponent's commitments for this plant expansion, and • the air modelling carried out by WEL in the PER was predictive and requires confirmation, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for air emissions.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
SOCIAL SURROUNDINGS				
Risk (Public Health and Safety)	Burrup Peninsula	Ensure that risk is assessed and managed to meet the EPA's criteria for off-site individual fatality risk in EPA Bulletins 611 and 627, the Interim Guidance #2 for 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', and the DME's requirements in respect of public safety. Ensure that public risk associated with implementation of the project is ALARP and in compliance with the criteria. Ensure that the Safety Management System for the expanded plant includes the additional plant operations and complies with the National Standard for the Control of Major Hazard Facilities.	The EPA notes that: • The results of the preliminary risk assessment show that the individual risk criteria of the EPA are met; and • The LNG plant currently operates under a Safety Management System, which meets the requirements of the National Standard for the Control of Major Hazard Facilities and which is administered by the Department of Minerals and Energy. The proponent has made commitments to: • Finalise the Quantified Risk Assessment and update the Safety Management System, to the satisfaction of DME prior to commissioning. The assessment will look at common mode failures and the security of domestic gas supply; and • Include a risk management plan for construction activities around the operating plant.	Having particular regard to: • the previous operating experience of WEL; • the results of the preliminary risk assessment; • the proponent's commitments for this plant expansion to update its Safety Management System; and • the increased risk to the operating plant during the construction period, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for risk, subject to preparation of a Construction Safety Management System, to the satisfaction of DME, prior to the commencement of construction.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Aboriginal Culture and Heritage	Burrup Peninsula	Comply with the *Aboriginal Heritage Act 1972* and other statutory requirements in relation to areas of cultural or historical significance. Ensure that changes to the biological and physical environment resulting from the project do not significantly affect cultural associations with the area. Information should be provided on the following: • Aboriginal cultural and heritage sites of significance • Potential impacts on any identified Aboriginal sites • Proposed measures to manage impacts to Aboriginal sites	The EPA notes: • WEL's previous experience with plant expansions. The proponent has made commitments to: • Instruct construction workers on the heritage value of the local area; • Obtain Aboriginal site clearance in accordance with the *Aboriginal Heritage Act 1972*; and • Continue the use of the Aboriginal Heritage Management Committee in site clearances and the proper curation of heritage material.	Having particular regard to: • the advice from the Aboriginal Affairs Department that WEL has satisfactorily addressed Aboriginal heritage issues and will continue to do so with the Aboriginal Heritage Management Committee; and • the proponent's commitments, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for Aboriginal culture and heritage.

APPENDIX 1

RECOMMENDED ENVIRONMENTAL CONDITIONS AND PROPONENT'S CONSOLIDATED ENVIRONMENTAL MANAGEMENT COMMITMENTS

Statement No.

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

NORTH WEST SHELF GAS PROJECT
ADDITIONAL LIQUEFIED NATURAL GAS (LNG) FACILITIES
BURRUP PENINSULA

Proposal: The construction of two additional Liquefied Natural Gas (LNG) processing trains, with support facilities, at the existing LNG plant on the Burrup Peninsula in the North West of Western Australia. This expansion will increase the LNG capacity of the plant from 7.5 million tonnes per annum to 15.5 million tonnes per annum. The export of the additional LNG will require the construction of one additional LNG jetty (see Schedule 1, attached).

Proponent: Woodside Energy Limited

Proponent Address: 1 ADELAIDE TERRACE, PERTH WA 6000

Assessment Number: 1188

Report of the Environmental Protection Authority: Bulletin 962

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Environmental Management System

3-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction, the proponent shall demonstrate to the requirements of the Environmental Protection Authority, on advice of the Department of Environmental Protection that there is in place an environmental management system which includes the following elements:

1 An environmental policy, and corporate commitment to it;

2 Mechanisms and processes to ensure:

2.1 planning to meet environmental requirements;

2.2 implementation and operation of actions to meet environmental requirements;

2.3 measurement and evaluation of environmental performance; and

3 Review and improvement of environmental outcomes.

3-2 The proponent shall implement the environmental management system referred to in condition 3-1.

4 Greenhouse Gas Emissions

4-1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan:

- to ensure that "greenhouse gas" emissions from the project are adequately addressed and best available efficient technologies are used in Western Australia to minimise Western Australia's "greenhouse gas" emissions; and
- to mitigate "greenhouse gas" emissions in accordance with the Framework Convention on Climate Change 1992, and consistent with the National Greenhouse Strategy,

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall include:

1 calculation of the "greenhouse gas" emissions associated with the proposal, as indicated in "Minimising Greenhouse Gas Emissions, Guidance for the Assessment of Environmental Factors, No. 12" published by the Environmental Protection Authority;

2 specific measures to minimise the "greenhouse gas" emissions associated with the proposal;

3 monitoring of "greenhouse gas" emissions;

4 estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product; and

5 an analysis of the extent to which the proposal meets the requirements of the National Strategy using a combination of:

- "no regrets" measures;
- "beyond no regrets" measures;
- land use change or forestry offsets; and
- international flexibility mechanisms.

4-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 4-1.

4-3 The proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 4-1 publicly available, to the requirements of the Environmental Protection Authority.

5 Decommissioning and Rehabilitation Management Plan

5-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

1 removal or, if appropriate, retention of plant and infrastructure;

2 rehabilitation of all disturbed areas to a standard suitable for agreed new land use / s; and

3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

5-2 The proponent shall implement the Decommissioning and Rehabilitation Management Plan required by condition 5-1 until such time as the Minister for the Environment determines that decommissioning and / or rehabilitation is / are complete.

5-3 The proponent shall make the Decommissioning and Rehabilitation Management Plan required by condition 5-1 publicly available, to the requirements of the Environmental Protection Authority.

6 Performance Review

6-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review report to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and
- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 962;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 environmental management system environmental performance targets;

4 environmental management programs and plans; and/or

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note:

1. This report may be amalgamated with the Triennial Report as required under the *North West Gas Development (Woodside) Agreement Act, 1979*.

2. The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review report.

7 Proponent

7-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

7-2 Any request for the exercise of that power of the Minister referred to in condition 7-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

7-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

8 Commencement

8-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

8-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

8-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 8-1 and 8-2.

8-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

9 Compliance Auditing

9-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

9-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal, written advice that the requirements have been met.

9-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

CHERYL EDWARDES (Mrs) MLA
MINISTER FOR THE ENVIRONMENT

Schedule 1

The Proposal

The proposal is to construct two additional LNG processing trains at the existing LNG plant on the Burrup Peninsula in the North West of Western Australia. This expansion will increase the LNG capacity of the plant from 7.5 million tonnes per annum to 15.5 million tonnes per annum. The export of the additional LNG will require the construction of an additional LNG jetty with its berthing pocket.

The key characteristics of the proposal are listed in Table 1 below.

Table 1. - Summary of key proposal characteristics

Project Characteristics	Requirements
Project life	30+ years
Reserve source	North Rankin, Goodwyn gas fields
Project facilities	▪ additional LNG processing trains; ▪ 1 additional fractionation unit; ▪ 2 additional power generation units; ▪ 1 additional LNG jetty berth; ▪ 1 additional LNG storage tank; ▪ Utilities upgrade (nitrogen plant, water treatment facilities, waste heat recovery from the existing power plant); and ▪ Relocation of administration complex.
Main process	Shell Propane/Mixed Refrigerant (C3/MR) process with waste heat recovery
Additional LNG production	8 Mtpa (existing 7.5 Mtpa)
Additional land disturbance (laydown)	45 Ha (existing 231 Ha)
Additional power supply	Approx 50 MW(for two trains)
Additional carbon dioxide emissions	2.9 Mtpa
Dredged seabed material for shipping lanes, ship berthing basins and turning circles	2.7 million cubic metres
Additional permanent workforce	Approximately 40-70 persons
Construction workforce	Approximately 2,000-2,500 persons (peak)
Construction period	Approximately 3 years per train

The project location map is at Figure 1 (attached), and a plan and aerial photograph showing the LNG expansion facilities are at Figures 2 and 3 (attached).

The additional LNG trains will be located to the south of the existing three trains. One new LNG storage tank will be located to the south west of the existing LNG storage tanks. The LNG trains and supporting facilities will be located within the existing Woodside leases. However additional areas for the project will be required for the lay down of construction materials and for quarrying. The proponent is negotiating the use of a 100m buffer strip to the south of the Woodside leases adjacent to the Gorgon LNG project lease area for these purposes, for which a temporary lease will be required. The haul road from the Dampier Port Authority to the south will also be used for transporting construction material.

The two additional LNG processing trains will require the construction of additional processing support facilities. The additional power supply of approximately 50 megawatts, will be supplied by high efficiency gas turbines. One additional fractionating unit, to remove heavier hydrocarbons, will be required. It will be positioned adjacent to the existing fractionating units 1 and 2.

The construction workforce of approximately 2,000 to 2,500 people will be accommodated in the Karratha area and the construction period is approximately 3 years if the trains are constructed together. The proponent may choose to stage the construction of any part or parts of this proposal, integrating this construction with other previous approvals, to meet market demands.

