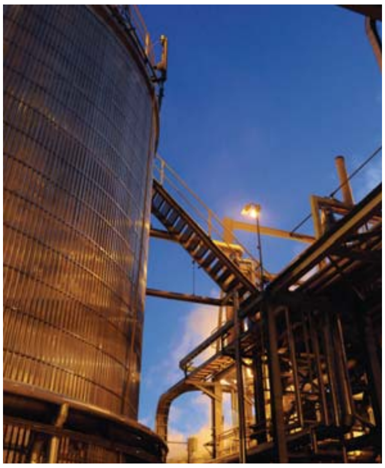

Proposed Ammonium Nitrate Facility
Heron Road, Kooragang Island

Environmental Impact Statement

Volume 1 Main Report

September 2012

Prepared for Incitec Pivot Limited
28 Freshwater Place, Southbank, Victoria, 3006
www.incitecpivot.com.au

Prepared by URS Australia Pty Ltd
407 Pacific Highway, Artarmon, NSW, 2064
www.urscorp.com

Incitec Pivot Limited

Statement of Validity

Submission of Environmental Impact Statement

Prepared as 'State Significant Development' under Part 4 of the *Environmental Planning and Assessment Act 1979* and under the *State and Regional Development State Environment Planning Policy* (SRDSEPP).

Environmental Impact Statement prepared by:

Role	**Project Director**	**Project Manager**
Name	Michael Chilcott	William Miles
Position	Principal - Environment	Senior Associate Planner
Qualifications	BSc; Dip. Nat. Res; MSc; CEnvP MEIANZ.	BSc (Hons); MSc; MEIANZ
Address:	URS Australia Pty Ltd Level 4 407 Pacific Highway ARTARMON NSW 2064	

In respect of

Applicant and Land Details

Applicant	Incitec Pivot Limited (IPL) Level 8, 28 Freshwater Place, Southbank, Victoria, 3006
Subject Site	IPL is proposing to construct an ammonium nitrate manufacturing facility with a capacity of 350,000 tonnes per annum. The facility would be located on the existing IPL Site in on Kooragang Island.
Project Summary	The Project incorporates the following: • Storage of up to 30,000 t of liquid anhydrous ammonia; • 280,000 tpa tpd Nitric Acid Plant (100%); • Bulk NA (60%) storage of 3,000 t; • 350,000 tpa Ammonium Nitrate Plant (100%); • Bulk ANSOL (88%) storage of 1,650 t; • Bulk TGAN Storage of 5,000 t; • Bagging of TGAN into one tonne bags and storage of 6,000 t; • Associated utilities and services; and • Associated infrastructure. Two additional pipelines would connect the facility to a Newcastle Port Corporation (NPC) bulk liquids berth to allow importation of ammonia. The pipelines would follow an existing redundant conveyor route. A wastewater pipeline would also cross Heron Road at this point before following the route of the proposed ammonia import pipeline and discharging below K2 berth. When operational, the Project would supply TGAN to mining the mining industry in the Hunter Valley and in wider NSW as well as ANSOL to the IPL facility at Warkworth in the Hunter Valley.
Lot and DP	Lot 3 on DP 1117013, Lot 7 on DP 262783, Lot 4 on DP 573972, Lot 361 on DP 1104196, Lot 28 on DP 775776 and Lot 6 on DP1104199

Environmental Impact Statement

An Environmental Impact Statement (EIS) is attached. The EIS assesses the environmental impacts of this Project and includes the matters referred to in Director-General's Requirements provided to the Proponent on the 1st December 2011 under Section 89G of the *Environmental Planning and Assessment Act 1979*.

Declaration

I certify that I have prepared the contents of the EIS in accordance with the requirements of the Environmental Planning and Assessment Act 1979 and Regulation and that, to the best of my knowledge, the information contained in this report is not false or misleading.

Signature: ______________________ **Date:** September 2012

Name: WILLIAM MILES

Tables

Figures

Appendices

Limitations

URS Australia Pty Ltd (URS) has prepared this Environmental Impact Statement (EIS) in accordance with the usual care and thoroughness and based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this EIS.

This EIS has been produced in accordance with the stipulations in the *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000*.

Where this EIS indicates that information has been provided to URS by third parties, URS has made no independent verification of this information except as expressly stated in the EIS. URS assumes no liability for any inaccuracies in or omissions to that information.

This EIS was prepared between October 2011 and September 2012 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This EIS should be read in full. No responsibility is accepted for use of any part of this EIS in any other context or for any other purpose.

Notes on Text

Note 1

As a determination of the Project will only be made after the Environmental Impact Statement has been on public display and submissions considered, the future consolidated tense is used throughout this Environmental Impact Statement when describing the Project, alternatives and assessing impacts. "Would" is, therefore, used throughout the text in preference to "will".

If all approvals are given for the Project to proceed, where applicable, all "would" references should be interpreted as "will", subject to final conditions of consent.

Abbreviations

AADT	Average Annual Daily Traffic
ABS	Australian Bureau of Statistics
ACM	Asbestos Containing Materials
AHC Act	Australian Heritage Council Act 2003
AHD	Australian Height Datum
AHMIS	Aboriginal Heritage Information Management System
AMBS	Australian Museum Business Services
AN	Ammonium Nitrate
ANP	Ammonium Nitrate Prill
ANSOL	Ammonium Nitrate Solution
ANZECC	Australian and New Zealand Environment Conservation Council
AOR	Ammonia Oxidation Reactor
AOS	Threatened Species Assessment Guidelines, the Assessment of Significance
AQIA	Air Quality Impact Assessment
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soils Management Advisory Committee
B(a)P	Benzo(a)pyrene
BAT	Best Available Technology
bgs	below ground surface
BLB	Bulk Liquids Berth
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CANRI	NSW Community Access to Natural Resources Information
CBD	Central Business District
CCO	Chemical Control Order
CEF	Clean Energy Future
CEMP	Construction Environmental Management Plan
CEO	Chief Executive Officer
CHL	Commonwealth Heritage List
CLG	Community Liaison Group
CMA	Catchment Management Authority
CMP	Contamination Management Plan
CO_2	carbon dioxide
CO2-e	carbon dioxide equivalent
COAG	Council of Australian Governments
COPC	Contaminant of Potential Concern
CP Act	*Coastal Protection Act 1979* (NSW)
CPCFM	Correct Planning and Consultation for Mayfield Group
CTB	Custom Transportable Buildings Pty Ltd
Cth	Commonwealth of Australia
CWD	Coarse Woody Debris
DA	Development Application

DCCEE	Department of Climate Change and Energy Efficiency
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment Climate Change and Water (NSW)
DG(RRT)	Dangerous Goods (Road & Rail Transport) Act 2008 (NSW)
DGRs	Director General's Requirements
DO	Dissolved Oxygen
DoP	NSW Department of Planning (now DP&I)
DP&I	Department of Planning and Infrastructure (NSW)
DPI	Department of Primary Industries (NSW)
DQOs	Data Quality Objectives
DSEWPaC	Department of Sustainability, Environment, Water, Populations and Communities (Cth)
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EEO	Energy Efficiency Opportunities (Cth)
EHC	Environmentally Hazardous Chemicals Act 1985 (NSW)
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMR	Environmental Management Representative
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPA	Environment Protection Agency (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPHC, 2009	National Waste Policy: Less Waste, More Resources (Cth)
EPIs	Environmental Planning Instruments
EPL	Environmental Protection Licence
ERA	Environmental Risk Analysis
ESA	Environmental Site Assessment
ESD	Ecologically Sustainable Development
EU	European Union
Explosive Regulations	*Explosive Regulations 2005* (NSW)
Explosives Act	*Explosives Act 2003* (NSW)
FIBC	Flexible Intermediate Bulk Containers
FM Act	*Fisheries Management Act 1994* (NSW)
FMECA	Failure Modes and Effects Criticality Analysis
GBD	Green Bean Design Pty Ltd
GGAS	Greenhouse Gas Reduction Scheme (NSW)
GHGs	Greenhouse Gases
GIS	Geographic Information System
GWMP	Groundwater Management Plan
GWP	Global Warming Potential
ha	hectares
HAZID	hazard identification
HAZOP	Hazard and Operability

HBTs	hollow-bearing trees
HCRCMA	Hunter Central-Rivers Catchment Management Authority
Heritage Act	*Heritage Act 1977* (NSW)
HIA	Heritage Impact Assessment
HIL	Health based investigation level
HIPAP	NSW Department of Planning's Hazardous Industry Planning Advisory Paper
HIWD	Hazard Identification Word Diagram
HP	High Pressure
IBRA	Interim Biogeographic Regionalisation of Australia
ICNG	Interim Construction Noise Guidelines 2009(NSW)
ICOMOS	International Council of Monuments and Sites
INP	Industrial Noise Policy1999 (NSW)
IPCC	Intergovernmental Panel on Climate Change
IPL	Incitec Pivot Limited
JBS	JBS Environmental Pty Ltd
K2	Kooragang no.2 Berth
K3	Kooragang no. 3 Berth
KBF	Kooragang Bulk Facilities Pty Ltd
kg	kilogram
KI	Kooragang Island
KIWS	Kooragang Industrial Water Scheme
km	kilometres
KTP	Key Threatening Process
ktpa	Kilotonnes per annum
KWRP	Kooragang Wetland Rehabilitation Project
L	Long/Low
LEPs	Local environmental plans
LGA	Local Government Area
LOR	Limit of Reporting
LOS	Level of Service
LP	Low Pressure
LR	Lloyd's Register Rail Ltd
LSIR	Location-Specific Individual Risk
LT	Long term
m	metres
m^3	cubic meters
MAEs	Major Accident Events
mAHD	Metres Australian Height Datum
MNES	Matter of National Environmental Significance
MS Act	*Maritime Services Act 1935* (NSW)
MT	Moderate term
Mt	Mega-tonne
MW	megawatts
MW-h	megawatt-hours

N_2O	Nitrous Oxide
NA	Nitric Acid
NCC	Newcastle City Council
NEPC	National Environmental Protection Council (Cth)
NEPMs	National Environment Protection Measures (Cth)
NGER	*National Greenhouse and Energy Reporting Act 2007* (Cth)
NH_3	Ammonia
NHL	National Heritage List (NSW)
NHMRC	National Health and Medical Research Council (Cth)
NO	Nitric oxide
NO_2	Nitrogen Dioxide
NOW	NSW Office of Water
NO_x	Nitrogen oxides
NPC	Newcastle Port Corporation
NPI	National Pollutant Inventory (Cth)
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSCR	Non Selective Catalytic Reduction
NSW	New South Wales
NSW NPWS	NSW National Parks and Wildlife Services
NSW MC	New South Wales Minerals Council
NV Act	*Native Vegetation Act, 2003* (NSW)
NW Act	*Noxious Weeds Act, 1993* (NSW)
OCPs	Organochlorine pesticides
OEH	NSW Office of Environment and Heritage
OEMP	Operational Environmental Management Plan
P&IDs	Piping & Instrumentation Diagrams
PAC	NSW Planning Assessment Commission
PAD	Potential Archaeological Deposit
PAHs	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulphate Soils
PCBs	Polychlorinated Biphenyls
PDC	Primary Distribution Centre
PEA	Preliminary Environmental Assessment
PELA Act	*Protection of the Environment Legislation Amendment Act 2011*(NSW)
PFDs	Process Flow Diagrams
PFM	Planning Focus Meeting
PHA	Preliminary Hazard Analysis
PID	Photo ionisation detector
PIRMPs	Pollution Incident Response Management Plans
PM10	Particulate Matter less than 10 micrometers in size
PM2.5	Particulate Matter less than 2.5 micrometers in size
PMF	Probable Maximum Flood
PMST	Protected Matters Search Tool
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)