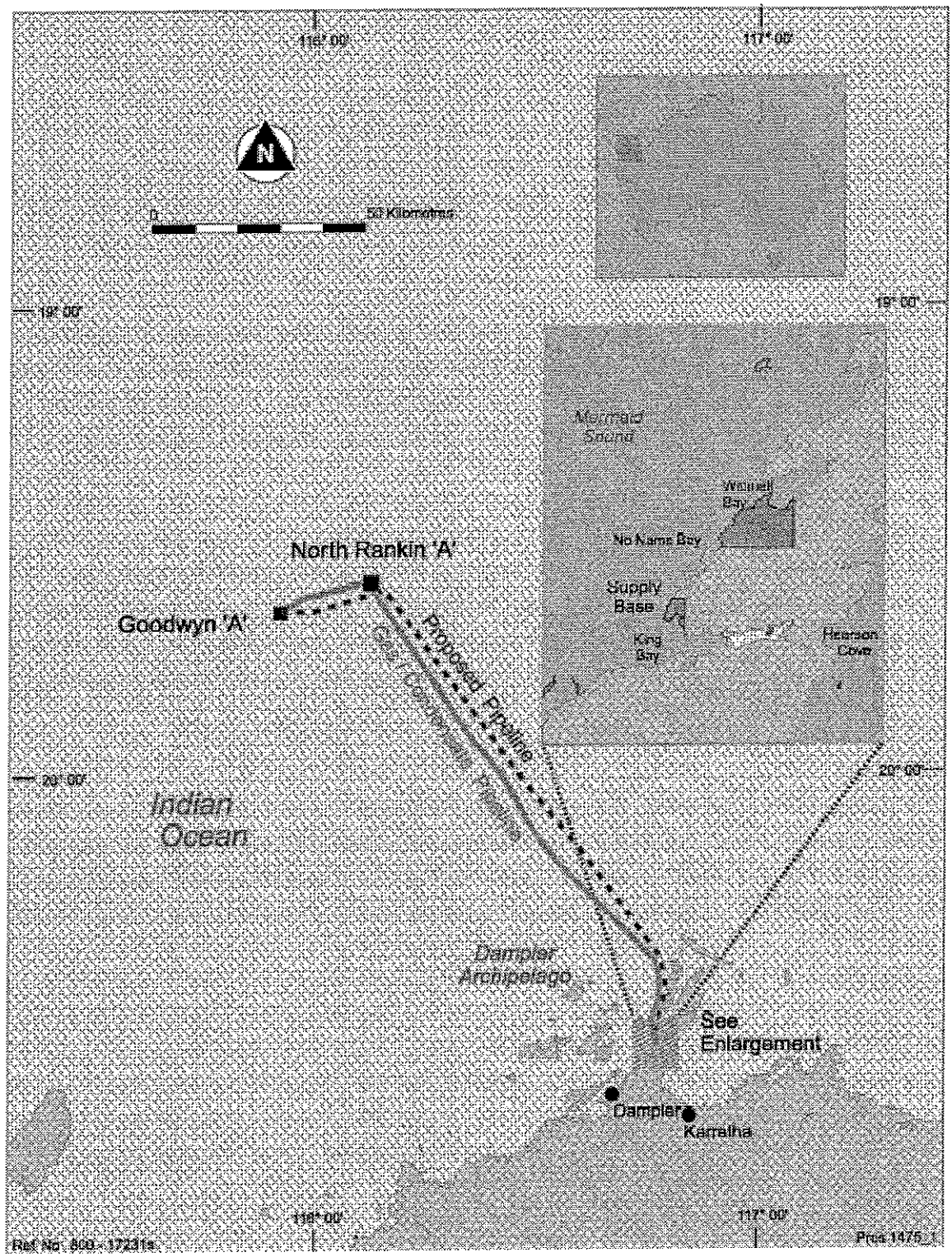

Figure 1. Project Location Map

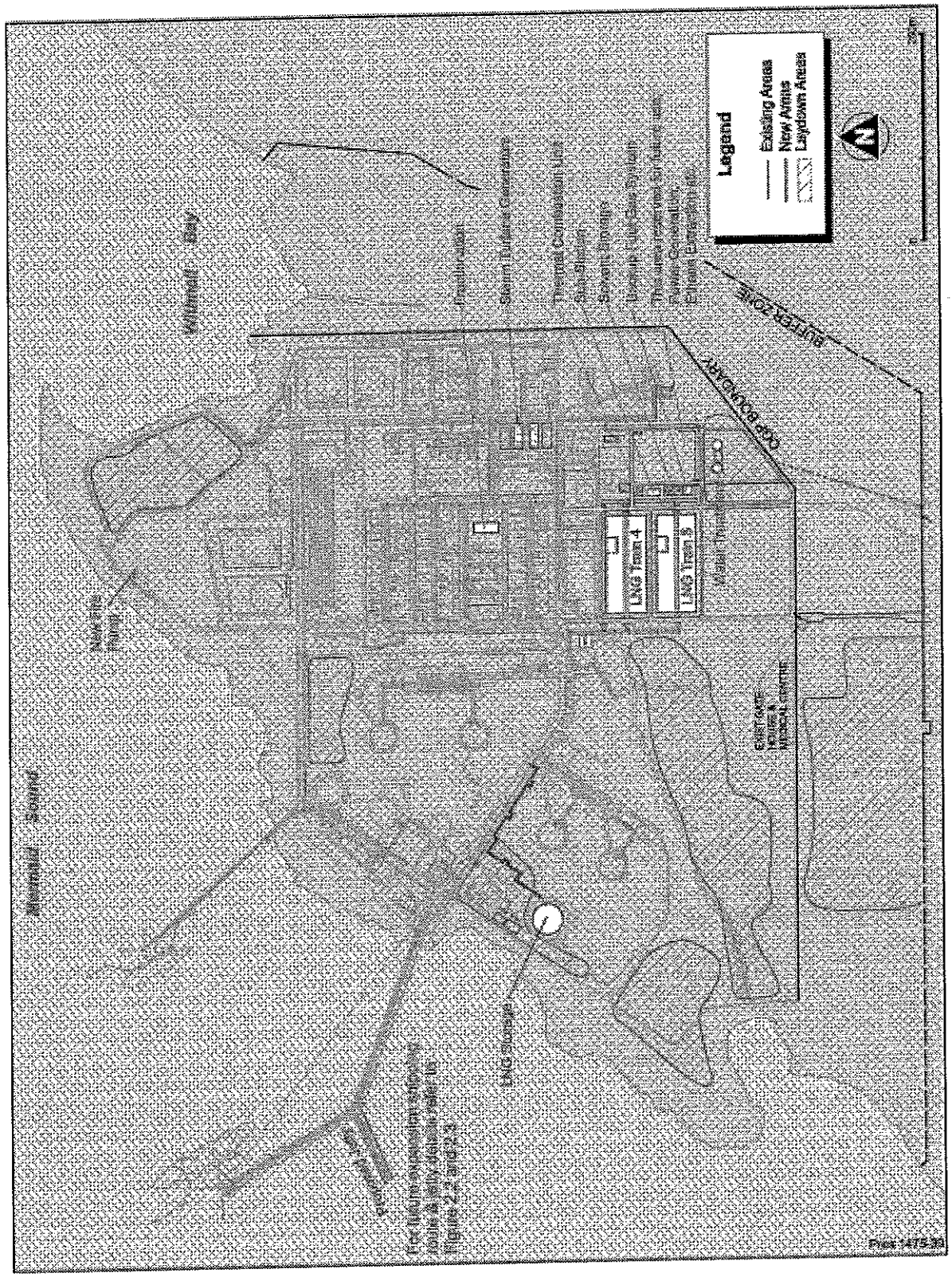

Figure 2. LNG Expansion Project Plan

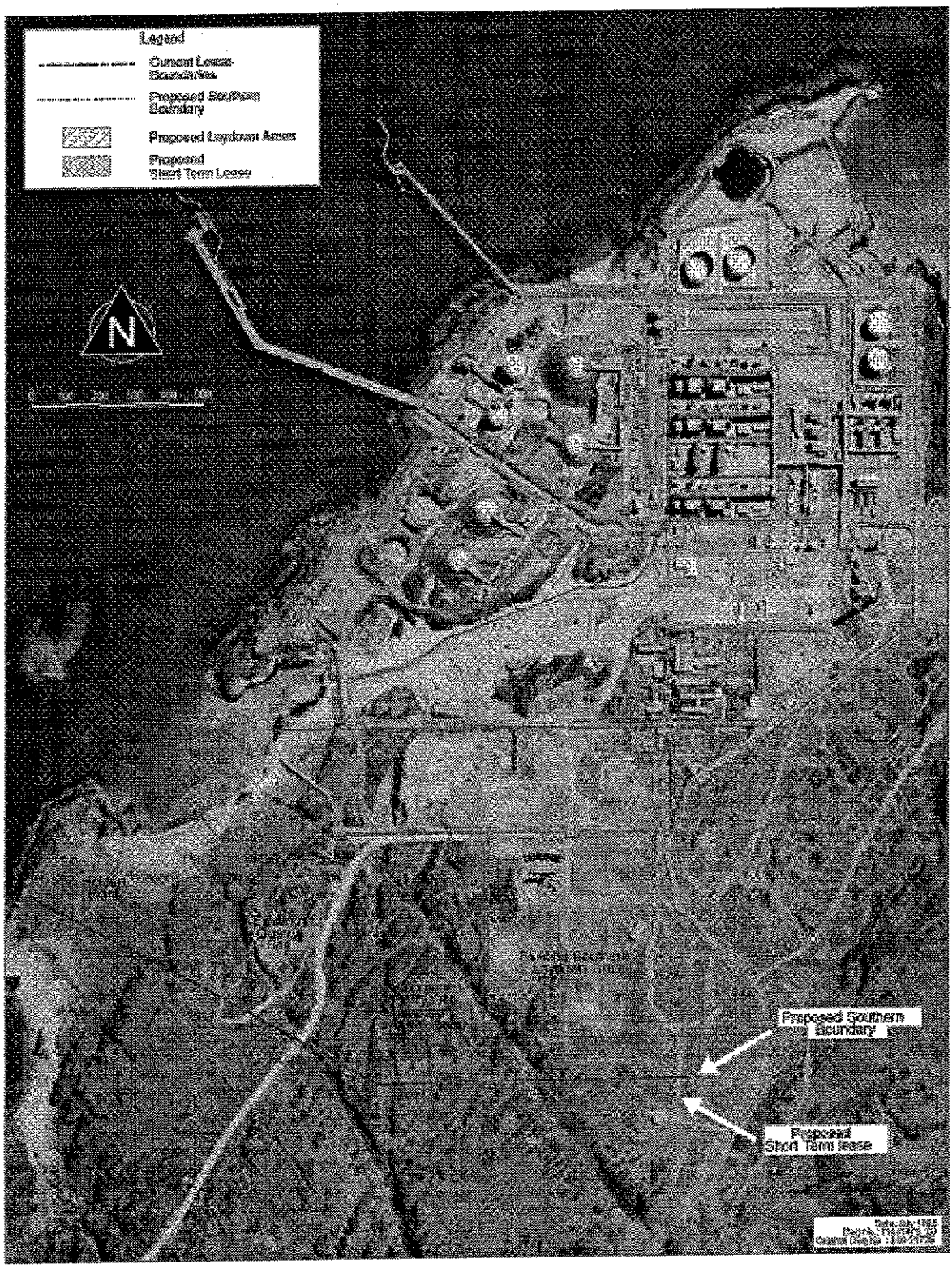

Figure 3. Project location ariel photograph

Schedule 2

Proponent's Consolidated Environmental Management Commitments

NORTH WEST SHELF GAS PROJECT ADDITIONAL LIQUEFIED NATURAL GAS (LNG) FACILITIES

(Assessment No. 1188)
July 1999

WOODSIDE ENERGY LTD

Schedule 2 - Proponent's Consolidated Environmental Management Commitments

No	Topic	Action	Objective	How	Timing	Whose advice
			CONSTRUCTION			
1	Dredging and Blasting Impacts	WEL to prepare a Dredging and Blasting Environmental Management Plan (DBEMP).	To manage and minimise the impacts on human safety, water quality, marine flora and fauna and nearby industries and communities, from dredging and blasting operations, and spoil disposal.	The DBEMP will include the following measures for: <u>Blasting, to:</u> 1. use a cutter suction dredge wherever possible to excavate calcarenite material; 2. incorporate delays into the blast pattern to reduce peak particle velocities and overpressures to minimise effects on marine life; 3. utilise operational procedures to minimise the impact of blasting on marine life; 4. ensure a whale and turtle watch is maintained in the blast area and to stop blasting while marine mammals/reptiles are in the blasting area; 5. develop a strategy to minimise the amount of plastic casing fragments generated by each charge. All signal tubes will be recovered after each blast; and 6. remove dead fish after each blast as soon as practicable to prevent injury to birds; <u>Dredging,</u> to minimise sedimentation impacts from dredging and the impact on neighbouring corals by: 1. not dredging for a suitable time period around the actual coral spawning event. The downtime for coral spawning will be managed in consultation with CALM; 2. monitoring the neighbouring corals before and after dredging; 3. minimising sediment generation by the use of appropriate dredging methods; 4. seeking to manage dredge position to minimise sediment dispersion to the shoreline; and 5. that in the event of significant (>50%) mortality of coral communities attributable to high levels of dredge spoil turbidity, the proponent will implement a suitable program of enhancing coral recruitment in that area.	Prior to jetty construction	CALM and EA.

No	Topic	Action	Objective	How	Timing	Whose advice
2	Dredging and Blasting Impacts	Implement the Dredging and Blasting Environmental Management Plan (DBEMP).	To achieve the objectives of commitment 1.		During construction of Shipping Channel & Turning basin.	
3	Shipping/ Vessel Management Wastes disposal	Ensure that wastes are disposed in accordance with MARPOL Annex IV or at the onshore gas plant waste system.	To manage the impacts of wastes from vessels on the marine environment.	Report in the annual report to the WA Government under the North West Gas Development (Woodside) Agreement 1979 (hereafter called the 'annual report to Government').	Report annually	
4	Shipping/ Vessel Management Sediment Ballast Water	Dredges arriving in Australia will be required to comply with AQIS Notice 92/2 'Controls on the discharges of ballast water and sediment from ships entering Australia from Overseas'. To audit compliance of the disposal of ballast water and control of sediments.	To manage the impacts of discharges from vessels, and sediment from dredges, on the marine environment.	A summary of compliance audits of this and of ballast water discharges will be sent to DEP.	Summary report will be provided to DEP on a regular basis or reported in the annual report to Government.	
5	Shipping/ Vessel Management Oil Spills	Include a Risk Assessment of extra shipping risks in the Project QRA.	To minimise the risks of oil spills from vessels on the marine environment.	Include the assessment of shipping risks in the plant Quantified Risk Assessment.	Prior to commissioning.	DME and DPA.
6	Shipping/ Vessel Management Oil Spills	Ensure MARPOL and WEL requirements for oil spills are reviewed.	To manage the impacts of oil spills from vessels on the marine environment.	Oil Spill Response Plans will be developed and implemented to interface with the WEL Oil Spill Contingency Plan..	Prior to project related vessel movements.	DPA and DME.

No	Topic	Action	Objective	How	Timing	Whose advice
7	Effluent discharges Hydrotesting	Obtain DEP agreement for each batched disposal of hydrotest fluids.	To manage the impacts of discharges from plant construction on the marine environment.	WEL will prepare a hydrotest program for approval by the DEP, prior to the commencement of the hydrotesting phase of construction. WEL will notify the DEP (if required) of the hydrotest discharges to be performed each day under the approved hydrotest program.	As required.	
8	Effluent discharges Pickling liquors	Pickling liquors will not be disposed off into the marine environment.	To manage the impacts of discharges from plant construction on the marine environment.	n/a	n/a	n/a
9	Dust	Control dust emissions from the project areas during construction, where necessary.	To protect surrounding land users from adverse impacts.	Dust suppression (road dampening) and dust water sprays will be utilised as required.	During construction of additional LNG trains.	
10	Flora and Fauna Disturbance of new areas.	Liaise with CALM prior to the destruction of Priority Flora and Fauna and report in annual report.	To protect the environment to the maximum extent possible.	Report in annual report to Government.	During construction of additional LNG trains.	CALM
11	Flora and Fauna Weed control	Construct vehicle washdown facilities in appropriate locations.	Maintain the abundance, diversity, geographic distribution and productivity of vegetation communities.	Report in annual report to Government.	During construction of additional LNG trains.	
12	Flora and Fauna	Participate in appropriate joint industry/government vegetation survey on the Burrup Peninsula.	Understand the abundance, diversity, geographic distribution and productivity of vegetation communities.		As initiated by Government.	