POEO Waste Regulation	*Protection of the Environment Operations (Waste) Regulation 2005* (NSW)
ppbv	parts per billion by volume
ppmv	parts per million by volume
PWCL	Port Waratah Coal Loader
QA/QC	Quality Assurance/Quality Control
QRA	Quantitative Risk Assessment
Ramsar Wetlands	Wetlands of International Significance that are recognised under the Ramsar Convention
RMS	Roads and Maritime Services (NSW)
RNE	Register of the National Estate (Cth)
RPD	Relative Percentage Difference
SCAG	Stockton Community Action Group
SCR	Selective Catalytic Reduction
SEPP 14	State Environmental Planning Policy No 14 – Coastal Wetlands (NSW)
SEPP 33	State Environmental Planning Policy No 33 – Hazardous or Offensive Development (NSW)
SEPP 55	State Environmental Planning Policy No 55 - Remediation of Land (NSW)
SEPP 71	State Environmental Planning Policy No 71 - Coastal Protection (NSW)
SEPP Infrastructure	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
SEPP Major Development	State Environmental Planning Policy (Major Development) 2005 (NSW)
SEPP S&RD	State Environmental Planning Policy (State and Regional Development) 2011 (NSW)
SEPPs	State Environmental Planning Policies
SHR	State Heritage Register (NSW)
SIC	Significant Impact Criteria
SIS	Species Impact Statement
SoC	Statement of Commitments
SO_x	Sulphur Oxides
SPA	State Property Authority
SPMTs	Self Propelled Modular Transporters
SPOCAS	Suspension Peroxide Oxidation Combined Activity & Sulfur
SSD	State Significant Development
SSDS	Security Sensitive Dangerous Substances
ST	Short term
SVOC	Semi-Volatile Organic Compound
TGAN	Technical Grade Ammonium Nitrate (UN No 1942)
T	Temporary
t	Tonne
TAA	Titratable actual acidity (of soil)
TEC	Threatened Ecological Communities
TIA	Transport Impact Assessment
TMP	Transport Management Plan
TPA	Titratable potential acidity (of soil)
tpa	tonnes of product per annum

tpd	tonnes per day
TPH	Total Petroleum Hydrocarbons
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
URS	URS Australia Pty Ltd
US	United States of America
VIA	Visual Impact Assessment
VOC	Volatile Organic Compound
VRA	Voluntary Remediation Agreement
WARR Act	*Waste Avoidance and Resource Recovery Act 2001* (NSW)
Water Act	*Water Act 1912* (NSW)
WM Act	*Water Management Act 2000* (NSW)
WMP	Waste Management Plan
WoNS	Weeds of National Significance
WoNS	Weeds of National Significance
WRL	Water Research Laboratory, University of NSW
WSP	Water Sharing Plan

Glossary

“A” Frequency Weighting	The method of comparing an electrical signal with a noise measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. The symbol to show this parameter has been included in the measurement is “A” (e.g. L_{Aeq}).
“C” Frequency Weighting	The response of the human ear varies with the sound level. At higher levels, 100 dB and above, the ear's response is flatter, as shown in the C-Weighted Response below. Although the A-Weighted response is used for most applications, C-Weighting is also available on many sound level meters. C-Weighting is usually used for Peak measurements and also in some industrial and entertainment noise measurement, where the transmission of low frequency noise can be a problem. C-weighted measurements are expressed as dBC or dB(C).
aboriginal archaeological site (Aboriginal site)	A place where physical remains or modification of the natural environment indicate past and ‘traditional’ activities by Aboriginal people. Site types include artefact scatters, isolated artefacts, burials, shell middens, scarred trees, quarries and contact sites.
acid sulphate soils (ASS)	Soils containing pyrite which produces sulphuric acid when exposed to oxygen. Main cause of acid generation within the soil mantle. Commonly found less than five metres above sea level, particularly in low-lying coastal areas such as mangroves, salt marshes, floodplains, swamps, wetlands, estuaries, and brackish or tidal lakes.
air pollutant	A substance in ambient atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment.
alluvial deposits	Soil or sediment deposited by a river or other running water. Typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel.
ambient noise	The all-encompassing sound at a site comprising all sources such as industry, traffic, domestic, and natural noises. This is represented as the L_{eq} noise level in environmental noise assessment. (See also L_{Aeq})
amenity	An agreeable feature, facility or service which makes for a comfortable and pleasant life.
Ammonium Nitrate	Odourless material, used as an oxidising agent in mining operations and as a fertiliser
arboreal mammals	Mammals that lives primarily in trees.
archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Australian Height Datum	The datum that sets mean sea level as zero in elevation
Background Noise levels	Background noise is the term used to describe the level of noise measured in the absence of the noise under investigation. It is measured statistically as the A-weighted noise level exceeded for ninety per cent of a sample period. This is represented as the L_{A90} noise level. The measurement sample time may be indicated in the form $L_{A90,t}$ where t is the measurement sample time i.e. $L_{A90,15\ min.}$

background scatter	Aboriginal artefacts that cannot be usefully related to a place or focus of past activity.
basin	A river basin is an extent or an area of land where surface water from rain converges to a single point, usually the exit of the basin, where the waters join another waterbody, such as a river, lake, estuary or ocean. While river catchment and basin can be viewed as different terms for the same thing 'basin' refers to the local catchment area draining into a particular river system, while 'catchment' refers to a wider area.
biodiversity	Biodiversity is defined as encompassing biological variety at genetic, species and ecosystem scales (DASETT 1992). The maintenance of biodiversity, at all levels, is acknowledged internationally as a high conservation priority, and is protected by the International Convention on Biological Diversity 1992.
bioregion	An ecologically and geographically defined area. They cover relatively large areas of land or water, and contain characteristic, geographically distinct assemblages of natural communities and species distinct from other bioregions.
blasting	The controlled use of explosives to excavate or remove rock
Bleed	Intentional drainage of a certain amount of water to decrease the build up of salts.
Blow-down	The process involving loss of water from the towers to atmosphere by evaporation and a bleed
Bora Ground site	Indigenous ceremonial sites
Bunding	An area within a structure designed to prevent breaches or inundation of various types. E.g. chemicals, waste and dangerous goods must be contained within bunding.
catchment area	The area determined by topographic features within which rainfall will contribute to runoff at a particular point.
catchment disturbance index	A part of the Australian ‘Assessment of River Condition (ARC)’
causeway	A road or track that is raised above unstable ground e.g. water, sand
channel	River or irrigation channel, includes bed and bank.
contaminated plume	A contaminated volume of a substance that moves from it’s source to areas that are away from it’s source
Cumulative effects	The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.
curtilage	The enclosed area of land around a building
Dangerous Goods	These are articles or substances that pose risk to people, property or the environment due to their physical or chemical properties. They are normally classified with reference to their immediate risk.
dB (Decibel)	A unit of sound level measurement that uses a logarithmic scale.
Dewatering	The process of removing groundwater to lower the water table below the lowest level of excavation.
dispersibility	A characteristic of soils relating to their structural breakdown in water to individual particles.

drainage line	A passage along which water concentrates and flows towards a stream, drainage plain or swamp intermittently during or following rain.
ecological community	A combination of plants that are dependent on their environment and influence one another and modify their own environment. They form together, with their common habitat and other associated organisms, an ecosystem, which is also related to neighbouring ecosystems and to the macroclimate of the region.
Ecologically Sustainable Development (ESD)	Using, conserving and enhancing the community's natural resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future does not decrease.
ecosystem	A system that includes all living organisms (biotic factors) in an area as well as its physical environment (abiotic factors) functioning together as a unit.
emission	A discharge of a substance into the environment.
Emissions Trading	Process in which greenhouse gas reductions are traded.
Emulsification	Breakdown of large particles into smaller particles
endangered ecological communities	A community listed under Schedule 1, Part 3 of the NSW Threatened Species Conservation Act 1995.
endangered species	Those plants and animal species likely to become extinct unless action is taken to remove or control the factors that threaten their survival.
Endemic species	Species that are unique to an area and are not found in any other areas.
Energy Efficiency Opportunities (EEO)	Government program which requires large businesses to report publicly on cost effective energy saving opportunities
environment	The physical, biological, cultural, economic and social characteristics of an area, region or site.
environmental constraints	Limitations on a project by components of the environment.
Environmental Impact Statement	The orderly and systematic evaluation of a proposal, including alternatives and objectives, and its effects on the environment, including the mitigation and management of these effects.
Environmental Management	That part of the overall management system which includes organisational structure, planning activities, responsibilities, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policy. (Refer to related term Environmental Management System).
Environmental Management Plan	The control, training and monitoring measures to be implemented during the design, construction and operation phases of a project in order to avoid, minimise or ameliorate potentially adverse impacts identified during environmental (being socio-economic, cultural, physical, biological) assessments. Prepared within the framework of Defence policies, objectives, strategies and actions.
Environmental Planning Instruments	Pieces of legislation or policy which guide planning decisions
Environmental Risk Analysis (ERA)	Provides an analysis of the environmental risks that have been identified and outlined as part of this EIS
Environmental Site Assessment	Assessing a site for the presence of contaminants

ephemeral creek	A creek that only flows after rainfall
erodibility	The tendency of a soil, earth or rock to erode.
erosion potential	The susceptibility of a parcel of land to the prevailing agents of erosion. It is dependant on a combination of climate, landform, soil, landuse and land management factors.
Ethylbenzene	A hydrocarbon
exothermic reactions	Chemical reaction that releases energy in the form of light or heat
Extraneous Noise	Noise resulting from activities that are not typical of the area. Untypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Failure Modes and Effects Criticality Analysis	Is an approach for identifying possible failures in design, manufacturing or assembling process, or product or service.
fauna	Animals.
feasibility study	A preliminary technical and economic study to assess the viability of a project from environmental, economic and social perspectives.
flora	Plants.
Free Field	An environment in which a sound wave may propagate in all directions without obstructions or reflections. Free field noise measurements are carried out outdoors at least 3.5 m from any acoustic reflecting structures other than the ground.
Frequency	Frequency is synonymous to pitch and is measured in units of Hz.
Frequency Spectrum	In environmental noise investigations, it is often found that the single-number indices, such as LAeq, do not fully represent the characteristics of the noise. If the source generates noise with distinct frequency components, then it is useful to measure the frequency content in octave or one-third octave frequency bands. For calculating noise levels, octave spectra are often used to account for the frequency characteristics of propagation.
Fumigation	
Geographic Information System (GIS)	A system which uses software and hardware to capture, analyse and display geographical features of an area
geology	The study of the history of earth, the structures that make up the earth, and the processes surrounding them
Geotechnical	Relating to the form, arrangement and structure of the geology.
Global Warming Potential (GWP)	The level of ability of a greenhouse gas to trap heat in the atmosphere when compared to another gas
grassland	Land with grass growing on it, especially farmland used for grazing or pasture.
Greenhouse Gas Assessment	Method to assess the likely greenhouse gas emissions produced by the project
Greenhouse Gas offsets	Supporting projects that reduce emissions (eg. a wind farm) in order to compensate for a greenhouse gas emission elsewhere
Gross Regional Product	The total market value of all goods and services produced in a region in a given year

ground vibration	The level of vibration measured in mm/s.
groundwater	Water found beneath the earth's surface, in soil, rock, underground streams and/or aquifers
groundwater monitoring bores	Holes in the ground that extend the groundwater, enabling the extraction and testing of the groundwater for possible contamination
habitat index	A part of the 'Assessment of River Condition (ARC)'
Hazard and Operability (HAZOP) study	An assessment to identify the likely problems that may produce risks to persons, equipment or reduce the efficiency of operations.
Hazardous Industry	A building or place used to carry out an industrial activity that would, when carried out and when all measures proposed to reduce or minimise its impact on the locality have been employed (including, for example, measures to isolate the activity from existing or likely future development on other land in the locality), pose a significant risk in the locality to human health, life or property, or to the biophysical environment.
hazardous waste	A classification of waste that has the potential to pose a hazard to people of the environment.
heritage	is a broad concept that encompasses Natural, Indigenous and Historic or Cultural inheritance
Hydraulic modelling	A software modelling program that is used to display the physical characteristics of the behaviour of a fluid
hydrogeology (geohydrology)	The study of groundwater and the related geologic aspects of surface waters.
hydrological disturbance index	Assesses the flow regimes change that result from river regulation and/or substantial flow diversion or extraction.
hydrology	The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.
Impulsive Noise	Noise having a high peak of short duration or a sequence of such peaks. Noise from impacts or explosions, e.g., from a pile driver, punch press or gunshot, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of the sound pressure level.
indigenous	Native to a land or region
Indirect Impacts	Impacts on the environment, which are not a direct result of the development but are often produced away from it or as a result of a complex pathway.
infiltration	The process of surface water soaking into the soil.
Intergovernmental Panel on Climate Change (IPCC)	International body that assess and presents the scientific, technical and socio-economic information relevant to understanding the risks of human induced climate change.
Intermittent Noise	Noise with a level that abruptly drops to the level of or below the background noise several times during the period of observation. The time during which the level remains at a constant value different from that of the ambient being of the order of 1 s or more.
inter-tidal	Changes with the change in the tides. An inter-tidal zone is an area that is below water at high tide, and above water at low tide.
invertebrate	Species that do not have a backbone or spinal column.

ion-exchange resins	Polymers capable of exchanging particular ions within the polymer with ions in a solution that passes through them
isolated find	Single stone artefact, not located within a rock shelter which occurs without any associated evidence of Aboriginal occupation within a radius of 60 m.
Key Threatening Process'	If it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community, it is a key threatening process.
knapping	The process of shaping stone to produce tools.
Kyoto Protocol	An international agreement, where countries commit to reducing their carbon emissions.
LA_1	The A-weighted sound pressure level which is exceeded for 1 % of the measurement period.
LA_{10}	The A-weighted sound pressure level which is exceeded for 10 % of the measurement period.
LA_{90}	The A-weighted sound pressure level which is exceeded for 90 % of the measurement period. It is determined by calculating the 90th percentile (lowest 10 %) noise level of the period. This is referred to as the background noise level. (See Background Noise)
LA_{eq}	A-weighted equivalent continuous noise level. This parameter is widely used and is the constant level of noise that would have the same energy content as the varying noise signal being measured. The letter "A" denotes that the A-weighting has been included and "eq" indicates that an equivalent level has been calculated. This is referred to as the ambient noise level. (See Ambient Noise)
LA_{max}	The A-weighted maximum Root Mean Square (RMS) sound pressure level measured during the sample period.
Landcover	Combinations of land use and vegetation that cover the land surface.
landform	A specific feature of a landscape (such as a hill) or the general shape of the land.
landscape character	The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape and how it is perceived by people.
Landscape Feature	A prominent eye catching feature, for example a headland or built feature.
leachate	Solution resulting from the leaching of soil
Linear Peak (LIN Peak)	The maximum level of air pressure fluctuation measured in decibels without frequency weighting (see 'A Frequency Weighting').
lithologies	Rock types.
LLF	Low frequency noise level in the frequency range 20 Hz to 200 Hz.
Local Environment Plan (LEP)	A plan developed by a council to control development in part or all of their shire or municipality.
Lux	SI unit of luminance and luminous emittance
macropods	Made up of 50 species in Australia and New Guinea. The term 'macropod' means 'large footed'. Members of the group include Kangaroos and Wallabies, and are characterised by their large hind legs.

Matter of National Environmental Significance	These include listed threatened species and ecological communities, migratory species protected under international agreements, Ramsar wetlands of international importance, the Commonwealth marine environment, World Heritage properties, National Heritage places, Great Barrier Reef Marine Park and nuclear actions.
middens	Midden deposits can contain a variety of archaeological material, including animal bone, faeces, shell, botanical material, and other artefacts associated with past human occupation.
mitigation measures	Measure employed to reduce (mitigate) an impact
monitoring	The checking of impacts of a proposal or an existing activity in order to improve or evaluate environmental management practices. To check the efficiency and effectiveness of the environmental impact assessment process. To determine if the requirements of environmental legislation and associated regulations are being met.
native vegetation	A broad term for vegetation comprised of plant species which occur naturally in Australia (but which are not necessarily indigenous).
Nitric Acid	Transparent, colourless to yellowish corrosive liquid primarily used to make synthetic commercial fertilizer
Noise Barrier	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings. Etc used to reduce noise without eliminating it.
noxious	Introduced species considered to be harmful to native species or to the habitat of native species.
nutrient and suspended load index	A part of the ‘Assessment of River Condition (ARC)’.
Offensive Industry	a building or place used to carry out an industrial activity that would, when carried out and when all measures proposed to reduce or minimise its impact on the locality have been employed (including, for example, measures to isolate the activity from existing or likely future development on other land in the locality), emit a polluting discharge (including, for example, noise) in a manner that would have a significant adverse impact in the locality or on existing or likely future development on other land in the locality.
offset strategy	A method of offsetting disturbance attributable to the project through additional or compensatory measures.
Operation Environmental Management Plan (OEMP)	An element of an Environmental Management Plan that addresses the control, training and monitoring measures to be implemented during the operational phase of a project in order to avoid, minimise or ameliorate potentially adverse impacts identified during environmental assessments.
Organochlorines	A group or organic chemicals used in pesticides. Most organochlorine pesticides have low water-solubility, but high chemical and biological stability. They are fat soluble and tend to accumulate in the fat tissue of organisms.
oxidisation	A chemical reaction with oxygen
pedological organisation	The arrangement of soil peds (soil particles bound together – ‘clumps’ of soil). A soil with weak pedological organisation will have minimal structure, whilst a soil with strong pedological organisation has strong structure.

Perception of Sound	The number of sound pressure variation per second is called the frequency of sound, and is measured in Hertz (Hz). The normal hearing for a healthy young person ranges from approximately 20 Hz to 20 kHz. In terms of sound pressure levels, audible sound ranges from the threshold of hearing at 0 dB to the threshold of pain at 130 dB and over. A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to small but noticeable change in loudness. An increase of about 8 – 10 dB is required before the sound subjectively appears to be significantly louder.
Photomontage (Visualisation)	Computer simulation or other technique to illustrate the appearance of a development.
Plume	Area of impact extending from a source.
Polychlorinated biphenyls (PCBs)	Are amongst a broader group of harmful persistent organic pollutants that are toxic and pose risks to human health and the environment. They have been used as coolants and lubricants
Polycyclic Aromatic Hydrocarbons (PAH)	A class of organic chemicals, PAHs are formed by incomplete combustion or organic material, diagenesis (during or throughout generation) and biosynthesis. PAHs are naturally occurring, however, a significant proportion are the result of anthropogenic combustion.
Potential Acid Sulphate Soils (PASS)	Soil material which is waterlogged and contains oxidisable sulphur compounds, usually iron sulphide (pyrite) that has a field pH of 4 or more (1:5 soil:water).
precautionary principle	The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.
Preliminary Environmental Assessment (PEA)	An initial assessment conducted to identify the potential environmental impacts of a proposed project.
Preliminary Hazard Analysis (PHA)	An initial assessment of the likely hazards caused by a project.
prill	Porous solid pellets
putrescible wastes	Solid waste that contains organic matter that is able to be decomposed, produces strong odours, and attract/provide food for animals
Quantitative Risk Assessment	Involves the quantitative estimation of the consequences and likelihood of accidents
Ramsar wetland	Wetlands that are internationally recognised as being representative, rare or unique wetlands, or are important for conserving biological diversity
receptor	Physical landscape resource, special interest or viewer group that will experience an effect.
register of the national estate	A list of the National Estate developed under the provisions of the Commonwealth's Australian Heritage Commission Act 1975.
relief	The variation in landscape elevation over a region.
revegetation	Replacement of vegetation, principally grasses and legumes on areas disturbed by construction activities.

riparian	Relating to, or situated on the bank of a river or other body of water ie riparian vegetation.
risk	Likelihood of a specific event occurring within a specified period or in specified circumstances. Listed as a frequency or probability.
risk assessment	A process used to determine whether people and the environment are at risk (e.g. health and safety) from exposure to hazardous substances used or produced (mainly in an industrial or work place) so that appropriate control measures or management practices can be introduced to prevent or minimise the risk.
scarred tree	Tree with cuts in its bark or wood made by indigenous population.
scat	The excrement of an animal.
Selective Catalytic Reduction (SCR)	A process by which emissions of NO/NO_2 are reduced through a reaction with a selected catalyst within the process reaction before being released.
Sound Power Level (SWL)	Sound power is the energy radiated from a sound source. This power is essentially independent of the surroundings, while the sound pressure depends on the surroundings (e.g. reflecting surfaces) and distance to the receptor. If the sound power is known, the sound pressure at a point can be calculated. Sound power is also measured in logarithmic units, 0 dB sound power level corresponding to 1 pW (10-12 W). The symbol used for sound power level is SWL or Lw, and it is specified in dB.
Sound Pressure (SPL)	Sound pressure is the measure of the level or loudness of sound. Like sound power level, it is measured in logarithmic units. The symbol used for sound pressure level is SPL, and it is generally specified in dB. On this scale 0 dB is taken as the threshold of human hearing.
State Significant Development	Development that is declared State Significant by the Minister for Planning and Infrastructure, or that is listed under Clause 10, Schedule 1 of the State and Regional Development State Environmental Planning Policy (SRDSEPP).
Temperature Inversion	An atmospheric condition in which temperature increases with height above the ground.
threatened species	Schedule 1 of the TSC Act lists threatened species as species that are endangered or presumed extinct.
Toluene	
Total Petroleum Hydrocarbons	A collective term for a number of hydrocarbons
transect	Is a path along which one records and counts occurrences of the phenomenon of a study ie plants.
Typical Noise Levels	Compared to the static air pressure (105 Pa), the audible sound pressure variations are very small ranging from about 20 μPa (20x10-6 Pa), which is called “threshold of hearing” to 100 Pa. A sound pressure of approximately 100 Pa is so loud that it causes pain and istherefore called “threshold of pain”.
understory	The term for the area of a habitat which grows in the shade of the emergent or forest canopy.

Visual Absorption Capacity (VAC)	A classification system used to describe the relative ability of the landscape to accept modifications and alterations without the loss of landscape character or deterioration of visual amenity
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual envelope	Extent of potential visibility to or from a specific area or feature.
Visual Impact Assessment	A process of applied professional and methodical techniques to assess and determine the extent and nature of change to the composition of existing views that may result from a development
vulnerable species	Schedule 2 of the TSC Act lists vulnerable species and defines a 'vulnerable' species as likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate.
whacker rammer	A vibratory rammer used to compact soil in a confined area
wind climate	A description of the meteorological conditions created by the wind involving measurements of wind speed, direction and frequency of gusts for average, seasonal and annual conditions.
Xylenes (BTEX)	A hydrocarbon

Executive Summary

Introduction

Incitec Pivot Limited (IPL) (the proponent) is seeking approval for the development of a Nitric Acid (NA) / Technical Grade Ammonium Nitrate (TGAN) facility (the 'Project') at Kooragang Island, Newcastle.

Kooragang Island has been mainly used for industrial purposes since being reclaimed from the Hunter River in 1951 as part of the Hunter River Islands Reclamation Scheme. The scheme joined islands within the Hunter River with dredged sand and silt material. When this process was completed in 1960, the island was designated for industrial and port related activities.

The Project detailed in this Environmental Impact Statement (EIS) would be located on a lot of land owned by TOP Australia Ltd, a wholly owned subsidiary of IPL. This lot of land (the 'Lot') is situated at 39 Heron Road, Kooragang Island within the Port of Newcastle, approximately 3 kilometres (km) north from the Newcastle CBD, NSW. The Lot is legally described as Lot 3 on DP1117013 and is 36.8 hectares (ha) in size. Within the Lot is an existing IPL operation and a section of mainly vacant land on which the Project would be situated (the 'Site'). A location plan of the Lot and the Site is presented in **Figure ES-1**.

The Site has been used as a fertiliser manufacturing facility since its development and was originally owned by Australian Fertilizers Ltd. IPL currently use the Site as a fertiliser distribution centre, this existing use is concentrated in the western portion of the Lot and comprises a number of industrial buildings and facilities such as storage tanks, as well as office buildings and associated infrastructure. The existing operation and the majority of the existing infrastructure would be retained alongside the Project.

The Project is required to service the needs of the growing mining industry in the Hunter Valley. Whilst not an explosive itself, Ammonium Nitrate (AN) is the main raw material used in the manufacture of commercial blasting products used by the mining, quarrying and construction industries. Projections have indicated that by 2012 AN demand will exceed the local supply triggering a need for increasing levels of AN imports, or an increase in local production, in order to meet the demand in the Hunter Valley.

There are significant restrictions on the existing manufacturing facilities and importation of AN in NSW. The Project would replace the need for imports and ensure that the expanding mining operations in the Hunter Valley, and the economic benefits that brings to the local and broader NSW economy, are not unnecessarily constrained through an inadequate supply of this important product.

This EIS considers a range of environmental, safety, legal, social and economic impacts that projects of this type could have. It then assesses and describes the methods by which those impacts would be controlled, mitigated or offset for this Project to levels and standards which would ensure compliance with applicable legislative controls and which should be acceptable to regulators, IPL's neighbours and the broader community.