No	Topic	Action	Objective	How	Timing	Whose advice
13	Flora and Fauna	Participate in appropriate joint industry/government weed research programme on the Burrup Peninsula.	Maintain the abundance, diversity, geographic distribution and productivity of vegetation communities.		As initiated by Government.	
14	Surface Water Disturbance of new areas and disposal of waste rock.	Change to landform will not extend past the immediate area of disturbance. Maintain beneficial uses of surface water consistent with draft EPA Guidance #26.	Manage contaminated surface water runoff consistent with draft EPA Guidance #26.	Post construction site audit and report in annual report to Government.	After construction of additional LNG trains	
15	Waste Management Solid Wastes	Dispose off solid wastes in accordance with the Shire of Roebourne and DEP requirements.	To reduce the environmental impacts from waste disposal.	Develop recycling procedures, where possible, for higher quality wastes. Dispose of lower quality wastes in accordance with the Shire of Roebourne and DEP requirements. Report in annual report to Government.	During construction of additional LNG trains.	Shire of Roebourne
16	Noise, vibration	Monitor noise levels where appropriate during construction.	To meet the *Environmental Protection (Noise) Regulations 1997.*	Report in annual report to Government.	During construction of additional LNG trains.	
17	Onshore Process Spills	Install bunding in areas where there is a possibility of accidental oil contamination.	To protect the marine environment.	Bunding to meet AS 1940 Standards. Report in annual report to Government.	After Construction of additional LNG trains.	
			OPERATION			
18	Effluent discharges from LNG plant operation	Sulfinol concentrations in effluent discharges will be maintained within the DEP licence conditions.	To protect the marine environment.	Report discharge in annual report to Government.	After construction of additional LNG trains.	

No	Topic	Action	Objective	How	Timing	Whose advice
19	Shipping impacts on the marine environment. Turbidity Tri-butyl-tin	Monitor the effect of turbidity on corals, and TBT accumulation in Mermaid Sound.	To protect the marine environment.	Report results of the monitoring annually as part of the Chemical and Ecological Monitoring of Mermaid Sound (CHEMMS) Programme.	During plant operation.	
20	Greenhouse Gases	Incorporate the LNG expansion project into the cooperative agreement with the Commonwealth Government under the "Greenhouse Challenge" program.	Measure and report greenhouse gas emissions.	Annual report to the Greenhouse Challenge Office.	During operations.	Greenhouse Challenge Office
21	Greenhouse Gases	Install equipment (sulfinol vent gas combustion) and other measures to reduce greenhouse gases, as proposed in the PER.	Minimise Greenhouse Gas emissions.	Report in annual report to Government.	After Construction of additional LNG trains.	Greenhouse Challenge Office
22	Greenhouse Gases	Undertake a study of forestry and other options as part of the ongoing greenhouse gas reduction strategy.	Minimise Greenhouse Gas emissions.	Annual report to the Greenhouse Challenge Office.	During operations	Greenhouse Challenge Office
23	Air Emissions	Install low NOx burners on all new gas equipment.	Minimise the potential for photochemical smog.	Report in annual report to Government.	After Construction of additional LNG trains.	
24	Air Emissions	Confirm the predictive air modelling as part of the Pilbara Air Quality Study.	To confirm predictive modelling results.	Report in annual report to Government.	Prior to construction of additional LNG trains.	

No	Topic	Action	Objective	How	Timing	Whose advice
25	Mercury regeneration	Dispose of the spent mercury bed material in an appropriate manner.	To prevent mercury losses to the environment.	Report in annual report to Government.	During operations	
26	Groundwater monitoring	Confirm any additional groundwater monitoring requirements.	To maintain the beneficial uses of the groundwater.	Ascertain any requirements for additional groundwater monitoring on completion of the current groundwater study.	Construction	
27	Risk	Undertake a full Quantified Risk Assessment.	To confirm the results of the preliminary risk assessment.	Quantified Risk Assessment to include analysis of common mode failures.	Commissioning	DME
28	Risk	Update the Safety Case and Safety Management System.	To include the additional facilities in the safety case.	Safety Case to include managing the additional risks from construction activities.	Commissioning	DME
29	Aboriginal Heritage	Site clearance will be undertaken in accordance with the *Aboriginal Heritage Act 1972*.	To comply with the *Aboriginal Heritage Act 1972*.	To utilise the Aboriginal Heritage Management Committee in site clearance and curation of heritage material.	During construction	AAD

APPENDIX 2

LIST OF SUBMITTERS

GOVERNMENT

Pilbara Development Commission
Department of Resources Development
Western Australian Museum
Dampier Port Authority

Department of Land Administration
Aboriginal Affairs Department
Department Of Transport
Department of Conservation and Land Management
Department of Minerals and Energy
Shire of Roebourne
Fisheries Western Australia
Department of Environmental Protection

PRIVATE

J Gourley
Friends of the Burrup
RECFISHWEST
GORGON Australian LNG
(West Australian Petroleum Pty. Limited)
Combustion Air Pty Ltd
C Walters
C Heal
L Staude

APPENDIX 3

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APPENDIX 4

PROPONENT'S TABLE OF PROPOSED MANAGEMENT STRATEGIES

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
MARINE ISSUES –MANAGEMENT STRATEGY AND CONTROL					
[1] Dredging – Shipping lane and jetty berth construction.	[Sea floor, marine flora and fauna] Maintain biodiversity of the seafloor and ensure that any impacts on locally significant marine communities, including turtles, are avoided.	[1.1] A detailed Dredging and Blasting Environmental Management Plan (EMP) will be prepared. The plan will consider human safety, spoil disposal, sedimentation and potential impacts on nearby industries and communities. The EMP will also consider measures of minimising blasting activities.	EMP prepared for dredging and blasting operations, spoil disposal and monitoring programmes. Wherever possible, the use of the cutter suction dredge for excavation of the sea bed will be encouraged instead of blasting.	Before start of construction phase.	Letter of acceptance of Dredging and Blasting EMP by DEP(WA).
[2] Blasting Impacts – Star Rock, Shipping Channel.	[Sea floor, marine flora and fauna] Maintain biodiversity of the seafloor and ensure that any impacts on locally significant marine communities, including turtles, are avoided.	[2.1] Procedures will be developed to ensure a whale and turtle watch is maintained in the blast area.	▪ Consultation with regulatory agencies on ascribed distances for blasting. ▪ The intent of the procedures will be to temporarily stop blasting while marine mammals/reptiles are in the blasting area.	Before and during dredging and blasting works.	▪ Acceptance of Dredging and Blasting EMP by DEP(WA). ▪ Letter from CALM confirming safe distance required. ▪ Explosives will be used by an experienced operator who is holder of a WA shotfirer's permit.
	[Terrestrial fauna, Endangered species] Protect terrestrial fauna (eg bird life).	[2.2] Develop strategy to minimise the release of plastic coatings after each charge.	Investigate alternatives to buoyant or persistent plastic coating on explosive charges.	Before and during dredging and blasting works.	Acceptance of Dredging and Blasting EMP.
	[Terrestrial fauna, Endangered species] Protect terrestrial fauna (eg bird life).	[2.3] Dead fish removed after each blast as soon as practicable to prevent injury to birds.	Organise collection of dead fish after each blast.	During blasting activities.	Acceptance of Dredging and Blasting EMP by DEP(WA).
	[Sea floor, marine flora and fauna] Maintain biodiversity of the seafloor and ensure that any impacts on locally significant marine communities, including turtles, are avoided.	[2.4] Control of charge structure for blasting. Overpressure effects on marine life will be minimised by optimising the charge structure for blasting.	Details of the techniques used will be included within the Dredging and Blasting EMP.	During blasting activities.	Acceptance of Dredging and Blasting EMP by DEP(WA).

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[3] Sedimentation Impacts.	[Sea floor, marine flora and fauna] Maintain biodiversity of the seafloor and ensure that any impacts on locally significant marine communities, including turtles, are avoided. Note: jetty construction, dredging and blasting in inshore areas should be managed so as to avoid impacts on coral spawning.	**[3.1]** Sedimentation impacts from dredging will be managed through the Dredging and Blasting EMP. Dredging operations will not be performed for a suitable time period around the actual coral spawning event. The downtime for coral spawning will be managed in consultation with CALM and compliance with the Dredging and Blasting EMP.	Details of management of sedimentation included in Dredging and Blasting Management Plan.	Timing included in Dredging and Blasting EMP before construction. *(Note During the LPG Project dredging operations were stopped for a period of 2-3 days during the coral spawning period).*	▪ Included in Dredging and Blasting EMP. ▪ Letter of acceptance of EMP by DEP(WA). ▪ Liaising with coral watch group.
[4] Spoil Disposal.	[Dredging and disposal of dredge spoil] Protect environment from significant impacts consistent with the Environment Protection (Sea Dumping) Act and London Dumping Convention.	**[4.1]** Permit sought to utilise dedicated spoil grounds.	A Sea Dumping Permit will be sought to utilise spoil grounds A and B for spoil disposal.	Before dredging and blasting phase.	Issue of Permit by Environment Australia and compliance with conditions during operations.
[5] Vessel Management – Waste Management Aboard Vessels.	[Solid wastes] Adopt measures to reduce and recycle solid wastes where practicable. Dispose of remaining wastes so as to reduce any environmental impacts.	**[5.1]** Wastes to be disposed of into marine water in accordance with MARPOL Annex IV or at the OGP in the waste management system.	▪ The disposal of grey water, sewage and solid wastes will not be permitted within the waters of the Dampier Archipelago or offshore unless treated in accordance with the requirements of MARPOL Annex IV. ▪ All other wastes will be brought ashore and managed through Woodside's Waste Management Strategy. Vessel operations will be included in the proposed Dredging and Blasting Management Plan.	During operation of dredging and support vessels.	Confirm in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[6] Vessel Quarantine.	[Ballast water] Protect the adjacent marine environment from any impacts associated with foreign entrained organisms and chemical constituents contained in discharged ballast water, consistent with current AQIS guidelines on ballast water.	**[6.1]** Dredges arriving in Australia from overseas ports be required to comply with AQIS Notice 92/2 *Controls on the Discharges of Ballast Water and Sediment from Ships Entering Australia from Overseas.* Woodside will audit compliance with this standard.	A quarantine inspection will be undertaken and report prepared prior to any dredge arriving in Pilbara waters. The report will ensure that the vessels have a current De-ratting Exemption Certificate (issued every 6 months), are free of exotic organisms and that there is minimal residual sediment contamination from previous dredging operations.	Prior to any dredge and other *Project* support vessels entering Pilbara marine waters.	Quarantine inspection reports for vessels included in *Project* documentation. Summary of vessel audits sent to DEP(WA).
[7] Vessel Operations – Oil Spills.	[Oil from shipping accidents] Ensure minimal risk of leakage by identifying and managing risk and by adapting international best practice equipment and operating procedures. [Shipping traffic] Risks to existing shipping to be As Low As Reasonably Practicable (ALARP).	**[7.1]** A full QRA for the *Project* that includes additional risks from extra shipping will be conducted.	Conduct QRA for *Project*.	Prior to start-up of *Project*.	QRA accepted by DPA and DME.
	[Oil from shipping accidents] Ensure that the oil spill contingency plan is consistent with the expanded plant/vessels.	**[7.2]** MARPOL and Woodside requirements for oil spill response plans will be reviewed prior to *Project* related vessel movements.	Ship board oil spill response plans will be developed and implemented, as required by MARPOL to interface with the Woodside's Oil Spill Contingency Plan.	During dredging and blasting works.	Updated oil spill contingency plan accepted by DPA and DME.
	[Oil from shipping accidents] Protect sensitive environments and species from hydrocarbon spills.	**[7.3]** Vessels will carry oil spill equipment. All spills greater than 20L will be reported and corrective actions taken.	▪ Vessels will be required to carry oil spill equipment on board, appropriate for minor spill clean-ups. ▪ Vessel masters will be required to report spills greater than 20l and corrective actions taken to Woodside.	During dredging and blasting works.	Updated oil spill contingency plan accepted by DPA and DME.
	[Oil from shipping accidents] Protect sensitive environments and species from hydrocarbon spills.	**[7.4]** Procedures will be prepared for oil spills during re-fuelling of vessels.	Refuelling procedures will be prepared for all vessels involved in dredging and blasting operations.	During dredging and blasting works.	Refuelling procedures and training will be documented by dredging contractor in contract. Reported to DEP(WA) in Dredging and Blasting EMP.