The nearest residential properties are located at Stockton, approximately 800 metres (m) to the south east of the Site boundary. Residential properties are also located close by in Carrington to the south, Fern Bay to the north east and Mayfield to the west, approximately 1.5 km, 1.5 km and 2 km from the Site respectively. In addition, the Hunter Estuary Wetlands are located on the northern side of Kooragang Island approximately 545 m north of the Site boundary.

Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or warranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.

Source: Nearmaps 2011

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

Legend

Site Boundary

Lot and DP Boundary

N W E S

SITE LOCATION PLAN

URS

Figure: **ES-1**

File No: **43177771.066.wor** Drawn: **STB** Approved: **WM** Date: **27-08-2012**

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IPL is aware of certain community concerns and sensitivities within the local area following recent environmental incidents on Kooragang Island. Although many of the community concerns and issues are historical, and do not directly relate to the Project, the Site, or to IPL itself, the views of the local communities in Stockton and the wider Newcastle area are nonetheless important to consider in light of the Project. IPL has sought to better understand the views and concerns of the local community through a community consultation program. Through commissioning the expert studies that inform the EIS, IPL has genuinely tried to acknowledge and address concerns and questions from the local community. Those technical studies contain the scientific basis for the discussions and conclusions set out in the pages which follow.

IPL firmly believes that it can develop the Project in a manner sensitive to community concerns and that does not pose an unacceptable risk of safety to those local communities or the surrounding environment which we all share.

This Project is considered to be State Significant Development (SSD) for the purposes of the relevant NSW planning legislation as it falls within the requirements of Clause 10, Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP S&RD). Specifically the Project falls within the category of chemical industry that would manufacture, store and use dangerous goods in such quantities that constitute the development as a major hazard facility. As such, this EIS has been prepared under the provisions of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to support the Proponent’s application for planning approval.

To provide the reader with a greater understanding of this EIS, which is a significant document to read and digest, this Executive Summary provides a brief description of the key outcomes of the EIS.

Project Need and Alternatives

The Need for AN

The first issue to understand is why there is a need for the Project and what alternatives were considered.

AN is a vital raw material for the thermal coal operations in the Hunter Valley. Exports of coal from the region are projected to increase by 6% per annum over the next decade and projections indicate that demand will outstrip supply as early as this year, 2012.

Options for Satisfying the Demand for AN

In order to be able to meet the increase in demand for AN, a reliable supply of AN must be secured for the Hunter Valley coal operations. In considering how that demand could be met, IPL considered a number of options, guided at all times by the following Project objectives:

1. only consider a solution to the strategic AN need that would be considered safe for local communities and the environment;
2. develop a sustainable and secure solution to meet the medium and long term market demand for AN in the Hunter region;
3. ensure that thermal coal production is supported to maintain the economic benefits to the local region and the State; and
4. introduce competition into the AN manufacturing market in the Hunter region.

These objectives were used to help evaluate the following alternatives for the Project:

Option 1: Take No Action

This scenario would not allow for the delivery of an AN supply chain with improved security of supply and cost competitiveness to support the growth of mining in the Hunter Region and the economic benefits that expansion would bring for the local community, IPL and the economy of NSW. Therefore this option is not considered viable.

Option 2: Increase AN Imports

Logistical limitations restrict the viability of this option because it is difficult to source, transport and store AN in bulk from sources outside the Hunter region. There are a limited number of bulk export sources capable of meeting the projected rise in demand and those that are available are unlikely to commit to long term supply contracts. Additionally, due to the potentially hazardous nature of AN, limitations are imposed on storage and transportation quantities. As such, whilst this import option could achieve some of the Project objectives in the short term, it would not be considered viable in the medium to long term.

Option 3: Build a new AN Facility

Development of a new AN manufacturing facility would mean that the Hunter Region would have two AN facility thereby increasing the security of AN supply if one facility had to close. Development of a new facility, as proposed by IPL, would introduce increased competition into the AN market in the Hunter Region and would help support the thermal coal industry into the future. It would also allow the highest safety and environmental standards to be implemented with the construction of a brand new plant. This third option was considered to meet the Project objectives and was therefore chosen for further consideration.

Location of the new AN Facility

IPL determined that the choice of location for any new AN plant would be based on a number of criteria, including safety considerations, and the availability of labour resources, raw materials and infrastructure and logistical considerations. A key criteria would be access to ammonia, the main feedstock for the AN manufacturing process. Three locations were shortlisted for the Project:

1. Kooragang Island;
2. Hunter Valley; and
3. Tomago.

The Selection of Kooragang Island

Kooragang Island was selected as the preferred site for the Project based on the following ten reasons:

1. The Site is located in an existing industrial area.
2. The Site can be located on part of the Lot already owned by IPL, therefore no land acquisition is required.
3. The Site on the Lot is already cleared and contains existing usable infrastructure and utility services such as water, natural gas and power supply.
4. The Project would be an integrated production facility with the majority of products transported off site being finished products, TGAN and Ammonium Nitrate Solution (ANSOL). A single integrated

production facility on Kooragang Island means that safety and environmental issues can be managed more effectively.

5. The distance from the Site to the nearest residential community was expected to ensure that there would be no unacceptable risk to the local community from the Project. This expectation was confirmed by the Preliminary Hazard Analysis discussed in **Chapter 9 Hazards and Risks**.
6. The Site, being located in Newcastle, has good access to skilled labour.
7. The Site is close to Newcastle Port and the proposed Newcastle Ports Corporation (NPC) bulk liquids berth.
8. The Project location allows for import of large, prefabricated Project components via the (CTB)Transportable Buildings berth during construction, thereby reducing the impact of the construction phase on the locality. Access to the Newcastle Port also allows for the export of excess AN to international markets without increasing traffic movements.
9. Building the Project in this location has lower capital and operating costs than an inland site.
10. Building the Project in an inland location would require the building of a standalone ammonia storage facility at the port and the transport of large quantities of ammonia via truck or pipeline from the port to either Tomago or the Hunter Region. Ammonia is a potentially dangerous substance and requires purpose built trucks for transport. The transport of ammonia presents a greater risk to public safety than the transport of TGAN or ANSOL.

Project Design Alternatives

A number of different design options have been considered for the Project.

Specific technologies (e.g. incorporating dual pressure technology as opposed to mono-pressure technology in the NA plant) have been preferred to help reduce various environmental impacts. These have included measures to reduce water consumption, air quality emissions, particulate matter and greenhouse gases. The proposed Project design is provided in **Chapter 4 Project Description**.

Project Location and Existing Environment

The Site

The Site is approximately 3 km from the Central Business District (CBD) of Newcastle, NSW. The Lot on which the Site is located is legally known as Lot 3 on DP1117013 and is approximately 36.8 hectares (ha) in size. The Site takes up approximately 34 hectares of that 36.8 hectare site.

The Existing Surrounding Environment

Kooragang Island is a partially reclaimed island located in the Hunter River Estuary. The reclamation process that formed the island began in 1951 and was completed in 1961. The southern portion of Kooragang Island is entirely occupied by industrial and port related operations.

The industrial heritage of the area has shaped the growth of the communities in Newcastle, Stockton and Mayfield. The Newcastle Port area continues to be strategically important to NSW and is included as a ‘Three Ports Site’ within the *State Environmental Planning Policy (Major Development) 2005*.

The Lot, of which the Site forms part, is currently used as a Primary Distribution Centre for bulk and bagged fertiliser. The IPL Site receives and stores solid and liquid fertilisers, before blending, bagging and dispatching both bulk and bagged fertiliser. This operation would continue throughout the construction and operation stages of the Project.

The land immediately surrounding the Site is also used for industrial and port related activities and includes:

- to the south, an Ammonium Nitrate Facility operated by Orica Australia Pty Ltd;
- to the west and east, beyond Heron and Greenleaf Roads, the land is owned by Newcastle Port Corporation; and
- to the north east, Eastern Star Gas (now Santos) which has recently purchased a vacant parcel of land.

The nearest residential properties are located at Stockton, approximately 800 m to the south east of the Site. Stockton is located on the opposite side of the harbour from the Newcastle CBD.

Project Description

The Project involves the construction of an AN Plant on Kooragang Island, Newcastle and would include Nitric Acid (NA), Ammonium Nitrate Solution (ANSOL) and TGAN manufacturing facilities which would produce approximately 350,000 tonnes per annum (tpa) of AN for sale to customers.

The Project would be located on the existing IPL owned lot of land on Kooragang Island, NSW. The existing bagging and storage operation on the Site would be retained, with the Project being located on unused land on the south east of the Site.

Ammonia would be the primary feedstock for the process of AN manufacture. The Project would import the majority of that ammonia by ship. Specialist ships would unload ammonia via a new unloading arm and piping at the proposed NPC liquids unloading berth located adjacent to berths K2 and K3. The bulk liquids berth is being developed by Newcastle Ports Corporation separate to this Project to service a number of existing and proposed operations.

Ammonia from the bulk liquids berth would be piped onto Site and stored in a new ammonia storage tank. The Ammonia import supply would be supplemented via road tankers from existing IPL ammonia manufacturing facilities in Queensland. The ammonia would then be used as a feedstock to produce NA in the new NA Plant. The ammonia and NA would then be used to produce ANSOL in the new ANSOL Plant. This ANSOL would be either used to produce TGAN or stored as ANSOL for transport by truck to IPL's Warkworth facility in the Hunter Valley. TGAN would be stored on the Site as solid prill and transported by truck to customers in the Hunter Valley. The ammonia storage and road tanker facilities would also be utilised to meet regional farming requirements.

Construction

It is anticipated that the construction phase of the Project would last 28 months, starting in the first quarter of 2013. The capital cost of the investment is estimated to be $600 million.

The construction process would involve six months of site preparation before any components are installed on the Site. Once the construction begins, processes would operate concurrently in order to expedite the completion of the Project construction. At the peak of the construction there will be approximately 340 construction staff employed on the Site.

In order to limit the impact of the construction activities on the local area, which was an issue raised by the community, certain Project components would be constructed offsite and would be transported to the Site by sea as prefabricated modules. The modules would be shipped to Newcastle Harbour before being transferred to barges at the Western Basin berth. From there the modules would be transported to the CTB berth on Greenleaf Road for unloading. Movements from the CTB berth to the Site would be along Greenleaf Road. The modules would enter the Site at the new Greenleaf Road entrance.

The majority of the construction activities are planned to take place from 7 am to 6 pm from Monday to Friday and 8 am to 1 pm on Saturdays. Construction work would only be conducted outside these hours if the work could be completed with no perceivable acoustic impact at the nearest residential areas. Where construction work would need to take place outside the normal Monday to Saturday hours above, IPL would inform any potentially affected parties at least five days in advance.

Planning Policy and Approvals

Due to the nature of the Project, it has been classified as State Significant Development under section 89C of the EP&A Act and Schedule 1 of SEPP S&RD. As such the Project will be subject to assessment by the Department of Planning and Infrastructure (DP&I) and determination by the Minister for Planning and Infrastructure. However, the Minister may delegate this determination to the NSW Planning Assessment Commission (PAC).

Other approvals may be required for the Project including those under the following legislation:

- *Protection of the Environment Operations Act (POEO) 1997 (NSW);*
- *Explosives Act 2003 (NSW);*
- *Work Health and Safety Act 2011 (NSW); and*
- *Water Management Act 2000 (NSW).*

The Project would be situated on land that is zoned *SP1 (Special Uses).* The Site is part of an area that is identified as one of the 'Three Ports' sites under the *State Environmental Planning Policy (Major Development) 2005.* SP1 zoning allows development that encourages employment, maximises the use of waterfront areas and requires separation from residential areas. The Project satisfies all of these planning criteria.

A complete account of relevant Commonwealth, State and local legislation and policy is contained in **Chapter 6 Planning Policy and Legislation**.

Consultation

In preparing this EIS, IPL have implemented the consultation strategy described in **Chapter 7 Consultation**. Consultation activities were started before the Project was publically announced and have continued throughout the preparation of this EIS.

The purpose of this strategy was to identify key stakeholders who may have an interest in the Project and to understand their concerns and questions. This included understanding the issues of the local community close to the Site, particularly given their concerns following a number of environmental incidents on Kooragang Island in recent times. Those issues were unrelated to IPL or its operations on Kooragang Island but nonetheless were identified as genuine concerns which also needed to be addressed as part of this Project. The key issues raised by residents in Stockton and Mayfield included the risk of pollution, general impacts of industrial activity, and risks to community health and safety.

IPL also engaged with government, industry and other stakeholders throughout the Project inception and planning process. The outcomes of this consultation are outlined in **Chapter 7 Consultation**.

IPL's Community consultation included:

- Various community presentations;
- Newsletters, media releases, radio interviews;
- An interactive and informative website; and
- The establishment of a Community Liaison Group.

An independent Community Perception Survey was also completed to further assist IPL in understanding the concerns of the local community. This survey concluded that:

- 69 percent of all respondents across the Newcastle LGA were unaware of the Project;
- Stockton respondents (80) had the greatest level of awareness of the Project and the most negative attitudes towards it;
- areas away from the Project (200) held the most positive attitude to the Project;
- 49 percent of respondents had concerns about the Project, including the health and safety of surrounding residents, proximity of the plant to residential areas, and potential impacts on air quality; and
- the greatest perceived benefit of the Project was seen to be increased employment opportunities.

Table 7-1 at the end of **Chapter 7 Consultation** lists the various issues that were identified during consultation and shows where in this EIS these issues are assessed by IPL and mitigation measures put forward.

Environmental Scoping Assessment

In order to assess the environmental impact of the Project, a number of key environmental issues have been identified through consultation with regulators and the community.

A qualitative risk assessment of these environmental issues has been conducted. The risk assessment was based on a recognition that a more detailed assessment would be required for the environmental aspects with the highest potential likelihood and greatest potential consequences.

The risk assessment was based upon the guidelines outlined in AS/NZS 4360:2004 and AS/NZS ISO 31000:2009.

Hazard and Risk

An assessment of Hazard and Risk was conducted for the Project by expert consultants, Lloyds Register Rail. The assessment was undertaken in two parts, a Preliminary Hazard Analysis (PHA) and a Transport Risk Assessment (TRA). The assessment was both quantitative and semi-quantitative in nature, compliant with, and assessed against, the criteria contained within the DP&I's *Hazardous Industry Planning Advisory Paper* (HIPAP) *No.4 – Criteria for Land Use Safety Planning*, *HIPAP No.6 – Guidelines for Hazard Analysis* and *HIPAP No.10 – Land Use Safety Planning.*

The PHA is included in this EIS as **Appendix D1 Preliminary Hazard Analysis**. The TRA is included in **Appendix D2 Transport Risk Assessment.** Both of these risk assessment reports are summarised in **Chapter 9 Hazard and Risk.**

The nature of the Project as a Potentially Hazardous Industry requires a PHA to be conducted, the PHA determined that, provided precautionary practices are maintained by IPL throughout the operation of the Site, the Project is safe and does not exceed the acceptable levels of risk adopted in HIPAP No.4.

The TRA determined using semi-quantitative analysis that the risk for populated areas along the transport routes is below comparable risk criteria applied for fixed facilities in NSW. The safety practices for handling dangerous goods that are practiced by the current transit contractors, employed by IPL, represent best practice. Provided those best practices are maintained throughout the operation of the Project, the risk presented by the transport of potentially dangerous goods was also considered to be acceptable.

Air Quality and Odour

An Air Quality Impact Assessment (AQIA) has been conducted for the Project in line with the requirements of the Director General Requirements (DGRs). The assessment addressed the impact of key pollutants on the air quality of the area. A complete account of the air quality issues identified by the assessment is included in **Chapter 10 Air Quality and Odour** and in **Appendix E Air Quality Impact Assessment**.

Ammonia was considered to be the key odorous pollutant associated with the Project. Ammonia has therefore been used as a surrogate for the assessment of potential odour impacts.

The AQIA compiled an inventory of all the activities associated with the construction and operation of the Project that would potentially cause air pollution. The key pollutants identified were nitrogen oxides (NO_x), ammonia and particulate matter less than 10 microns in size (PM_{10}). PM_{10} usually takes the form of smoke or dust. The assessment also examined the meteorological conditions of the area to determine how nitrogen dioxide (NO_2), ammonia and PM_{10} would be dispersed around the local area. The potential for dispersion was modelled using the EPA endorsed modelling software, Calpuff.

Air quality mitigation measures have been included in the Project design. Therefore the impact of these measures has been included in the assessment. The Project design includes air filters and scrubbers in the Project areas that would produce dust, such as the bagging area and AN Prill Tower. The Project also includes selective catalytic reduction abatement that would minimise NOx from the tail gases before remaining air is discharged into the tail gas stack. Appropriate refrigeration of ammonia on import and storage would also prevent gaseous emissions emanating from the import and storage process. The AQIA determined that the mitigation measures that would be incorporated into the design of the Project would significantly reduce the likelihood of impacts on air quality.

The Project design incorporates Best Available Technology and compared favourably against other plants of a similar nature both throughout Australia and globally.

A number of mitigation measures would also be implemented during Project construction to ensure that all air quality and dust impacts are minimised to the extent practicable. These measures would include the use of dust suppression measures during soil disturbance or other construction activities.

Noise and Vibration

Noise and vibration from the construction of the Project has been assessed within the **Appendix F Noise and Vibration Report** and summarised with **Chapter 11 Noise and Vibration**.

Criteria for assessment of the Project's acoustic impacts have been established for construction noise and vibration from the *Interim Construction Noise Guidelines (ICNG) (DECC, 2009)* and for operational noise and vibration, from the *Industrial Noise Policy (INP) (EPA, 2000)*.

Construction of the Project would occur within working hours as defined by the ICNG. Additionally construction noise is not anticipated to be louder than the defining industrial noise of the area and is therefore unlikely to cause a discernible increase in noise at the nearest sensitive receptors.

Construction noise would be controlled within the Construction Environmental Management Plan (CEMP) and all complaints would be appropriately logged, investigated and corrective measures taken wherever practicable.

The Project would operate 24 hours a day, therefore noise limits for its operation would be particularly sensitive, especially during night time operation. In order to establish an achievable noise limit for the Project, **Chapter 11 Noise and Vibration** recommends a slight modification to the noise limits for the suburban areas surrounding the Site to allow for the industrial / suburban interface that exists in the area. The noise limit would be well below the existing noise levels.

Given that IPL and Orica are two operators that could materially influence industrial noise levels in Stockton, the two sites assume an equal responsibility in achieving the nominated criteria. This would require that each operation contributes no more than the identified noise level less 3 decibels (dB) in order to ensure no perceivable acoustic increase at the nearest residential areas.

Soil and Groundwater

Soil

An Environmental Site Assessment (ESA) has been conducted for the Project by JBS Environmental Pty Ltd, and is included as **Appendix G Environmental Site Assessment**. The Project is located in an area that was once an intertidal sandbar in the Hunter River Estuary.

The nature of the soil in the area is predominantly estuarine with evidence of reclaimed land found throughout the Site. Kooragang Island is generally level and no more than 5 m above Australian Height Datum (AHD). The soils in the area are predominantly dredged alluvial sediment, typically comprising light brown silty sands and shell fragments. Underlying this fill material, clayey silts and sand sediments are present. The clayey silts (estuarine clays) occur in discrete bands below the fill material, between 2-4 m below ground surface (bgs). Below the clayey silts are sand sediments (alluvial) which generally become denser with depth.

The Lot has been used for the manufacture, storage and distribution of fertiliser since it was first occupied between 1954 and 1965. As a result of this prolonged usage isolated areas of phosphogypsum are also present on the Site.

The Acid Sulfate Soil (ASS) Risk Map (NSW Natural Resource Atlas website, 2011) indicates that the Site is located within an area that has a ‘low probability of occurrence’ of acid sulfate soils.

Groundwater

Groundwater is present between 1.2 and 2.7 m bgs across the Lot. The water table is slightly higher on the western part of the Lot. As the Site is located in close proximity to the Hunter River there is a likelihood of saline influence in the shallow aquifer underlying the Lot. However, results from the ESA indicate that any saline influence is limited. The groundwater within the Lot is classified as brackish and is considered unsuitable for human consumption due to previous and current industrial practices on Kooragang Island.

Site Contamination

There is some evidence of contamination from Total Petroleum Hydrocarbon C_{10} – C_{36} (TPH) and Nitrogen within the Lot. Although one sample recorded traces of TPH above the adopted Health Based investigation levels for commercial / industrial land use, all other samples recorded all potential contaminants of concern to be within safe parameters. Ammonia traces on the Lot are not thought to pose a threat to the surrounding environment.

Based on the findings of the ESA, the Site is considered suitable for the commercial/industrial uses associated with the Project, without any requirement for the remediation of soils or groundwater. The ESA is summarised within **Chapter 12 Soil and Groundwater**.

Construction and Operation Impacts

In order to mitigate the impacts of the construction and operation of the Project a series of measures have been suggested; these would be incorporated into the Construction Environmental Management Plan (CEMP). The CEMP would be maintained throughout the construction process to ensure all environmental impacts of potentially contaminated soil and groundwater are minimised. The CEMP would include an Acid Sulphate Soil Management Plan and a Ground Water Management Plan. During Project operation an Operational Environmental Management Plan (OEMP) would also be adapted from the existing Management Plan for the Site to ensure that the Project continues to comply with all the Environmental Protection Licence requirements.

Surface Water and Waste Water

An assessment of the impact of the wastewater and storm water run off from the Project was conducted and is included as **Appendix H Water Management Report**. The report has assessed the impact of the Project in storm water runoff, flood risk, waste water generation and management and discharge into the Hunter River. These assessments have been summarised into **Chapter 13 Surface Water and Waste Water**.

There would be no overall change to the permeability and drainage output from the Site as a result of the Project. Currently the eastern portion of the Lot drains to the east and the western portion of the Lot drains to the west, this would continue throughout the construction and operation of the Project. Stormwater runoff from the Site would be passively managed using first flush controls. Areas of the Site that have no exposure to potential contaminants would be harvested or would flow into existing stormwater drainage. Areas with potential for exposure to contaminants, such as loading bays and roads, would drain to a designated holding pond that would contain the first of the stormwater that would be most likely to contain contaminants. If contamination is present on testing the water contained in this area, it would be treated before being released. Areas used for the processing and storage of chemicals would be separately bunded and all stormwater from these areas would be retained and tested before appropriate disposal.

The assessment of flood water impacts found that, although the Site is less than 5 m AHD and is located within areas identified as flood fringe, there would be no change as a result of the Project as no significant ground works are planned on the Site. Additionally, due to the anticipated velocity and depth of a flood event on the Lot, there would be no anticipated impact on water quality as a result of a flood event.

The Project has been designed to minimise the quantity and level of contaminants in the waste water through treatment, reuse and recycling. Waste water outfall into the Hunter River was modelled in order to determine its impact, if any, on the receiving environment. In the worst case results of the modelling showed a build up of nutrients over time when the waste water was allowed to outfall into the south arm of the Hunter River. As a result of this, the design and operation of the Project was altered to reduce the level of nutrients discharged. The use of a sub-surface diffuser at the K2 berth location would sufficiently increase the dispersion of nutrients to ensure that the quality of the waste water outfall would have no perceivable impact on the receiving environment.

The Project is not anticipated to have an adverse impact on the water quality of the receiving environment or the sensitive aquatic receptors in the neighbouring wetlands.

Greenhouse Gas

Scope 1 & 2 Emissions

A Greenhouse Gas (GHG) Assessment was conducted for the Project. The assessment included a quantitative analysis of the Scope 1 and Scope 2 emissions associated with the construction and operation of the Project.

Scope 1 emissions comprise those created directly by construction or operation of the Project and comprise of:

- combustion of diesel in vehicles;
- combustion of natural gas in boiler and flare; and
- production of a by-product nitrous oxide (N_20) within the Nitric Acid plant.

Scope 2 emissions are often referred to as indirect emissions and mainly comprise emissions resulting from the production of electricity purchased from the grid.

Greenhouse gasses are generally expressed in term of their greenhouse effect potential in relation to that of Carbon Dioxide equivalent (CO_{2-e}).

Construction Emissions

During the construction phase of the Project, greenhouse gas emissions have been estimated at approximately 11,000 tonne (t) CO_{2-e}. Of the construction emissions, approximately 6,000 t CO_{2-e} would be attributable to combustion of diesel in construction vehicles, not directly controlled by IPL. The remaining 5,000 t CO_{2-e} would be attributable to the purchase of electricity from the grid for the first plant start-up.