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[8] Effluent Discharges – Hydrotesting.	[Hydrotest fluids] Demonstrate that there will be no significant impacts from disposal of Hydrotest fluids / pickling liquors.	[8.1] Where possible, additives such as corrosion inhibitors and oxygen scavengers to hydrotest liquor will be avoided. Where this is not possible, discharges into Mermaid Sound will use adequate dispersion.	Disposal of effluent will be done on a case by case basis following DEP(WA) consultation. Woodside will allow for a minimum 48 hour response from the DEP(WA) following disposal notification.	During construction of additional facilities.	Letter of agreement from DEP(WA) on disposal option for each hydrotest water discharge.
[9] Effluent Discharges – Pickling Liquors.	[Pickling liquors] Demonstrate that there will be no significant impacts from disposal of hydrotest fluids / pickling liquors.	[9.1] No pickling liquor will be discharged into the marine environment.	Use of pickling liquor will be minimised during the construction process. The liquor will be disposed of by the pickling contractor in a manner acceptable to both Woodside and the DEP(WA).	During construction of additional facilities.	Woodside to notify and gain DEP(WA) acceptance of disposal methods.
ATMOSPHERIC ISSUES - MANAGEMENT STRATEGY AND CONTROL					
[10] Dust.	[Dust] Protect the surrounding land users such that dust emissions will not adversely impact upon their welfare and amenity or cause health problems.	[10.1] Dust nuisance to the workforce and adjoining land users will be assessed during construction and control measures instigated if necessary.	Dust minimisation strategies will involve road dampening using water trucks and/or stockpile mist spraying as required.	During construction phase.	Confirm in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.
TERRESTRIAL ISSUES - MANAGEMENT STRATEGY AND CONTROL					
[11] Disturbance of New Areas (Laydown Areas).	[Site Selection] Protect the environment to the maximum extent possible. Protect vegetation and natural resources from significant disturbance. Document site selection criteria and process in detail.	[11.1] The loss of habitats for laydown areas will be minor in comparison to that available on the Burrup Peninsula.	Surveys have been conducted and suggested that no environmentally significant habitats are present in the areas proposed for laydown activities. Disturbed areas will left in a safe condition as required by the appropriate government authorities. This condition will not compromise future industrial development.	Completed.	No action required.
[12] Laydown Area – Quarry Site Leases, Holden Point Lease.	[Terrestrial Vegetation] Maintain the abundance, diversity, geographical distribution and productivity of vegetation communities. Protect declared rare flora consistent with environmental legislation.	[12.1] Vegetation survey undertaken over laydown sites. Destruction of any priority flora subject to Commonwealth and WA legislation requirements.	Surveys undertaken of vegetation over prospective laydown sites. *(A number of individuals of priority species may have to be removed from the Holden Point lease).*	Completed.	▪ Liaison between Woodside and CALM prior to the destruction of Priority Flora. ▪ Confirm in env annual report under North West Gas Development (Woodside) Agreement 1979.

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
	[Terrestrial fauna] Maintain the abundance, species diversity and geographical distribution of terrestrial fauna.	**[12.2]** To prevent the spread of weeds, vehicles will keep to dedicated roads and will be washed down if they leave formed roads within the leased area.	Temporary washdown facilities will be constructed at appropriate locations.	During construction	Report in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.
	[Endangered Species] Protect endangered or threatened fauna and their habitats, consistent with environmental legislation.	**[12.3]** Fauna surveys undertaken over Burrup Peninsula area. *(Long term Woodside fauna survey data performed over some of the proposed Project area and similar habitats on the Burrup have not found any fauna species in the areas of the Project that are protected under State or Commonwealth legislation. The exception is the Holden Point lease where the Olive Python has been recorded).*	Continue existing fauna surveys over Burrup Peninsula. *(A number of individuals of priority species may be incidentally destroyed as a result of construction activities in the Holden Point lease area. This will not compromise the widely distributed populations of these species on the Burrup).*	On-going.	▪ Confirmation status of fauna in lease areas by continuing annual fauna studies and extending to leased areas. ▪ Report in annual env report under the ratified North West Gas Development (Woodside) Agreement 1979.
[13] Surface Water – Laydown Area.	[Surface water] Maintain the beneficial uses of surface water, including ecosystem maintenance, consistent with the draft EPA guidelines 1993. Manage contaminated surface water runoffs to ensure the above.	**[13.1]** Changes to landforms and drainage will not extend past the immediate area of disturbance.	The modified areas will be left in a condition that does not compromise existing surface drainage patterns.	During construction and operation phases.	▪ Post construction site audit. ▪ Report audit summary in annual env report under the ratified North West Gas Development (Woodside) Agreement 1979.
[14] Waste Management – Disposal of rock and soil.	[Solid wastes] Adopt measures to reduce and recycle solid wastes where practicable. Dispose of remaining wastes so as to reduce any environmental impacts.	**[14.1]** All surplus fill from site preparation activities will be removed to an existing storage area near No Name Creek.	Remove approximately 12,000 m^3 of rock from the LNG storage tank site and smaller amounts of soil when placing pipe under site roads.	During construction.	▪ Post construction site audit. ▪ Report audit summary in annual env report under the ratified North West Gas Development (Woodside) Agreement 1979.

MANAGEMENT OF CONSTRUCTION PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[15] Waste Management - Solid wastes, Primary Scrap Steel.	[Solid wastes] Adopt measures to reduce and recycle solid wastes where practicable. Dispose of remaining wastes so as to reduce any environmental impacts.	[15.1] Solid wastes will be disposed of in accordance with Shire of Roebourne and DEP(WA) requirements.	Estimated quantities of solid wastes will be provided to the Shire of Roebourne and DEP(WA) before and during construction work.	Before and during construction phase.	Confirm disposal details in writing to Shire of Roebourne and DEP (WA).
	[Solid wastes] Adopt measures to reduce and recycle solid wastes where practicable. Dispose of remaining wastes so as to reduce any environmental impacts.	[15.2] Where possible, high quality steel, aluminium scrap, wood and paper products will be reused or recycled.	▪ Develop recycling procedures for high quality materials. ▪ Lesser quality steel, aluminium, wood, paper and plastic debris not suitable for recycle will be disposed of in accordance with existing site procedures.	Before construction phase.	Recycling effort reported in annual Waste Summary Report to DEP(WA) under OGP environmental licence.
NOISE ISSUES - MANAGEMENT STRATEGY AND CONTROL					
[16] Noise.	[Noise] Protect the amenity of nearby residents from noise and vibration impacts resulting from activities associated with the proposal by ensuring that noise and vibration levels meet statutory requirements and acceptable standards.	[16.1] Woodside will devise suitable corrective actions so installed equipment and construction activities comply with the noise abatement statutes of WA.	Noise monitoring will be conducted when appropriate to ensure that levels are within acceptable criteria. *(The physical distance between the construction site and the nearest residential area (ie Dampier 10 km away) will attenuate the noise to negligible levels).*	During construction	Confirm noise monitoring results and any terrestrial action in annual env report under the ratified North West Gas Development (Woodside) Agreement 1979.
MARINE ISSUES – MANAGEMENT STRATEGY AND CONTROL					
[17] Effluent Discharges – Process Effluent/Stormwater.	[Oil from onshore] Protect sensitive environments and species from hydrocarbon spills.	[17.1] Bunding will be installed in areas where there is a possibility of accidental oil contamination. Where appropriate, the bunding will be protected from the ingress of rain.	Accidental spillage into bunds will be either reprocessed or disposed of at a DEP(WA) approved liquid disposal site. Accordingly, the quality of the effluent discharged into Mermaid Sound from the OGP will be minimised and continue to meet current licence conditions.	Ongoing.	▪ Confirm in annual Waste Summary Report to DEP(WA). ▪ Bunding to meet AS/NZS 1940. Approval under licensing/works approval requirements.

MANAGEMENT OF OPERATIONAL PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[18] Effluent Discharges – Process Effluent/Stormwater (continued).	[Oil from onshore] Protect sensitive environments and species from hydrocarbon spills.	**[18.1]** Sulfinol concentrations in OCW effluent discharged to the environment will be maintained within existing license conditions.	Potential Sulfinol spills from LNG trains 4/5 will be segregated from other general oil spills and reprocessed.	During design of facilities.	Confirm in annual Waste Summary Report to DEP(WA).
[19] Vessel Operations – Shipping Turbidity.	[Shipping traffic] Assess the impacts of the increased shipping frequency and volume.	**[19.1]** The existing ChEMMS monitoring program or other Woodside marine monitoring programs will continue to monitor for effects on corals in the vicinity of the product load-out jetties from increased turbidity. These projects will also monitor the overall impacts of the *Project* on the marine environment.	Report results of *Project's* impact on coral community in ChEMMS Programme or other marine monitoring program.	For each ChEMMS report.	Confirm in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.
[20] Vessel Operations – TBT Impacts.	[Shipping traffic] Assess the impacts of the increased shipping frequency and volume.	**[20.1]** TBT sediment and biota loads will continue to be monitored as part of the ChEMMS programme or other periodic marine monitoring programme.	Report results of *Project's* impact on TBT loads in sediment as part of ChEMMS Programme or other marine monitoring programme.	For each ChEMMS report.	Confirm in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.
ATMOSPHERIC ISSUES – MANAGEMENT STRATEGY AND CONTROL					
[21] Greenhouse Emissions from Existing OGP and *Project*.	[Greenhouse Gases] Estimation of carbon dioxide equivalent emissions from the existing and the proposed new plant.	**[21.1]** The increase in CO_2e emissions will be 2.9 Mtpa. The OGP total emissions will increase to 7.7 Mtpa. The increase in emissions is <60% of existing levels and corresponds to a production increase of 107%.	Woodside has committed to install equipment to minimise greenhouse gas emissions in both *absolute* terms (Mtpa) and in *greenhouse efficiency* terms (tonnes CO_2e/unit of hydrocarbon product). *(The additional greenhouse gas equipment add approximately $20 million to Project cost.)*	Ongoing.	No action required.

MANAGEMENT OF OPERATIONAL PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[22] Greenhouse Gas – Sink Enhancements.	[Sink Enhancement] Estimate the gross amounts of greenhouse gases that may be soaked up from sink enhancement programs linked to the proposed *Project* in CO_2 equivalent figures.	**[22.1]** Woodside has previously commissioned a study to investigate the feasibility of various offset options.	Woodside plans to undertake a more detailed study of forestry options as part of its ongoing greenhouse reduction strategy.	Ongoing.	A summary of the findings from the detailed study will be incorporated in the Annual Report to the Greenhouse Challenge Office when finalised.
[23] Greenhouse Gases – Benchmarking.	[Benchmarking of LNG Processes] Minimise greenhouse gas emissions ...with comparison to other LNG Processes (Project Assessment Guidelines). Indicate the intended measures and the world's most efficient technologies to be adopted to minimise greenhouse gas emissions (EPA Bulletin 12). Compare the greenhouse gas efficiency of the proposed *Project* (per unit of product or other agreed performance indicator) with the efficiency of other projects using the same or different technologies producing a similar product.	**[23.1]** The agreed performance indicator was process fuel efficiency as this bears a direct relationship to the major CO_2 emission source of fuel combustion. Emission information is commercially sensitive and not available from other similar plants. Woodside has selected the Shell C3/MR process with extended waste heat recovery. *(The process selected has a fuel efficiency of >94% (approx) compared with other processes selected with efficiencies of 90-93.5%).*	Woodside will install the Shell C3/MR LNG technology, giving it the world's most efficient LNG process.	Detailed Design through to operation.	Confirmation of design in the LNG Expansion Works Approval documentation and the annual report to the Greenhouse Challenge Office.
[24] Greenhouse Gas Reduction Strategy (Greenhouse Challenge).	[Greenhouse Gases] Mitigate greenhouse gases in accordance with established policies and agreements (Project Assessment Guidelines). As a matter of information, indicate whether the proposed *Project* will be entered into the Commonwealth Governments "Greenhouse Challenge" voluntary agreement program (EPA Bulletin 12).	**[24.1]** Woodside on behalf of the NWSGV partners has a current Co-operative Agreement with the Commonwealth Government under the "Greenhouse Challenge" program. The *Project* will be incorporated into the existing Company-wide Agreement.	Complete.	All phases of *Project.*	Annual Report to the Greenhouse Challenge Office.

MANAGEMENT OF OPERATIONAL PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[25] Management of NO_x Emissions.	[Air Emissions] Ensure that conditions which could promote the formation of photochemical smog are managed to minimise the frequency.	[25.1] The factors promoting the formation of photochemical smog that are within Woodside's capacity to manage (ie emissions) will be minimised through design and operation.	▪ Installation of low NO_X burners to all new gas fired equipment. ▪ Thermal combustion of the Sulfinol vent gas stream and the installation of dry seals (where technically feasible) or seal gas recovery in compressors. This will remove the major sources of photochemically reactive hydrocarbon emissions.	Construction phase and ongoing.	Compliance monitoring and reporting of air emissions through OGP licence and under *Environmental Protection Act 1986.*
	[Air Emissions] Ensure emissions are minimised.	[25.2] Fuel burning equipment has been specified to meet the following NO_x standards; • Guaranteed at <100 mg/m^3; • Expected operational concentrations of 70 mg/m^3.	Installation of low NO_X burners to all new gas fired equipment.	Construction phase.	Compliance monitoring and reporting of air emissions through OGP licence and under *Environmental Protection Act 1986.*
	[Air Emissions] Ensure emissions are minimised.	[25.3] Modelling performed by CSIRO for Woodside indicates that ground level concentrations of NO_x and smog products (ozone and particulates) from the expanded plant are well below NHMRC and Ambient Air Quality NEPM recommended levels considered acceptable for residential areas.	No actions required.	Completed.	Report included as part of PER appendices.
[26] Management of Other Emissions.	[Air Emissions] Ensure that emissions of NO_x, SO_x, hydrocarbons, toxics, particulates and smoke are assessed and meet acceptable standards. Ensure emissions are minimised.	[26.1] Emissions of toxics, particulates and smoke will meet established emission standards and existing licence conditions for the *Project.*	Existing OGP and *Project* processes do not produce emissions of these substances that warrant detailed consideration.	Ongoing.	Compliance monitoring and reporting of air emissions through OGP licence and under *Environmental Protection Act 1986.*

MANAGEMENT OF OPERATIONAL PHASE OF PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[26] Management of Other Emissions (cont)	[Ozone Layer] Protect the ozone layer in accordance with Commonwealth *Ozone Protection Act 1989* and the WA *Environment Protection (Ozone Depletion) Policy 1993.*	Most "hard" ozone depleting substances phased out on OGP. No action required.	No action required.	No action required.	No action required.
TERRESTRIAL ISSUES – MANAGEMENT STRATEGY AND CONTROL					
[27] Mercury Regeneration.	[Mercury regeneration] Prevent losses to the environment and ensure appropriate disposal of spent bed material.	**[27.1]** Spent mercury bed material will be re-processed to extract the mercury and then disposed appropriately by manufacturer or approved waste disposal contractor.	Take-back arrangement in place with manufacturer. *(NB: bed life is >6 years due to very small amount of mercury in feed gas).*	When bed capacity is exhausted.	Confirm in annual environmental report under North West Gas Development (Woodside) Agreement 1979.
[28] Groundwater.	[Groundwater] Maintain the beneficial uses of groundwater, including ecosystem maintenance, consistent with the draft WA Guidelines for Marine and Fresh Waters (EPA 1993).	**[28.1]** Areas where there is potential for process spillage will be fully contained to prevent contamination of the groundwater.	Areas around new facilities that have a potential for process material spills will be bunded. Accidental spillage into bunded areas will be either reprocessed or disposed of at a DEP(WA) approved liquid disposal site.	During construction phase.	▪ Post construction site audit. ▪ Report audit summary in annual env report under the ratified North West Gas Development (Woodside) Agreement 1979.
	[Groundwater] Maintain the beneficial uses of groundwater, including ecosystem maintenance, consistent with the draft WA Guidelines for Marine and Fresh Waters (EPA 1993).	**[28.2]** Groundwater monitoring is reported to the DEP(WA) in biannual and annual reports. This reporting mechanism is considered sufficient to cover the *Project*. However, requirements for additional monitoring bores will be ascertained on completion of a current groundwater study.	Investigations into below ground contours and drainage/groundwater flow paths will continue.	Before construction.	Confirm any additional groundwater monitoring requirements and reflect any changes in amendments to OGP environmental licence.
[29] Decommissioning.	[Decommissioning] Protect environment from adverse impacts and ensure that the State and Commonwealth Governments do not incur a long-term liability, in accordance with the Environment Protection (Sea Dumping) Act and the London Dumping Convention.	**[29.1]** The facilities have a life in excess of 30 years, and will be decommissioned simultaneously with existing facilities.	Decommissioning plans will be continuously pro-actively revised throughout this period to ensure best practice at the time of the plant closure.	During life of NWSJV *Project*.	Approval from DME and DEP(WA) of final decommissioning plan.

MANAGEMENT OF RISK ISSUES FOR PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
RISK ISSUES - MANAGEMENT STRATEGY AND CONTROL					
[30] Risk.	[Risk – human health and safety] Ensure that risk is assessed and managed to meet the EPA' criteria for off-site individual facility risk in EPA Interim Guidance (No 2) Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant and the DME's requirements in respect of public safety.	**[30.1]** The *Project* will meet established criteria for risk associated with the new facilities.	▪ Preliminary hazard assessments have been undertaken for the new facilities. The *Project* will meet established criteria for industrial activities. ▪ A full QRA will be undertaken for the *Project* and the Safety Case updated.	Prior to start-up of new facilities and on-going.	Acceptance of updated Safety Cases and Management System by DME.
[31] Risk.	[Risk human health and safety] Ensure the public risk associated with implementation of the *Project* is ALARP and in compliance with the criteria.	**[31.1]** Risks posed by plant expansion to human life has been assessed and will be utilised during the updating of the Safety Case.	Preliminary hazard assessments have been undertaken for the new facilities. This assessment will be expanded during the updating of the facility Safety Cases and Management System.	Prior to start-up of new facilities and on-going.	Acceptance of updated Safety Cases and Management System by DME.
[32] Risk.	[Risk human health and safety] Ensure that the SMS for the expanded plant includes the additional plant operations and complies with the National Standard for the Control of Major Hazard Facilities.	**[32.1]** The existing Safety Case will be updated to include the *Project*.	Updating of the Safety Case will be undertaken before construction phase for this *Project*. *(Updates of the Safety Case are performed at a maximum of five yearly intervals. The 5 yearly update will take the format of a review of the content for accuracy and a re-issue as a minimum).*	Prior to start-up of new facilities and on-going.	Acceptance of updated Safety Cases and Management System by DME.

MANAGEMENT OF SOCIAL ISSUES FOR PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
SOCIAL ISSUES - MANAGEMENT STRATEGY AND CONTROL					
[33] Workforce.	[Social Impacts] Ensure social impacts are acceptable. Information provided on the: ▪ Numbers of workers required at the various stages of the *Project*; ▪ Requirements for accommodation and options available.	**[33.1]** Ensure availability of accommodation for construction workforce of 2000-2500 and permanent workforce of 50-100 people.	Woodside is currently investigating using leased accommodation, new or existing village and caravan park capacity and land unconstrained by Native Title (refer Figure 7.1).	Prior to Start-up/ Ongoing.	No action required.
Workforce (continued).	[Social Impact] ▪ Provisions of other services and facilities to support the *Project* workforce and families. ▪ Effect of workforce on offsite areas (recreational use).	**[33.2]** Ensure adequate infrastructure in place for projected workforce.	▪ Previous Woodside contributions have ensured spare capacity in regional infrastructure to meet the needs of construction workforce (Naralup and Assoc 1996). ▪ Proposed accommodation village will include limited recreation opportunities to ease pressure on town facilities.	Before and during *Project*.	No action required.
	[Social Impact] ▪ Provisions of other services and facilities to support the *Project* workforce and families. ▪ Effect of workforce on offsite areas (recreational use).	**[33.3]** Bypass road around Karratha preferred for general and construction traffic.	Woodside will continue to strongly encourage the Government for early completion of the bypass road around Karratha (as identified by WA State Government in 1998 "Transform WA" package). This road would be utilised for general and construction traffic.	Ongoing discussions.	No action required. [State Government action]
	[Social Impact] ▪ Provisions of other services and facilities to support the *Project* workforce and families. ▪ Effect of workforce on offsite areas (recreational use).	**[33.4]** A *Project* transportation strategy summary document will be prepared for DEP(WA) information prior to *Project* commencement.	Transportation strategy under development. *(Bus transport by third party is currently preferred option).*	Before start-up.	Transportation strategy summary document provided to DEP(WA) for information prior to *Project* start-up.

MANAGEMENT OF SOCIAL ISSUES FOR PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
	[Social Impact] ▪ Provisions of other services and facilities to support the *Project* workforce and families. ▪ Effect of workforce on offsite areas (recreational use).	[33.5] Maximisation of local workforce in construction project.	▪ Ongoing discussions proceeding with main contractor to ensure more local participation in construction workforce, including support for further/re-training at Karratha College where required. ▪ Discussions with stakeholders to ensure job opportunities for local Aboriginal community.	Before start-up. During *Project* construction.	Summary of local workforce participation and training provided in annual environmental report under the ratified North West Gas Development (Woodside) Agreement 1979.
	[Social Impact] ▪ Provisions of other services and facilities to support the *Project* workforce and families. ▪ Effect of workforce on offsite areas (recreational use).	[33.6] Extension of exclusion zone around LNG Loading Facilities.	No significant impact on recreational activities around Burrup Peninsula.	Extension granted before start-up.	No action required.
[34] Aboriginal Heritage.	[Heritage] Comply with the Aboriginal Heritage Act 1972 and other statutory requirements in relation to areas of cultural or historical significance.	[34.1] A survey of affected areas for the *Project* has been conducted. [34.2] Any Aboriginal site clearance will be done in accordance with existing legislation.	Aboriginal site clearance will be undertaken in accordance with the Aboriginal Heritage Act (1972) and in particular Section 18. Consultation has previously been undertaken with local Aboriginal representatives and the Aboriginal Cultural Material Committee (ACMC) for all site disturbances. The Minister for Aboriginal Affairs has granted conditional permission in May 1998 to disturb Aboriginal sites within the *Project* land areas and has endorsed the Company's Site Management Plan.	Prior to the commencement of clearing for additional facilities or laydown areas.	Letter from AAD confirming acceptance of proposed disturbance areas.

MANAGEMENT OF SOCIAL ISSUES FOR PROJECT

Environmental Issue	Environment Australia/DEP(WA) Objective	Proposed Management Strategy	Proposed Implementation	Timing	Compliance Measurement
[35] National Estate.	[National estate] Protect areas listed on the Register of the National Estate or currently under assessment.	[35.1] Areas listed on the Register of the National Estate or currently under assessment will not be impinged upon by the *Project*.	A survey of protected areas on Register has been conducted.	Prior to start-up of clearing for *Project* area.	No action required.
[36] Shipwrecks.	[Historic shipwrecks] Protect historic ship wrecks from damage during dredging activities in accordance with the Historic Shipwreck Act and Maritime Archaeology Act.	[36.1] Selection of shipping channel and jetty berth dredging and blasting works to avoid crossing any listed historic shipwrecks.	Liaise with WA Maritime Museum to ensure historic wrecks are identified.	Before start of construction phase.	Letter from WA Museum confirming consultation re marine blasting and dredging works.
[37] Increased Demand for Natural Resources.	[Increased demand for natural resources] Specify the impact of this proposal on current reserves.	[37.1] This development will not impact to any appreciable degree on gas resource levels in Australia.	No action required.	N/A.	N/A.