Operational Emissions

Greenhouse Gas emissions during the operational phase of the Project would be minimised by catalytic abatement of the N_2O emissions from the production of NA. Emissions from natural gas combustion and liquid fuel combustion resulting from vehicle movements would also from part of the operational emissions profile. The GHG assessment has estimated that annualised Greenhouse Gas emissions from the Project would contribute approximately 0.06% of the NSW Greenhouse Gas registry and 0.02% to the Australian Greenhouse Gas inventory.

Energy Efficiency Opportunities

Energy loss has been minimised through efficient design of a range of energy recovery mechanisms within the Project. The heat generated from the exothermic reactions of the operational phase of the Project would allow the facility to produce steam for heat recovery and for the generation of electricity. It is expected that approximately 7.5 MW of electricity could be produced. This would equate to approximately 51,660 t CO_{2-e} per year should this electricity be purchased from the grid.

The Greenhouse Gas Assessment undertaken compared the Project to other plants of a similar nature both throughout Australia and globally. The Project compared favourably to other plants demonstrating the effective incorporation of the Best Available Technology to reduce the Greenhouse Gas Emissions associated with the Project.

Traffic and Transport

Understanding the Current Capacity

A Traffic Impact Assessment was conducted in order to assess the impact of the Project on the road, rail and port infrastructure in the vicinity of the Project. The assessment examined the existing infrastructure and the capacity at which it is currently operating. It then studied the anticipated impact of the Project at both construction and operational phases. The impact of the Project on the existing transport infrastructure could then be determined.

The Project is located on an island, accessible by two roads, Cormorant Road/Tourle Street/Tourle Street Bridge to the west and Teal Street Stockton Bridge to the east. State Highway 121 follows this route as it departs Newcastle and heads north from Industrial Drive and travels towards Port Stephens.

As the Project construction would be conducted over approximately a 28 month period and would not be operational until 2015, existing percentage increases in existing traffic volumes were used to forecast the anticipated traffic baseline in 2014 and 2015. An annual increase of 2.5% per annum from current traffic figures was used in order to provide a robust assessment.

The capacity of the road network was determined by using information about the capacity of the intersections. Level of Service (LOS) is a performance measure used to describe the performance of an intersection or midblock location. LOS ranges are defined as falling between A, which indicates good intersection performance, to F, which indicates saturated conditions with long queues and delays. Upon assessment of the existing environment, it was discovered that the exiting road network already features areas that are operating at or near their capacity, at a LOS of F. Roads and Maritime Services (formerly Roads and Traffic Authority) is working on identifying short term and long term options to improve traffic flow across Kooragang Island.

Construction Traffic

The construction of the Project would involve the import of approximately 60 prefabricated modules, these would arrive by sea and be transported on to the Site using customised vehicles. This methodology is designed to significantly reduce the impact of the construction of the Project on the local road network.

IPL would ensure that the majority of the construction staff would travel to and from the Site using a park and ride scheme. This would further limit the impact of the construction of the Project on the road network.

Operational Traffic

The operation of the Project would involve some additional heavy vehicle movements as TGAN and ANSOL are distributed. Additional heavy vehicle movements would not constitute more that ten percent of total heavy vehicle movements for the area.

The assessment concluded that, although the Project would cause an increase in the total number of vehicles on the road in the area, it would not have an impact on the LOS of any of the identified roads during construction or operation.

Other Transport Impacts

The Project is anticipated to cause an increase in the number of ships using the docking facilities within the Port of Newcastle. The Construction of the Project is anticipated to cause approximately nine ship movements as Project components are delivered. The operation of the Project is anticipated to cause an additional eight ship movements per annum, this is within the operating capacity of the Port of Newcastle.

Waste Management

Assessment of Project Waste Streams

An assessment of the wastes produced by the Project was completed as part of this EIS. The waste assessment involved an analysis of the Project to identify potential or likely waste streams and volumes arising from the construction and operation of the Project. The assessment was completed using information provided by the Proponent and the requirements of relevant legislation and policy.

The Site would continue to operate through the construction and operation phases of the Project, therefore waste streams associated with the Project would be in addition to the existing waste streams from the Site. It is the responsibility of the Proponent to classify the waste produced as a result of the Project.

Construction Waste

Due to the modular construction methodology, construction wastes for the Project are likely to be minimal, restricted to construction consumables such as packaging or construction materials and off cuts from wires and pipes.

Operational Waste

Operational wastes for the Project would mainly result from water and air discharges. Other wastes would include minor quantities of maintenance waste, waste oil and chemical drums and bags, oily water and general wastes. Waste ANSOL is stored and concentrated on-site before being transported to the IPL facility at Warkworth for manufacture of fertiliser solutions.

Waste management

The waste streams from the Project would be governed under the following hierarchy:

- **Avoid** by identifying appropriate materials and procuring;
- **Reduce** waste by optimising construction and operation methods;
- **Reuse** waste by identifying sources that can utilise the waste;
- **Recycle** waste by identifying facilities that are able to recycle waste;
- **Recover** Energy from waste; and
- **Dispose** of waste at an appropriate facility.

Waste steams that are produced as a result of the Project would be managed through a Waste Management Plan, incorporated within the CEMP and OEMP.

Visual and Landscape

A Visual Impact Assessment (VIA) was conducted for the Project. The assessment determines the likely visual impact of the Project on people living and working in, or travelling through, the landscape surrounding the Site. The potential visual impact of the Project at individual view locations would result primarily from a combination of the potential visibility of the Project infrastructure and the visual character of the landscape between and surrounding the viewer and the Project.

The Project is industrial in nature and would be situated in an area that is already highly industrial in nature. The VIA therefore determined that the Project would have a low visual impact on surrounding receptors, including sensitive receptors. Additionally, existing mature tree planting and vegetation surrounding the IPL Site would provide screening and visual filtering to some of the lower portions of proposed infrastructure on the Site.

There are no significant views toward the Site from surrounding dedicated public lookouts. Distant pubic vantage points including Fort Scratchley and foreshore areas adjoining the Newcastle CBD would not be significantly impacted by the Project.

Although the prill tower and NA absorber, the tallest structures associated with the Project, would be visible from a number of surrounding residential properties as well as surrounding local roads they would be in keeping with the nature of the current built environment of Kooragang Island. The tallest elements would also be visible above the skyline from some view locations surrounding the Site.

Distant views (in excess of 3 km) toward the Project are likely to be influenced by atmospheric conditions which would tend to reduce the visibility of the taller structures.

Appropriate mitigation measures would be incorporated into the design and operation of the Project to further reduce the visual impact. The Project would be painted so as to reduce the reflectivity of the structures. Night time lighting would also be designed so as to avoid direct line of sight, where possible.

Flora and Fauna

A Flora and Fauna assessment was conducted for the Project. The Assessment comprised a desktop assessment along with a visit to the Site by trained ecologists. A search was also completed of State and Commonwealth threatened species registers and records of historical information of sightings in the area surrounding the Site.

The desktop search concluded that although there were a number of threatened and vulnerable species found in the surrounding area, none were known to be present within the boundaries of the Site or the Lot.

A visit was conducted in order to gain a better understanding of the flora and fauna habitat resources that are found on the Site and the surrounding area. The field survey was undertaken in a manner that referenced the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Working Draft) (DEC 2004) and *Draft Guidelines for Threatened Species Assessment* (DEC & DP&I 2005). Given the condition of the Site, existing levels of disturbance, and overall lack of habitat resources, the survey recommendations of the above listed guidelines were adapted to allow appropriate assessment of a highly modified site. Dominant flora and habitats of note were recorded.

As a result of the visit to the Lot, key vegetation items could be identified and retained through incorporation into the design of the Project. The location of the waste water outfall from the Project could also be positioned so as to minimise the impact of the water outfall on the Ramsar and SEPP 14 Wetlands to the north and east of the Site.

The Assessment also identified threatened species with the potential to occur in the area. The significance of impact of the Project on threatened species with the potential to occur within the Site and surrounding area was determined through the completion of a Significant Impact Criteria (SIC). SICs were completed for one floral species, two faunal species, one habitat and several migratory birds.

The assessment of the Site and surrounding area concluded that the Project would not have any significant impacts on the surrounding flora, fauna, ecosystems or habitats.

Heritage

The Project is located in a location that was reclaimed from the Hunter River in the later part of the last century and has been used solely for industrial purposes since this time. There are no items of heritage significance located within the boundaries of the Lot. No impacts are anticipated on recorded items of heritage significance surrounding the Site. Should any items be discovered during the construction process, work would cease until a trained archeologist can conduct an investigation.

Resource Implications

Construction and operation of the Project would result in a demand for resources. During construction, the electrical demand would peak at up to ten megawatts (MW) for short periods with consumption increasing during the commissioning phase from approximately 30 megawatt-hours (MW-h) per day to a peak of approximately 150 MW-h per day. Once operational, the Project would require less that 2 MW from the grid with an additional 7.5 MW being generated on site as a by-product of the process.

During construction approximately 12 m^3 of water would be required per day. During operation, between 180 and 220 m^3 of water would be required per hour. Water would be drawn from Hunter Water mains.

During plant commissioning, approximately 20 gigajoules per hour (GJ/hr) of natural gas would be required per day. During operation approximately 75 GJ/hr of natural gas would be required per hour for steady state operation. During project start up, an event which is likely to occur around three times a year, extra natural gas would be required to heat Project components to the required temperature and run the NA compressor. At these times approximately 170 GJ/hr of natural gas would be required.

Approximately 100,000 litres of diesel would also be required on the Site every year for fuelling vehicles and generators.

The EIS concluded that none of these increases in resource use are material and all can be accommodated within existing utility supplies. Furthermore, the Project's resource consumption would have no detrimental effect on the availability of those resources for other operations or local communities.

Socioeconomic

The Project represents an investment in the area of around $600 million (M). Jobs will be created both locally and nationally as a result of the upstream and downstream impacts of the Project. The Socioeconomic impact assessment that was conducted for the Project demonstrated that some of the required skills and training requirements are available within the local area.

The study demonstrated that of the total $600M investment, the expenditure of $223M on labour during construction is calculated to make a total contribution to the Gross Regional Product of $345M over this phase, mainly from labour income.

Ongoing annual operational expenditure from the Project is estimated at $33M and would make a contribution of $35M to Gross Regional Product per annum, after adjustments are made for intermediate inputs purchased from other areas of Australia.

The EIS therefore determined that all of the socio-economic impacts arising from the Project were positive for the local and NSW economies.

Cumulative Effects

Assessment Conducted

In accordance with the DGRs, an assessment of the cumulative impacts of the Project on the receiving environment was conducted as part of the technical studies outlined above. For the majority of these studies there was found to be no significant residual impact as a result of the Project. As such, in many cases a cumulative impact assessment was not required.

The cumulative impact assessment for the Project examined the potential residual impacts of the Project on Hazard and Risk, Air Quality, Traffic and Transport, Noise and Vibration, and Visual. These residual impacts were assessed against the stated impacts of other projects in the area that have the potential to have an impact on the same receptors as the Project at the same time.

In order to identify relevant projects two databases were reviewed:

- Major Project Assessments register on the NSW DP&I website; and
- Public notices and invitations to comment register on the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) website.

A review of these databases was considered the most effective way of identifying projects that are likely to have significant residual impacts, and therefore may have a cumulative effect with this Project.

Projects that are currently operational are not considered as part of the cumulative impact assessment as these would be captured as part of the environmental baseline.

Hazard and Risk

The DGRs requested an assessment of how the hazard and risk profile for Kooragang Island would be affected with the operation of the Project alongside the existing Orica facility and the proposed Orica expansion project.

The maximum cumulative individual fatality risk for Orica's expanded facility and the Project was found to be significantly lower than the NSW DP&I individual fatality risk criterion for residential land uses (viz. $1x10^{-6}$p.a.), which is applicable for a single proposed development. Therefore, it can be concluded that the Project would not increase the cumulative individual fatality risk to an unacceptable level.

Air Quality

The cumulative AQIA is designed to assess the impact of the combined operation of the Project and the expanded Orica facility on the air quality of the area.

The results indicated that the cumulative NO_2 emissions for the Project and the Orica expansion project would not exceed the NSW Office of Environment and Heritage (OEH) NO_2 criteria provided within the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (OEH, 2005) at the discrete receptor locations. Based on this assessment the potential for the Project to result in adverse cumulative air quality impacts is considered to be low.