APPENDIX 5

SUMMARY OF PUBLIC SUBMISSIONS AND THE PROPONENT'S RESPONSES

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A1.1	DRD/CALM co-ordinate peninsula weed survey resulting in weed management strategy	Woodside will consider participation in an appropriate joint industry/government weed survey, but the organisation of such a survey is not a principal action for the proponent
A1.2	Proponent control weeds on lease; surveys by trained botanists and management strategy	Woodside will institute a weed management strategy to control weed introductions to project areas that are being disturbed and continue to monitor and where possible, control, weed introductions on all project areas
A1.3	CALM/DRD to survey vegetation on the Burrup Peninsula. Industries to contribute to costs	Woodside will contribute to appropriate joint industry/government vegetation surveys on the Burrup Peninsula to increase knowledge of vegetation communities and distribution.
A1.4	Only 0.8 ha of sand plain exists on the Burrup and the proponent should seek an alternative to sandplain disturbance at Holden Point	As stated in the Second Trunkline PER, the majority of this sandplain area will be utilised by the Second Trunkline Project for which environmental approval has already been given. Only minor use of this area will occur during LNG expansion. Studies performed as part of the Second Trunkline Project have indicated no viable alternative to disturbance of this sandplain area. The area has been zoned "industrial" under the Burrup Land Use Management Plan.
A1.5	Proponent should give consideration to sourcing rock off the peninsula in a less environmentally sensitive location	The Quarry lease areas on the lease areas will be used for the Second Trunkline Project (environmental approval granted) to prepare some of the sites to be used for future LNG expansion. A large number of alternative rock sources were reviewed with DRD and the ones selected were the best practicable options.
A1.6	Supplementary data on acid precipitation from SO2 emissions	There will be low emission rates of sulphur compounds from the new LNG facilities. This combined with the intense and ephemeral nature of rainfall on the Burrup indicates that the loading of runoff with sulphur will be negligible and too dilute to damage calcarenite formations in the drainage systems. It is considered unlikely that detectable reductions in pH will occur.
A1.7	Proponent to become involved in biological control of weed species research	Woodside will consider participation in appropriate joint industry/government weed research programs, however the organisation of such a survey is not a principal action for the proponent.
A1.8	The 1979 vegetation and flora study is dated and does not provide the NWSJV with a good understanding of the conservation status of vegetation communities	Woodside will contribute to appropriate joint industry/government vegetation surveys on the Burrup Peninsula to increase knowledge of vegetation communities and distribution.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A1.9	Further industrialisation will cause the loss of the overall integrity of the Burrup landscape and the fragmentation and opening up of biological systems	The matter of industrialisation on the Burrup has been addressed by the Burrup Peninsula Land Use Management Plan. This plan has been endorsed by the State Cabinet and matters affecting zoning will have to be addressed within the WA Government.
A2.1	Proponent has not considered rationalisation of infrastructure with other projects to minimise environmental impact	Rationalisation can only be considered when firm project proposals are available. As yet no other suitably progressed projects are available on the Burrup. In addition, while project facility rationalisation can be seen as a creditable objective, its application to projects, such as the NWS LNG project with its high dependence on plant availability and reliability and fulfilling the strict safety criteria has yet to be proven.
A2.2	Project not adequately defined (2 Jetty berth options). Proponent to report to EPA prior to EPA advice being finalised	A review of the technical feasibility and a cost benefit analysis has now being completed with the project proceeding with the short jetty option (option 2).
A2.3	Describe precisely activities on Holden Point foreshores	Activity on the Holden Point foreshore is restricted to the Second Trunkline Project and will be largely confined to a rock loadout jetty and headworks. Approval has already been given for this project.
A2.4	Basis for 500 m exclusion zone around jetties. Recreational boat traffic implications.	The exclusion zone around the berth is presently 700 m and not the 500m quoted in the PER. This distance is set by the Dampier Port Authority for operational safety purposes and has being unchanged since start-up. There is no intention of reducing the 700m zone and the marine charts will have to be updated to show the new contours once the 5th train is approved.
A2.5	DEP requests type, composition and toxicology of antifoulant used on existing & future LNG ships	The NWS LNG vessels have been using TBT free paint from construction. It is anticipated that TBT paint will be withdrawn from use by around 2003 (as a result of IMO resolutions) and any new tonnage will be coated with the appropriate approved system that is available during construction. It is likely that this coating system will be copper based, but will reflect the best proven coating in terms of both environmental toxicity and cost. *[For information: This resulted from the fact that it has not been possible to apply TBT paint in a Japanese shipyard since mid 1980's.]*
A2.6	Decommissioning plans for the facility	Decommissioning plans for the facilities will be advised as per item 29 of the Project Summary Table in the PER.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A2.7	Proponent commit to weekly monitoring of coral communities in vicinity of dredging during months when the water temp is high (Nov-April). If sub-lethal effects such as bleaching occur, dredging should be suspended.	Woodside considers weekly monitoring of corals is too frequent to note sub-lethal effects, especially bleaching events. Woodside will commit to before dredging, after dredging and follow-up surveys. In addition, Woodside will prepare a Dredging and Blasting Management Plan prior to commencing work. Details of this plan are provided in response to Question A 2.8.
A2.8	Proponent should detail specific measures to minimise turbidity plumes from dredging, including contractor management	The proponent has committed to a "Dredging and Blasting Environmental Management Plan" (DBEMP) prepared to the satisfaction of the DEP. The DBEMP will encompass the following: To minimise sedimentation impacts from dredging and the impact on neighbouring corals by: 1. not dredging for a suitable time period around the actual coral spawning event. The downtime for coral spawning will be managed in consultation with CALM; 2. To monitor the neighbouring corals before and after dredging; 3. Minimise sediment generation by the use of appropriate dredging methods; 4. Seek to manage dredge position to minimise sediment dispersion to the shoreline; and 5. In the event of significant (>50%) mortality of coral communities attributable to high levels of dredge spoil turbidity, the proponent will implement a suitable program of enhancing coral recruitment in that area.
A2.9	Proponent should examine recruitment, size distributions and species shift to assess impact of disposal of dredge spoil on coral communities	The examination of recruitment, size distributions and species shift to assess impact of disposal of dredge spoil was addressed in the 1994 Report "LPG Jetty and Ship Turning Basin Spoil Disposal Program - Marine monitoring Study" performed by Le Provost Consultants and has been previously supplied to the DEP. The results of this study showed minimal impact on these parameters from the LPG dredging program
A2.10	Are current conditions for Oil-in-Water and Sulfinol concentrations world best practice?	Discharge concentrations of Oil and Sulfinol in effluent are comparable to other LNG facilities overseas. The discharge concentrations meet licence requirements, which have set by the DEP on the basis of toxicological data.
A2.11	Description of marine impact should include cumulative impact.	Environmental Impact legislation only requires evaluation of the proponents proposal on the existing environment. The WA government has the most complete information on environmental impacts by other proponents and is therefore in the best position to assess cumulative impact.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A2.12	Provide a map showing sampling and observation points on unconsolidated sediments	The term "unconsolidated sediments" is a generic term arising out of a sonar side-scan survey of the area which noted this region as "calcarenite sands". During the environmental survey of Star Rock, this classification was noted by the consultant to comprise mainly muds of greater than 40 cm depth. The survey also noted that these muds, while heavily bio-turbated, did not support any epibenthic assemblage. This conclusion is supported by the original NWS Project EIS/ERMP (1979). The observation points for this substrate type are provided in the PER Appendices, Appendix B.
A2.13	Proponent requested to liaise with DPA and other parties to estimate the contaminant loadings to MS from discharges of treated wastes from ships. (Cumulative discharge)	The majority of shipping (in tonnage terms) using Mermaid Sound is not due to the NWS Venture, and therefore any study to determine cumulative impact is more properly the province of Government or the DPA. However, Woodside will contribute to an appropriately targeted DPA sponsored study of contaminant loadings from ships within Mermaid Sound
A2.14	Commitments re vessel quarantine be made Ministerial conditions.	Woodside LNG tankers are required to comply with AQIS guidelines. Ministerial conditions regarding extra quarantine measures should be progressed by the EPA.
A2.15	Composition and toxicity of hydrotest fluid	Woodside will prepare a Hydrotest Water Discharge Management Plan for approval by the DEP when the final constituents of the hydrotest water are known. Woodside will carefully screen each hydrotest water additive to ensure a very low environmental toxicity and ensure discharge conditions result in minimum environmental impact.
A2.16	Company to confirm no release of pickling liquor	The pickling contract will specify that pickling liquor cannot be discharged from site.
A2.17	When will a centralised sewage plant for Burrup industries be built	This matter is a decision for the WA Government.
A2.18	What are the annual loads of oil, sulfinol and nitrogen from the new plant?	The annual loads of pollutants are available in the "Interim and Detailed Reports on Environmental Investigations and Monitoring" supplied since 1984 to the WA Government under the NWS Gas (Woodside) Agreement Act 1979. The effluent discharges from the new LNG facilities will be significantly less than double those from the existing plant, largely because the new facilities have a system based on containment rather than a dedicated Oil-in-Water sewer system.
A2.19	The proponent should detail the human safety risk of storm surge on company housing in Karratha.	Additional Woodside housing in Karratha will be constructed in compliance with Shire approvals, which take into account storm surge from cyclones.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A2.20	The proponent should continue to accept a duty of care for the form and quality of the Holden Point beach and littoral systems	As Holden Point Beach is not a Woodside Lease area it is not possible for Woodside to adopt a "duty of care" over the area.
A2.21	How would the Company evaluate the validity of a quarantine report that a ship is free of exotic organisms? Who is the issuing authority; how would the "free" status be determined	The Quarantine reports are issued by AQIS or delegated Commonwealth department. There is no need to verify these certificates.
A2.22	Is there any possibility of ship-ship refuelling procedures?	The possibility exists that dredges or support tenders may refuel on station. This is done with DPA approval and according to strict internal procedures. In such an event, oil spill equipment and personnel are alerted in Woodside's King Bay Supply Base for quick response if required.
A2.23	What are the results of ambient monitoring (water, sediments, and biota) from the current monitoring program?	The results of the ambient monitoring program in Mermaid Sound (Chemical and Ecological Monitoring of Mermaid Sound or CHEMMS) are available in the "Interim and Detailed Reports on Environmental Investigations and Monitoring" supplied since 1984 to the WA Government under the NWS Gas (Woodside) Agreement Act 1979.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A3.1	Woodside needs to go beyond "no-regrets" and indicate how it can contribute to the net 8% GHG emission increase target	The NWS LNG plant is already among the most energy efficient in the world. Our Technical Adviser (Shell International OP) has designed LNG plants for installation all over the world and this is the first brownfields expansion where waste heat recovery has been included to such an extent. This is well beyond world's best practice as LNG plants are always located close to very large reserves of natural gas and minimising fuel gas usage has not been a prime driver. In these circumstances the prime design parameters for the engineers has traditionally been to: • maximise safety considerations for the construction and operation phase • minimise capital costs • minimise operating costs • maximise reliability of supply of natural gas and LNG. The NWS considers that the proposed integrated expansion goes considerably beyond an economic no-regrets scenario based on the following observations: • The Thermal Combustion Unit proposed for the Sulfinol system is being installed exclusively for the purposes of greenhouse gas emission abatement and cannot be classed as "business-as-usual" (BAU). The cost of this unit is approximately $10 million. • The new high efficiency LNG gas turbines will certainly save fuel gas. However, the gas saved is assumed to be only recovered at the end of the project and the value of the gas at End Of Fieldlife (EOF) is discounted to a negligible value. In addition, the project loses on condensate and LPG revenues, as these are high value products produced simultaneously with the gas and lower gas usage means less liquids produced. • The disproportionate operating costs (compared with BAU) involved in changing to a steam system are also expected to add to the NWS operating costs, offsetting any potential value from savings in fuel gas.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
		In the current competitive LNG market worldwide, there are more sellers than buyers. In this respect the NWS LNG project is competing against lower cost producers in the same markets. All of these competitors are in non-annex B countries, not bound to greenhouse gas emission targets under Kyoto, as is Australia. In addition, Joint Venture investment capital in the NWS Venture has to compete against other LNG expansions and hydrocarbon development projects worldwide. Any additional impost on the NWS project for greenhouse gas abatement has the potential to make the product uncompetitive and jeopardises its development. To install greenhouse gas abatement technology "beyond no-regrets" is an investment decision for the NWS partners. Because growth demand of domestic gas has not been as strong as expected, the project phasing has been changed with LNG expansion now preceding Domgas and Liquids expansion. The extent of how much beyond no-regrets the NWS Venture has gone, does not translate into a quantifiable environmental benefit or assist in the environmental management of the project. In summary, from both economic and competition viewpoints the project can be viewed as having invested heavily in "beyond no-regrets" technology primarily for the purposes of greenhouse gas abatement. In this respect it exceeds the requirements of government.
A3.2	The proponent will need to provide an "Action Plan" of mitigation measures, including forestry, re-injection, industrial processes. For the shortfall, the company should carry out non or semi commercial activities (eg for salinisation control). This plan needs to be included in the assessment and approvals process.	Woodside has already committed in the PER to carry out investigations into CO2 abatement measures such as re-injection of reservoir gas, sink enhancement and the industrial use of CO2. Because of the uncertain treatment of these issues in international and national policies and measures for CO2 abatement, the early implementation of these measures would impose both high degrees of risk and potential to further decrease the project's competitiveness. An "action plan" as suggested in the response would be premature as insufficient information is available to provide a technically and cost efficient program of abatement measures. However, the project is happy to produce a "Greenhouse Management Plan" prior to the commencement of construction where the progress of these investigations is reported on and discussed and any specific actions detailed. Further reporting against the Management Plan will be done in the Annual Report produced under the NW Gas Development (Woodside) Agreement Act (1979).

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A4.1	What are the likely requirements for maintenance dredging (as opposed to capital dredging)?	Experience with the existing OGP dredged channels and basins is that maintenance dredging will probably not be required within time periods shorter than 10 years and may be substantially longer. In the event of maintenance dredging being required, Woodside will ensure all relevant permits are obtained and measures necessary to protect the environment are implemented.
A4.2	Can boiler pipes be run through the ballast tanks of the LNG tankers to destroy Foreign Entrained Organisms?	The Project LNG tankers comply with AQIS guidelines. Further methods of reducing the possibility of Foreign Entrained Organism introduction, such as that stated in the question, will be considered as the ships are designed and experience from BHP and other operators becomes available
A4.3	Has Woodside looked at deterrent measures used by other petroleum operators prior to underwater blasting?	Yes, especially in Devonport TAS where very similar blasting occurred. This issue has also been discussed at length between Woodside engineers and potential marine blasting contractors.
A4.4	The proponent should formulate a proper waste management recycling and disposal plan with the SOR prior to construction	These commitments are provided in the PER summary table 15.1 and 15.2 respectively
A4.5	Has the proponent considered the Ruggies recycling scheme	The proponent has previously considered the "Ruggies" recycling scheme for its North West Shelf Operations, however transport costs make this impracticable.
A4.6	OIW and sulfinol discharge limits for the new plant should be designed to allow for progressive restriction of limits and with continual improvement (BPEL) in mind.	Reduction in future Oil in Water and Sulfinol limits will be taken into account in the detailed design process for effluent handling from the new facilities. The new oily water handling protocols should limit the incremental discharge of effluent discharged to Mermaid Sound.
A4.7	Has Woodside taken into account worst case scenarios and process upsets in definition of NOx discharges and smog modelling?	Woodside believes the nature of the modelling undertaken has accounted for worse case scenarios. Vendor design data was used which is inherently conservative and in Woodside's experience often significantly higher than actual emissions. The OGP and new LNG facilities will also be a "base load plant" burning a very consistent fuel, this would indicate the lack of a "worst case" for the bulk of the NOx emissions. As indicated in the PER, NOx emissions will be reduced by approximately 80% in the new facilities when compared with business as usual.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
A4.8	Information on SOx emissions is limited. WEL should commit to meeting current stack limits. Relaxation in discharge limits might not be appropriate in the light of CI and BPEL.	SOx emission increases will be minor and originate from the combustion of the very small amount of Hydrogen Sulphide in the Sulfinol vent stack. North West Shelf gas produces negligible sulfur oxide emissions when combusted. The Thermal Combustion Unit installed on the Sulfinol Vent substantially reduces the greenhouse profile of the plant and in this sense is a small "trade-off" of emissions. Previous modelling of a similar air pollutant (NOx) indicates this is probably not a problem in the airshed, however Woodside will do more modelling to confirm this prior to any application for a relaxation of the current licence limit for this particular stack.
A4.9	What is the basis of the comment on limited potential for SOx sources in the region?	The comment is based on expected SOx emissions from higher probability projects (mainly burning low sulfur gas from the NWS) in the DRD development list for the Pilbara region.
A4.10	WEL commitment to investigate Dark Smoke reduction technologies not reflected in PER. Reduction reliant on supply of steam from LNG/LEP. WEL advised to institute an active community consultation program on this as part of BPEL	The commitment to investigate Dark Smoke reduction technologies was made in the context of the OGP environmental licence. While the presence of steam on the plant may enable scope for reduction of Dark Smoke, the LNG Expansion Project will not involve the construction of any new flares. WEL will continue to comply with the OGP Licence Limits for the emission of Dark Smoke.
A4.11	What security to heritage sites can WEL provide during the construction period	Education concerning nature and regulations of Aboriginal heritage sites is always provided to new starters on site. This will continue in an enhanced manner with the construction workforce. Woodside will at all times comply with the conditions of its Section 18 approval under the Aboriginal Heritage Act and its Heritage Protocol negotiated with the local Aboriginal community and Native Title Claimants.
A4.12	There should be a community consultation update on heritage developments and other community issues during construction.	There will be a number of community consultations re the LNG Expansion project. Aboriginal heritage will be the subject of a number of community discussions due to the nature of the agreement between Woodside and the Native Title claimants
A4.13	Who will undertake quarantine inspections and how will compliance with AQIS guidelines be verified.	The Quarantine reports are issued by AQIS or delegated Commonwealth department. There is no need to verify these certificates.
A4.14	Proponent to have a disposal plan for Hydrotest water prior to any disposal	Woodside will prepare a Hydrotest Water Discharge Management Plan for approval by the DEP when the final constituents of the hydrotest water are known. The DEP will be notified as to the daily requirements for discharge under the approved plan. Woodside will carefully screen each hydrotest water additive to ensure a very low environmental toxicity and ensure discharge conditions result in minimum environmental impact.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
	The 'living -away-from-home' allowance paid to construction workers could cause an increase in the rental market	Living-Away-From Home Allowance (LAFHA) is not an environmental issue, it is an industrial award condition over which WEL has no control. However, Woodside's goal is to maximise the number of persons in managed accommodation, although the Company has no influence over a person's domicile. WEL has also advised the local community of its intention as much as possible and pressed government to release more land for accommodation purposes.
A5.1	No formal commitment required by WEL to be involved in the Pilbara Air Quality Study. DEP assumes inclusion of WEL based on past commitments	Woodside will continue to contribute resources to the Pilbara Airshed Study as appropriate.
A6.1	Because of the 10 km distance to Dampier, noise levels from the plant are unlikely to be of concern to residents or to exceed levels specified in the 1997 Noise regulations.	No Response required
A7.1	Jetty iso-risk contours and exclusion zones need to reflect jetty options	A map is attached to this document as Appendix A, correcting that supplied in the original PER
A7.2	Knock-on effects between trains, common mode failure and threats to domestic gas supply need to be evaluated in final QRA and plant layout design.	This issue is being and will continue to be reviewed and analysed throughout the design process. A number of common failure analyses on the trains and the common utilities will be performed during the Project Specification phase. These analyses will be available when the final QRA is carried out and also with respect to plant layout. Based on increased equipment redundancy, the reliability of the domestic gas supply will, if anything, be enhanced due to the increased capacity from offshore.
B1.1	Is WEL saying they do not wish to contribute all they should to the indirect costs which will be borne by the SoR and the people of Karratha/Dampier as a consequence of the influx of people...for the Project	The NWS Venture has previously contributed to Karratha Infrastructure in a period when the population was slightly larger than that planned during the LNG expansion construction phase. As a result existing infrastructure will be able to cope with increased population levels. In addition, Woodside meets all its obligations in the town, paying rates etc on all housing and contributing a substantial revenue source (from permanent and construction workforces) to the town's commercial life on an ongoing basis.
B1.2	How does the term "stakeholder" differ from "the public"?	The term 'stakeholder' embraces everyone with an interest in the project, and in addition to the community, also includes government and non-government organisations. The term is restricted to those who have an interest in the Project.

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
B1.3	WEL only estimate the temporary & permanent workforce. Has the multiplier effect been calculated and the estimated costs attributable to these extra people?	The multiplier of the NWS LNG Expansion Project is estimated in the order of 10%. The costs of these people have already been taken into account when calculating this multiplier.
B1.4	If an appropriate document [AHMP] is still being negotiated, why has a time limit of 4 weeks been set for commenting or questioning the plan [PER]?	The 4 week public review process for the PER was agreed between the State and Commonwealth Governments according to their respective EIA legislation. The EIA process was independent of the negotiations between Woodside and the Native Title Claimants
B1.5	Why is it assumed any modern aboriginal group has exclusive rights over rock art made several thousand years ago? Is this "art" not part of the wider World or National heritage? If so, administration should be assigned to the appropriate body.	In accordance with the Aboriginal Heritage Act and the Native Title Act 1993 (NTA) Aboriginal people have certain rights of consultation and in some cases negotiation regarding the use of their traditional lands, or for that matter 'claimed' traditional lands. Woodside has merely complied with the law in its dealings with the Aboriginal community. For more information, refer to the High Court's decision in Mabo v Queensland (1992) and subsequent Federal and High Court decisions relating to Aboriginal native title to answer the question regarding exclusivity. Jurisdiction of the matter (ie Aboriginal heritage management) has been conditionally assigned to the Aboriginal Heritage Management Committee (AHMC), which consists of Woodside representatives, native title claimant representatives, the Registrar of Aboriginal sites and a regional member of the Aboriginal Cultural Materials Commission (ACMC). The Minister for Aboriginal Affairs considers the AHMC to be a competent body, with the assistance of specialist advice where required, to manage Aboriginal Heritage sites within Project lands.
B1.6	The Aboriginal Heritage Management Plan [AHMP] provides the public with no basis to know what will be done with significant heritage materials or even assess the competence of the assessors. In this respect the PER does not perform its public duty? eg The submission suggests that the Hearson's Cove compound has been mismanaged	WEL proposes to organise a public release of information regarding the general plans of the AHMC that should answer the first part of this question. In relation to the Hearson Cove compound, the question should be referred to the WA Museum, who have always had the responsibility and expertise to manage the materials stored in the compound. The Aboriginal Heritage Protocol and Management Plan as implemented through the AHMC will resolve the issue of the proper curation and management of the archaeological and cultural materials stored in the compound.

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Ref No	**Comment**	**Response**
B1.7	Appoint a panel of 4 people who are "eminently qualified" and provide them with the resources to assess the Burrup and consider the best way to create a government sanctioned "heritage museum" [NB No role for the proponent in this recommendation]	No response required - this issue is for government to resolve
B1.8	Only 4 weeks was given to respond to the PER. There is no instituted formal process which meets all the requirements of consultation in its formal sense	Please see response to comment B1.4
C1.1	Location of Jetties in Fig 5.4 does not tally with locations in Figs 3.4 and 3.5.	The map will be corrected in the full Qualitative Risk Assessment (QRA).
C1.2	Ignition Probability reduced from 1 to 0.1 for fired furnaces will have to be addressed in the QRA to the satisfaction of EDG. The QRA should also include an inventory for each new release case associated with the new facilities	A full explanation for the probability of ignition being reduced for furnaces on the OGP will be provided in the final Project QRA.
C1.3	Underwater blasting must be done by a person who is a holder of a WA shotfirers permit with underwater experience	WEL agrees with this comment and will implement
C1.4	A Construction SMS is required prior to construction commencing.	WEL agrees with this comment and will implement
C1.5	A detailed QRA and updated safety case/SMS is required prior to commissioning.	WEL agrees with this comment and will implement
C1.6	Overall, the PER seems to provide a reasonable representation of the risks from the plant with additional LNG facilities	No response required
D1.1	Possible conflicts between Jetty option 1 and Gorgon facilities berth and shipping. Independent advice being sought.	A review of the technical feasibility and a cost benefit analysis has now being completed with the project proceeding with the short jetty option (option 2).

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Ref No	**Comment**	**Response**
D1.2	Short term lease (the 100m boundary strip). NWSV lease conditions should ensure land available for Gorgon developments at appropriate time and condition.	This issue is not an environmental approval issue and is currently being addressed in consultation with the Department of Resource Development.
D1.3	Short Term lease (2); This should be excluded from area designated as "Long Term Expansion.	This issue is not an environmental approval issue and is currently being addressed in consultation with the Department of Resource Development.
D1.4	Quarrying must ensure future development of Gorgon LNG trains is not compromised. The southern Quarry area in the 2TL PER sits underneath the LNG Tr1 &2 of Gorgon.	This issue is not an environmental approval issue and is currently being addressed in consultation with the Department of Resource Development.
D1.5	Proposed 2nd jetty berth in risk contour map does not reflect actual position.	A corrected map is supplied as Appendix A to this document
D1.6	The 700m exclusion zone detail will need to be provided and assessed by Gorgon as to impacts.	A corrected map showing the revised exclusion zone is supplied as Appendix A to this document
E1.1	It is not clear whether Jetty option 1 or 2 is less damaging to the environment.	A review of the technical feasibility and a cost benefit analysis has now been completed with the project proceeding with the short jetty option (option 2).
E1.2	Proponent should hold discussions with local divers and rec. fishing Committee to determine which jetty and exclusion zone option impinges the least on these activities.	WEL, through its extensive stakeholder consultation has already gathered considerable information on the impact of both jetty options. With respect to both options the jetty berth will be inside the existing 700m exclusion zones which preclude diving and recreational fishing. The exclusion zone is set by the DPA based on risk data provided by WEL, which would be expected to remain unchanged at 700m. Also for technical, environmental and cost reasons option 2 has now been selected.
E1.3	Effect of other developments needs to be considered (Environment and usage study) for cumulative impacts as soon as possible.	Environmental Impact legislation only requires evaluation of the proponents proposal on the existing environment. The WA Government has the most complete information on emissions and discharges to the environment by other proponents and is therefore in the best position to assess cumulative impact. In addition, the current NWS Marine Study being performed by the DEP will assist in providing information on cumulative impact
E1.4	The present CHEMMS monitoring program is adequate to assess marine impacts around the OTP	No response required

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
F1.1	Council oppose the encroachment of the 10(-6) risk contour on areas outside the WEL lease and public exclusion zone.	While the 10(-6) risk contour does move outside the Woodside lease boundary for a very short distance, the LNG expansion project meets all DEP criteria regarding risk to external parties (ie EPA Guidance for the Assessment of Environmental Factors No 2: Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant, 1998):
F1.2	Shire does not have the financial capacity to service the needs associated with the construction of the Project without assistance. It would not be acceptable for council to bear the financial burden given that there are no real income increases for the Shire associated with the Project	This issue requires a response by the WA Government and cannot be resolved by the proponent
G1.1	Woodside should commit to obtain certification to ISO 14000 from a JASANZ accredited organisation. This would assure the public of the adequacy of auditing of environmental activities	WEL already possesses a Corporate Environmental Management System as part of its overall HSE management System. The EMS is aligned to ISO 14000, which is a requirement of the "Best Practise" licensing system of the WA DEP. In addition, an audit of the proponent's EMS and reporting to the DEP on the outcomes of the audit are specified in the OGP licence. Finally, certification of the OGP is an operational matter and not part of the environmental approval process.
G1.2	Woodside devise control measures to prevent petroglyph desecration by the construction workforce.	Education concerning nature and regulations of aboriginal heritage sites is always provided to new starters on site. This will continue in an enhanced manner with the construction workforce. Woodside will at all times comply with the conditions of its Section 18 approval under the Aboriginal Heritage Act and its Heritage Protocol negotiated with the local Aboriginal community and Native Title Claimants, however WEL has no authority over the construction workforce or general public outside its lease areas.
G1.1	Not in favour of the project as overall energy policy [for the State] is not heading in the direction of lowest impact. The energy (alternative sources) policy in this state is deficient.	No response required as this is a matter for the WA government and not within the proponents ability to influence.