Traffic and Transport

Six cumulative projects were identified with potential to have a cumulative effect upon this section of the road network. The impact of the Level Of Service (LOS) for identified roads in the area was calculated. The LOS for the peak construction year remains unchanged when considering the relevant cumulative projects. Therefore no significant cumulative adverse traffic impacts are expected as a result of the Project.

Visual

The Project is considered to have limited potential to increase the significance of cumulative visual impact due to the relatively small scale of the Project and its proximity to existing and similar infrastructure on Kooragang Island, together with the wider occurrence of industrial infrastructure within the Newcastle Port facility. Therefore no significant cumulative visual impacts are expected from the Project.

Proposed Management and Mitigation Measures

Mitigation measures that have been identified to address potential risks identified during this EIS process have been collated and a series of measures for consideration by DP&I. These measures could be used by the regulator to inform the conditions of consent. The measures are contained within **Chapters 9 – 19** and are compiled within **Chapter 23 Proposed Management and Mitigation Measures**. The chapter also outlines how these measures would be implemented and monitored by IPL through the Construction Environmental Management Plan (CEMP).

Project Justification

The mining industry in the Hunter Valley represents a significant proportion of the NSW economy.

This industry is expected to grow at a rate of around 6% per annum over the next decade. Economic operation of the mines is reliant on a reliable source of AN. Currently AN for the Hunter Valley mines is sourced from one supplier within NSW. This single source leaves the supply vulnerable to supply chain problems. These problems could include the aging of the existing infrastructure and the environmental limitations placed upon it as well as the availability of AN from international sources.

IPL has considered a number of alternatives and options in order to meet the strategic need for a more reliable, sustainable and secure source of AN in the Hunter region. They have recognised that if this strategic need is not met, that there could be an adverse impact on the growth of the mining operations in the Hunter Valley and the direct and indirect economic benefit that this industry provides to NSW.

To address the strategic need, IPL examined three alternatives, namely, take no action, increase AN imports and construct a new AN plant. An examination of these alternatives against the Project objectives concluded that the most appropriate option for the Hunter region and NSW would be construction of new AN plant.

Options regarding the location of the new AN plant were also examined. A number of specific environmental, social, economic and infrastructure constraints were identified and three potential locations for the AN plant were evaluated. The result of this evaluation concluded that Kooragang Island was the most appropriate location for a new AN plant to service the strategic need in the Hunter region.

The evolution of the Project design has been driven by IPL's desire to put forward a 'world class' AN plant. Where possible the conclusions of the stakeholder and community consultation alongside the results of various technical studies have helped finalise the Project design, Project layout and construction methodology. The conclusions of a number of the technical studies show that the Project can be considered 'world class'.

After consideration of the alternatives and options above, the Project is considered to be only viable and sustainable option to secure the Hunter region mining industry's medium and long term AN requirements.

Conclusion

This EIS document provides a comprehensive assessment of the Project and includes investigations regarding all relevant technical, social, planning and environmental issues.

Potential adverse impacts arising from the Project have been identified in a variety of ways, including through the community consultation program, and then assessed. Arising from that assessment the identification of strategies to ensure that IPL can avoid, minimise and mitigate those identified impacts is a key part of the EIS process. Those strategies are identified throughout the EIS document and then collected in **Chapter 23 Proposed Management and Mitigation Measures** so that, if approved, IPL has a register of all of the measures undertaken to limit the impact of the Project.

The Project has, to the extent feasible, been designed to address the issues of concern to the community and Government. IPL has recognised, that this Project is being proposed at a time when the local community is sensitive to industrial operations of any kind, following the recent incidents on Kooragang Island. IPL has endeavoured to engage with the community to understand their concerns and questions and then has attempted to address all of those concerns in this EIS document attached.

This EIS has identified that the Project should proceed for four key reasons:

- First, because the Project will provide a safe, secure and sustainable supply of AN to Hunter Valley mines;
- Secondly, because the Project will provide significant local employment opportunities, particularly during the construction phase, and will result in both direct and indirect ongoing positive economic impacts for the local community and the NSW economy;
- Thirdly, according to the expert assessments, the Project can be undertaken in a manner which will not result in any unacceptable adverse safety or environmental impacts on the local community and the surrounding environment. If the project could not be undertaken in a safe manner , IPL would not propose it; and
- Lastly, the EIS has established that the Project not only satisfies current economic, safety and environmental standards and expectations but also satisfies ecologically sustainable development principles, such as intergenerational equity, which assess whether the Project is sustainable in the medium to long term.

On the basis of the studies detailed within the EIS, and with IPL's commitment to the implementation of the recommended mitigation measures, the Project is considered to be World Class, justified and worthy of approval.

1 Introduction

1.1 Project Outline

Incitec Pivot Limited (IPL) is seeking planning approval for the development of a Nitric Acid (NA)/Technical Grade Ammonium Nitrate (TGAN) facility (the 'Project') at Kooragang Island, Newcastle. The Project is required to service the needs of the growing mining industry in the Hunter Valley. Whilst not an explosive itself, Ammonium Nitrate (AN) is the main raw material used in the manufacture of commercial blasting products used by the mining, quarrying and construction industries. Projections have indicated that by 2012 AN demand will exceed local supply and there will be increasing levels of AN imports required to meet demand in the Hunter Valley. The Project would replace the need for imports and ensure that the expanding mining operations in the Hunter Valley are not unnecessarily constrained through an inadequate supply of this important product.

The Project would be located on the IPL site situated at 39 Heron Road, Kooragang Island within the Port of Newcastle, approximately 3 kilometres (km) north from the Newcastle CBD. Kooragang Island was developed in 1951 as part of the Hunter River Islands Reclamation Scheme. The scheme joined islands within the Hunter River with dredged sand and silt material. When this process was completed in 1960, the island was designated for industrial and port related activities.

The IPL site is located on the Lot legally described as Lot 3 on DP1117013. This Lot is approximately 36.8 hectares (ha) in size. A location plan of the Site and Lot 3 (the 'Lot') is presented in **Figure 1-1**. The Lot has been used as a fertiliser manufacturing facility since its development and was originally owned by Australian Fertilizers Ltd. IPL now owns the Lot through a wholly owned subsidiary, TOP Australia Ltd. It is currently used as a fertiliser distribution centre. This existing use is concentrated in the western portion of the Lot and comprises a number of industrial buildings and facilities such as storage tanks, as well as office buildings and associated infrastructure. The existing operation and the majority of the existing infrastructure would be retained alongside the Project and is located within the Site.

This Environmental Impact Statement (EIS) considers a range of environmental, safety, legal, social and economic impacts related to the Project. It assesses and describes the methods by which those impacts would be controlled, mitigated or offset to levels and standards which would ensure compliance with applicable legislative controls and which would be acceptable to regulators, and enable the facility to operate safely in the broader Kooragang and Newcastle communities.

The nearest residential properties are located at Stockton, approximately 800 metres (m) to the south east of the Site boundary. Residential properties are also located close by in Carrington to the south, Fern Bay to the north east and Mayfield to the west, approximately 1.5 km, 1.5 km and 2 km from the Site respectively. In addition, the Hunter Estuary Wetlands are located on the northern side of Kooragang Island approximately 545 m north east of the Site boundary.IPL is aware that the local community is likely to be sensitive to perceived hazards resulting from a project of this type following incidents at the Orica facility on Kooragang Island in 2011. In March 2012 the Office of Environment and Heritage (OEH) published the following release:

'Orica Australia has pleaded guilty in the NSW Land and Environment Court today for the pollution incident that impacted on residents of Stockton Newcastle, on 8 August 2011.

Orica has pleaded guilty to breaching its Environment Protection Licence in that it failed to operate its ammonia plant in a proper and efficient manner, an offence under section 64 of the Protection of the Environment Operations Act 1997.

Orica also pleaded guilty to failing to notify the EPA as soon as practicable after becoming aware of the incident, an offence under section 148 of the Protection of the Environment Operations Act 1997.'

Following this incident and resulting enquiry, changes were made to reporting requirements under the *Protection of Environment Operations Act 1997* (POEO Act). The Orica plant on Kooragang Island has since restarted production.

Therefore the views of the local communities in Stockton and the wider Newcastle area are important to consider in light of this Project. IPL has therefore sought to better understand the views and concerns of the local community through a community consultation program and has tried to acknowledge and address those concerns and questions within this EIS.

IPL believes that it can develop the Project in a manner which is sensitive to the community's concerns and which does not pose an unacceptable risk of safety to those local communities or the surrounding environment.

This Project is considered to be State Significant Development (SSD) for the purposes of the relevant NSW planning legislation as it falls within the requirements of Clause 10, Schedule 1 of the State Environmental Planning Policy on State and Regional Development. Specifically the Project falls within the category of chemical industry that would manufacture, store and use dangerous goods in such quantities that constitute the development as a major hazard facility. As such, this EIS has been prepared under the provisions of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to support the Proponent's application for planning approval.

1.2 The Proponent and Project Team

The proponent is Incitec Pivot Limited (IPL), whose head office is situated at Level 8, 28 Freshwater Place, Southbank, Victoria 3006.

The environmental planning and assessment work required for the Project is being managed and completed by URS Australia Pty Ltd (URS), c/o 407 Pacific Highway, Artarmon, NSW 2064.

IPL is an international manufacturer and distributor of chemicals, industrial explosives and fertilisers, which is listed on the Australian Securities Exchange. The IPL group includes the Dyno Nobel, Incitec Pivot and Southern Cross International businesses.

The main business in which the IPL group is engaged is the manufacture, transport, and sale (wholesale and retail) of fertilisers and explosives. The IPL group owns and operates a number of Ammonium Nitrate (AN) plants, and operates facilities in many parts of the world including Australia, the USA, South America, Asia and Europe. The company is a market leader in fertilisers and explosive manufacture.

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Source: Nearmaps 2011

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

Legend

- Site Boundary
- Lot and DP Boundary

N W E S

SITE LOCATION PLAN

URS

Figure: 1-1

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1.3 Project Components

The Lot is currently used as a fertiliser distribution centre. The structures relating to this activity and their current use will remain unchanged during construction and operation of the Project. The Project will involve the construction of a number of new structures and related infrastructure across the central part of the Lot. For the purposes of this EIS, this part of the Lot will be referred to as the Site.

The key Project components include the construction of:

- Additional pipe racks including an overhead connection to the proposed Newcastle Ports Corporation bulk liquids berth for Ammonia unloading;
- Ammonia Storage Tank;
- Nitric Acid (NA) Plant including an air compressor, gas heater, waste heat boiler, steam superheater, air heater, condenser, absorber tower, power generator and various catalysts;
- Nitric Acid storage tank;
- AN Plant including an ammonia vessel, neutraliser, flash drum, evaporator, remelt tank, prill tower and fluidised bed cooler;
- AN Solution (ANSOL) storage tank;
- AN Prill (ANP) bulk and bagged storages;
- Cooling water tower and pumps;
- Additives and coating agent storage;
- Waste concentrated ANSOL storage;
- Associated utilities and services;
- Associated infrastructure including new stormwater and wastewater systems as well as stormwater outfalls to the east of the Lot; and
- Associated buildings including a control room and laboratory, administration building and workshop and stores.

The key elements of the proposed works are outlined in **Chapter 4 Project Description**.

1.4 Terms and Definitions

Table 1-1 provides a summary of the terms used throughout this EIS.

Table 1-1 Summary of Key Terms and Definitions

Terminology used in this EIS	Definition
the Project	The Project is a proposal to construct and operate a Nitric Acid (NA)/Technical Grade Ammonium Nitrate (TGAN) Facility. The facility would be located on the existing IPL site on Kooragang Island. Additional piping would connect the facility to a Newcastle Port Corporation berth to allow importation of ammonia.
the proponent	Incitec Pivot Limited (IPL).
the proposed works	Actions relating specifically to the construction of the Project.
EIS	This document, known as the Environmental Impact Statement (EIS). The requirement for IPL to produce an EIS comes from Section 78A of the EP&A Act 1979. The form and content of an EIS is prescribed in Schedule 2 of the EP&A Regulation 2000.
the Lot	The Lot is the 36.8 hectare (ha) area of land on which the Site is located. It is legally described as Lot 3 on DP1117013 and its registered owner is TOP Australia Limited, a wholly owned subsidiary of IPL. The Lot is located in the south east of Kooragang Island between the north and south arm of the Hunter River.
the Site	The Site is that area of the Lot and surrounding lots upon which the works associated with the Project are to be carried out. The Site comprises approximately 34.02 hectares and includes the existing IPL Fertiliser Distribution Centre.
the study area	The area in which environmental studies have been undertaken to assist in assessing the potential impacts of the Project. The parameters of any study area will vary depending on the environmental study being completed.