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G1.2	Did not believe assurances about the effects of microbial and chemical contamination of coastal waters [from waste water discharges] as there is a large range in individual sensitivities and the wider view is not taken.	The NWS Marine Study will ensure that the wider view of the existing marine baseline and cumulative impact is available to project proponents and government
H1.1	There is a conflict between Page 7.10 of the PER and Statements at the Karratha public meeting as to the number of aboriginal sites which will need to be disturbed	The PER is correct in its statement of the number of sites
H1.2	Is the NWS committed to better ballast water management for its ships?	The Project LNG tankers comply with AQIS guidelines. Further methods of reducing the possibility of Foreign Entrained Organism introduction, will be considered as the ships are designed and experience from BHP and other operators becomes available. The NWS Project is committed to taking all practicable measures to reduce the possibility of ballast water derived introductions from Project shipping.
H1.3	Is the NWS JV committed to future conversion of existing gas turbines to allow for steam recovery?	The Project has made a commitment to maximise the use of waste heat recovery in LNG expansion facilities. Part of the proposal in the PER is that the existing power generation gas turbines with be retrofitted with waste heat recovery for raising steam, consistent with Plant energy requirements.
I1.1	Unsupported 0.00001 risk criteria in S6.1.	The risk criteria source for the 10(-5) contour is set out in the EPA Bulletin 2 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant. July 1998.
I1.1	Only after reaching a satisfactory Safety Integrity Level (SIL) for the existing plant and considering the impact of the additional processing trains could a probability of failure be established.	WEL has performed an analysis of risk as documented in the OGP Safety case and has an established level of risk for the existing OGP, which meets statutory guidelines, and ALARP. Through Safety Management Systems Woodside ensures that we maintain this level of risk. The additional facilities have been risk assessed on the same basis as the existing facilities to ensure they meet the same criteria for risk and "As-Low-As-Reasonably Practical" (ALARP).
I1.2	Domino effect in the new and existing trains IEC Seveso II directive (1996) (96/082EEC)	Woodside has considered domino effects and found its impact on the overall risk of the existing plant was negligible and hence they have not been included in the LNG expansion risk assessment. However, domino effects have a much greater effect on risk of supply (a non-environmental factor) and it is expected that it would be given detailed consideration during the design phase of the Project. This consideration will include input from the recent Longford gas explosion in Victoria.

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I1.3	Commit to future recommendations from appropriate authorities being reference in amended Safety cases	Woodside has produced a safety case for the existing plant well in advance of the legislative requirement to do so and this indicates its willingness to implement recommendations from appropriate authorities. In the case of LNG expansion, recommendations from the various Longford inquiries will be considered in future safety cases and design requirements of the new facilities if appropriate.
J1.1	Effect of blasting Star Rock on natural silt movement along coast	The blasting of Star Rock will largely involve the removal of calcarenite from below the sea bed. There will be a small quantity of granophyre removed from the rock itself, however this is close to the seabed, hence unlikely to provide any modification to the longshore movement of sediment in the area.
J1.2	What are the long term effects to marine habitats further along the coast of small increases in sedimentation [from shipping increases] combined with changes in distribution [from star rock blasting]	From 1991 to 1994 Woodside initiated a detailed program to investigate the impact of dispersed sediment plumes from shipping on inshore corals in Mermaid Sound. During this program the species composition and status of communities was measured at nine sites with the result that no clear correlation could be established with respect to distance from the LNG jetty or sedimentation load. With the increase in shipping, it is possible that minor changes in species composition could appear. However most of the species in the central Archipelago are sediment tolerant species as the Sound has naturally high sediment loadings. The small increment from increased shipping over most of the Archipelago is unlikely to affect most coral communities. In addition, Woodside will prepare a Dredging and Blasting Management Plan prior to commencing work. Details of this plan are provided in response to Question A 2.8.
J1.3	What impact of dust generation during quarrying etc on adjoining land owners?	There are no adjoining land-owners close to the OGP.
J 1.4	The weed management strategy should be upgraded and adhered to (as weeds opportunistic and spread by wind).	Woodside will institute a weed management strategy to control weed introductions to project areas that are being disturbed and continue to monitor and where possible, control, weed introductions on all project areas
J1.5	At what levels of pollutants (monitored in CHEMMS) are they no longer acceptable and what measures are in place to reduce rather than just monitoring them.	The monitoring in CHEMMS is effects based. That is, as well as measuring the concentrations of pollutants discharged from the OGP, CHEMMS looks at concentrations in the ambient water and selected organisms to check for bioaccumulation. In addition, corals and intertidal (rocky shore) communities are monitored for species composition and abundance. Currently no change has been found in which effects can be attributed to the LNG facilities. CHEMMS does look at ambient concentrations in the light of established health and ambient standards. If values approach any of these quality standards, action is taken to define the cause and bring the parameter back into acceptable bounds.

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Ref No	**Comment**	**Response**
K1.1	Uncertainty about economic benefits of the Project. While there would be short term impacts, over the long term, while the resource was in place it would be appreciating in value. The value could be realised in the future, when more environmentally friendly methods of exploitation had been developed.	This is not necessarily true. There is an alternate possibility that resources might have little or no value in the future if there is no market or developing the resource is uneconomic. It is in the interest of the State and nation to develop this resource in the short term in an environmentally responsible manner. There is no evidence that the method of development proposed is not environmentally acceptable nor that development later would realise more value.
K1.2	Option 1 removes 6.1 km3 for a new channel; option 2 removes 1 km3 from star rock. Removal of this amount of material is of concern to fisherman. Star Rock is a locally important FAD. Rock and dredge spoil must be used to create additional FAD ie no net loss of recreational amenity	Firstly, the amount of dredged material quoted in the response is incorrect. As quoted in the PER, option 1 will remove 6 million cubic metres and option 2, 1-2 million cubic metres. Star Rock does not have high levels of usage as a fishing reef due to its proximity to the current LNG terminal exclusion zone. It is sometimes used during tournaments as a secondary location for obtaining Trevally and other pelagic species. Woodside will consider the proposal by RecFishWest of relocating Dredge spoil as an Fish Attraction Device (FAD) and discuss with the regulating authorities & local fishermen as well as seeking to ensure the idea is practicable for the Project logistics.
K1.3	In combination with RecFishWest, WEL should update the previous recreational fishing guides.	Woodside will consider including on its list of public information activities, a reprint/update of the Guides to Fishing in the Dampier Archipelago, subject to budget approvals.
K1.4	WEL needs to clearly commit to undertake remedial or restitution for damages caused should any of the activities be shown to have a negative *long term* impact on environmental, recreational or amenity values.	WEL Environmental Policy states that all its activities will be "planned and performed to ensure that adverse effects on the environment are avoided or kept to an acceptable level, while meeting all statutory requirements". As this is corporate policy, it will be implemented and there should be no need for WEL to commit to remedial or restorative action on any of the stated values. Legal compliance will be the minimum standard for all activities.
K1.5	WEL should work with local residents and RecFishWest to ensure there are no secondary negative impacts of the development (ie effects on boat ramps or catch rates)	WEL is pleased to work with RecFishWest and the local fishing community to understand what the secondary impacts of the Project are and, if proven, to work towards the amelioration or elimination of the impact.
K1.6	RECFISHWEST believe that, provided certain conditions are met, the development is supported	No response required

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Ref No	**Comment**	**Response**
L1.1	What will be the impact of Star Rock blasting on Dampier township and what community information measures will be adopted	Star Rock is 10 km from Dampier Township. It is unlikely that blasting activities will be noticed within Dampier Township and no impact is expected. In consultation with the DPA, bulletins will be issued to users of the area, both land and sea, about the information, restrictions and timings.
L1.2	Procedures to stop drift of blasting derived plastic coatings	WEL has committed to this in item 2.2 of the PER summary table
L1.3	Construction of Karratha Bypass prior to commencement of project is essential to improve access and vehicle safety in Karratha township.	No response required, as this is a government matter. [Minister Barnett subsequently has announced in January 1999 that work would commence on the bypass during 1999].
L1.4	Vehicle turning lanes required onto Millstream Rd to improve vehicle safety during construction shift changes	No response required as this is a government matter
L1.5	The Construction workforce is strongly encouraged to use bus transport. This will require dedicated parking in town.	The workforce will be strongly encouraged to use the buses provided by the Project. The matter of parking is a government or Shire of Roebourne function.
L1.6	Prior to closure of Holden Point Beach access, a new road should be constructed to Conzinc Bay to maintain public access to beaches	No response required, as this is a government matter. It is believed such a road is contained in the CALM management Plan for the Burrup.
L1.7	Will access to Withnell Bay (and boat ramp) be stopped during construction?	It is not envisaged at this stage that access to Withnell Bay will be stopped.
L1.8	SoR encouraged to identify areas of its internal operators that will require expansion to enable services to be delivered in a timely manner and to an acceptable level as required by both the Company and the general public.	No response required as this is a government matter
M1.1	PER satisfactorily addresses the necessary environmental issues noted by this Department. The implementation of this Project is supported by DRD	No response needed
N1.1	No comments on the PER	No response needed

PROPONENTS RESPONSE TO SUBMISSIONS RECEIVED - LNG EXPANSION PER		
Ref No	**Comment**	**Response**
O1.1	No comments on the PER	No response needed
P1.1	No comments on the PER	No response needed
Q1.1	WEL has satisfactorily addressed Aboriginal heritage issues and is continuing to do so with the establishment of the Aboriginal Heritage Management Committee and the Draft Site Management Plan	No response needed
R1.1	Limits on turbidity and undesirable changes in coral communities	From 1991 to 1994 Woodside initiated a detailed program to investigate the impact dispersed sediment plumes from shipping were having on inshore corals in Mermaid Sound. During this program the species composition and status of communities was measured at nine sites with the result that no clear correlation could be established with respect to distance from the LNG jetty or sedimentation load. With the increase in shipping, it is possible that minor changes in species composition could appear. However most of the species in the central Archipelago are sediment tolerant species as the Sound has naturally high sediment loadings. The small increment from increased shipping over most of the Archipelago is unlikely to affect most coral communities.
S1.2	Confirm that Project ships do not using TBT anti-fouling.	Please see comment A2.5
S1.3	Explanation of AQIS Notice 92/2 with respect to the ballasting of project ships	The Project LNG tankers comply with AQIS guidelines. Further methods of reducing the possibility of Foreign Entrained Organism introduction, such as that stated in the question, will be considered as the ships are designed and experience from BHP and other operators becomes available. The NWS Project is committed to taking all practicable measures to reduce the possibility of ballast water derived introductions from Project shipping. However the project notes that it does not make up the bulk of shipping traffic in the Dampier Archipelago.
S1.4	Cost-benefit analysis for the jetty options	One of the main tools used in deciding the favoured jetty option is a cost benefit analysis. The reason two options were indicated in the PER is that WEL was lacking technical data to prove up technical viability of both options. Since the PER was issued the technical issues have being clarified and a cost benefit analysis has being carried out and Option 2 will be progressed.

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Ref No	**Comment**	**Response**
T1.1	Census of plants (*Terminalia supranitifolia and Brachychiton acuminatus)* in the expansion area could be undertaken. Possible collaborative research on the Burrup.	Woodside will contribute to appropriate joint industry/government vegetation surveys on the Burrup Peninsula to increase knowledge of vegetation communities and distribution. The survey of these species could be undertaken as part of such a study.
T1.2	Impact of SO2 on aquatic systems (ie freshwater pools and crustacean fauna needs to be addressed.	There will be low emission rates of sulphur compounds from the new LNG facilities. This combined with the intense and ephemeral nature of rainfall on the Burrup indicates that the loading of runoff with sulphur will be negligible and too dilute to damage calcarenite formations in the drainage systems. It is unlikely that the pH of runoff would be depressed.
T1.3	Rehabilitation concept plan and rehabilitation performance monitoring plan need to be reviewed	Rehabilitation of areas will eventually be performed to current Government standards. It is not envisaged at this stage that rehabilitation of areas will occur for some time. Future development opportunities indicate that areas such as laydown will be stabilised until required for further development.
T1.4	Issues of light (intensity and spectral characteristics) effects on turtle nesting should be accommodated in lighting for the Project.	The Onshore Treatment Plant is a significant light source in the area and because of its obscured position from seaward, the expansion would only be a small increment to this. Because the Onshore Treatment Plant is a considerable distance (8-10 km) from the nearest turtle nesting beaches and diffuse night lighting has not been proven to affect turtle nesting, the use of "turtle friendly" lighting by the project will not be given any special consideration.