1.5 State Significant Development Process

1.5.1 The Scope of this EIS

As a State Significant Development (SSD) (refer to **Chapter 6 Legislation and Planning Policy**), the Project is subject to the provisions of Part 4 of the EP&A Act, and accordingly, will be subject to assessment by the Department of Planning and Infrastructure (DP&I) and determination by the Minister for Planning and Infrastructure. The Minister may delegate this determination to the NSW Planning Assessment Commission (PAC).

On 1 December 2011 the DP&I issued Director General's Environmental Assessment Requirements (DGRs) for the Project pursuant to section 78A (8A) of the EP&A Act and in line with Section 51 and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). Those DGRs are provided in **Appendix A1** and a table cross referencing the DGRs and where they are addressed in this EIS can be found in **Appendix A2**.

The DGRs identified both general requirements and key issues which needed to be addressed in the EIS. The key issues comprised:

- Hazards & Risks;
- Air Quality & Odour;
- Noise & Vibration;
- Soil & Water;
- Greenhouse Gases;
- Transport;
- Waste;
- Surface & Groundwater;
- Visual;
- Flora & Fauna; and
- Heritage.

These key issues were investigated by IPL through targeted assessments by specialists in their fields in line with relevant guidelines and assessment requirements.

The Project team also identified other issues (refer to **Chapter 8 Environmental Scoping Assessment**) that could be considered important in the context of the Project and completed assessments of these accordingly. These technical assessments are presented and/or summarised in **Chapters 9 – 22** of **Volume 1** of this EIS. Where necessary the conclusions in these chapters are supported by a number of detailed assessments provided in **Appendices C – M** of **Volume 2** of this EIS.

The outcomes of these assessments have then been used to formulate the Proposed Management and Mitigation Measures (refer to **Chapter 23 Management and Mitigation Measures**) and to justify why the Project is needed and should be approved (refer to **Chapter 24 Project Evaluation and Justification**).

1.5.2 EIS Preparation and Exhibition

The objectives of this EIS are to:

- comply with the requirements of the EP&A Act and EP&A Regulation as formalised in the DGRs;
- provide the Minister for Planning and Infrastructure and the Minister's delegates at the Planning Assessment Commission (PAC) with sufficient information to assess the potential environmental impacts, confirm the mitigation measures required and understand the benefits of the Project; and
- inform the community about the Project. An active program of community engagement has been implemented throughout the preliminary planning process of the Project in order to maintain an active dialogue with the community and to ensure IPL fully understand their issues and concerns so they could be appropriately assessed and addressed. A full account of this process is included in **Chapter 7 Consultation** and **Appendix C Consultation Report**.

The EIS will be placed on exhibition for public review for a minimum period of 30 days, in accordance with Section 89F of the EP&A Act.

1.5.3 Assessment and Determination

Following exhibition of this EIS, DP&I will provide IPL with submissions, or a summary of the submissions, received during the exhibition period. IPL may then be required to provide a written response to the submissions that have been received.

DP&I will make the following documents publically available:

- the environmental assessment requirements;
- the development application, including any accompanying documents or information and any amendments made to the development application;
- any submissions received during the submission period and any response provided under clause 85A;
- any environmental assessment report prepared by the Director-General;
- any development consent or modification to a development consent;
- any application made for a modification to development consent, including any accompanying documents or information; and
- any documents or information provided to the Director-General by the applicant in response to submissions.

The Director-General will then prepare an Assessment Report for the Project that will take into account comments from relevant Government authorities as well as other stakeholders and the community. The Assessment Report will be provided to the Minister for Planning and Infrastructure, or their delegate, who will determine whether to recommend project approval. If granted, the project approval may include a number of recommended conditions of consent to which the proponent and Project would need to adhere.

1.6 Document Structure

Volume 1	*Executive Summary*	This summarises the key issues and findings detailed in the other parts of the EIS.
	Introduction	**Chapter 1** provides an outline of the Project, briefly outlines the environmental impact assessment process and introduces the various terms used throughout the EIS.
	Project Need and Alternatives	**Chapter 2** details the Project need and Project alternatives.
	Project Location and Existing Environment	**Chapter 3** provides a description of the location of the Lot and the Site and describes the existing environment.
	Project Description	**Chapter 4** provides a detailed description of the Project.
	Construction	**Chapter 5** provides detail of the construction methodology.
	Legislation and Planning Policy	**Chapter 6** includes the relevant controlling Commonwealth and State legislation and State and local policies. It identifies the licences and approvals required to enable the Project to proceed.
	Consultation	**Chapter 7** summarises the issues raised during consultation with the statutory authorities, other relevant Stakeholders, and the local community. The issues raised during the consultation process are addressed in the subsequent specialist chapters of the EIS.

	Environmental Scoping Assessment	**Chapter 8** provides an assessment of the potential environmental impacts of the Project and identifies the key issues for further assessment.
	Environmental Assessment	**Chapters 9 - 22** provide an assessment of the potential impacts of the Project and the identification of appropriate mitigation measures to safeguard the environment.
	Management and Mitigation Measures	**Chapter 23** details proposed environmental management and mitigation measures to safeguard against or minimise potential impacts.
	Project Evaluation and Justification	**Chapter 24** addresses the principles of Ecologically Sustainable Development (ESD) and the objects of the EP&A Act as well as providing a justification for the Project.
Volume 2	*DGRs and Application Documentations*	**Appendix A** contains the DGRs for the Project and a DGR response table outlining where each requirement has been addressed in this EIS.
	Licences	**Appendix B** presents the existing Environmental Protection Licence (EPL) and Workcover Licences for the Site and the current operations.
	Consultation	**Appendix C** describes the work that has been undertaken during the Project planning process to ensure that an active dialogue has been maintained between the proponent, the community and the relevant regulatory authorities. It also details issues raised during that process that are of concern to stakeholders.
	Technical Appendices	**Appendices D – M** contain technical appendices for the preliminary hazard analysis (PHA), transportation risk assessment, air quality and odour assessment, acoustic assessment, site investigation report, an assessment of surface water and waste water, greenhouse gas assessment, transport impact assessment, visual impact assessment, ecology and heritage assessment reports.

2 Project Need and Alternatives

2.1 Introduction

The EP&A Regulations require that this EIS identifies the objectives of the Project and provides an analysis of any feasible alternatives for the Project, including the consequences of not carrying out the Project. To meet this requirement, this chapter will outline the need for and objectives of the Project and discuss the alternatives that were investigated in arriving at the preferred Project design and location in order to meet the Project objectives.

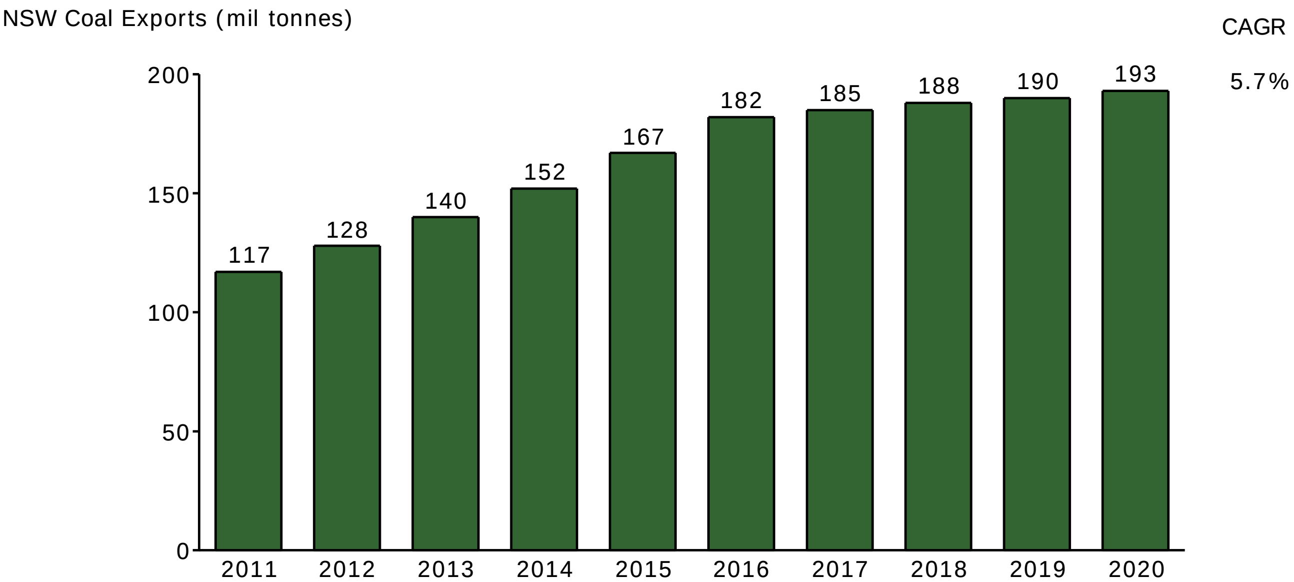
2.2 Strategic Need

Mining Growth in the Hunter Valley

Mining is one of the largest industries in Australia. The “Earnings Before Interest, Taxes, Depreciation and Amortization” (EBITDA) measure attributes 17.9 percent of Australia’s national earnings to mining and related industries[1]. As well as having ongoing significance to the national economy, mining and related industries are of significant importance to the economy of NSW.

The thermal coal operations in the Hunter Valley are large scale, high quality and low cost mining operations which have a long lifespan. The effect that mining has on the NSW economy is set to increase as Australian exports of thermal coal from the Hunter Valley region are forecast to grow at around six percent per annum over the next decade[2]. **Figure 2-1** shows the forecasted coal exports from NSW from 2011 through to 2020.

Figure 2-1 Forecast NSW Coal Exports



[1] Australian Bureau of Statistics (ABS) 2009/10 http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/D5FA0E97E0C7F421CA25789C0023E04A?opendocument
[2] Australian Government Data, RBS Equities.

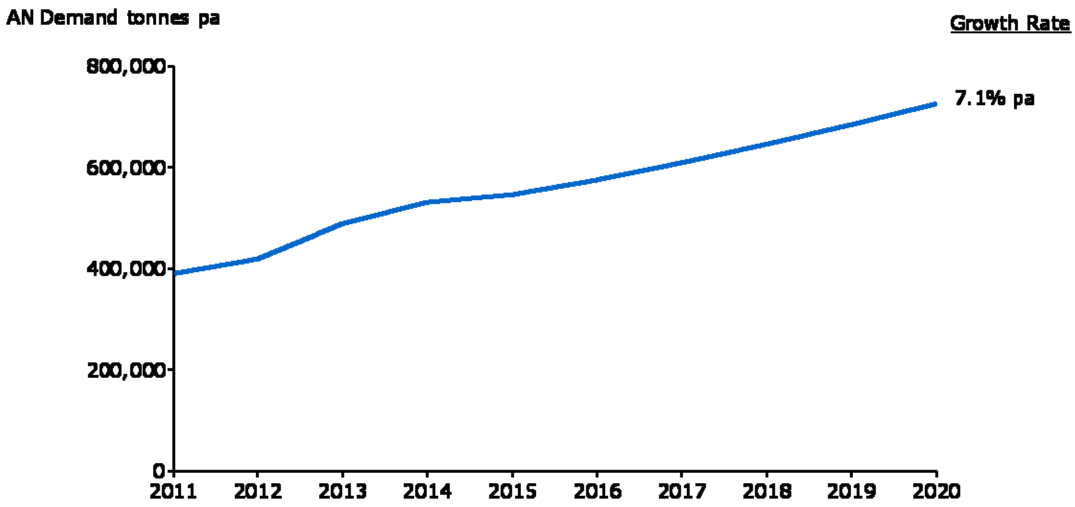
Mining Growth and AN Demand

Given this planned mining growth in the Hunter Valley region, the mining industry has a need to maintain an adequate supply of raw materials. These raw materials include AN, either in solid or liquid form. Technical Grade Ammonium Nitrate (TGAN) and Ammonium Nitrate Solution (ANSOL) are the main raw materials in the manufacture of commercial blasting products used by the mining, quarry and construction industries.

Total AN demand in NSW over the next nine years is expected to grow by around seven percent per annum along with the projected increase in mining in the Hunter region[3]. Equally it was recognised that the AN market is expected to move into deficit in 2012. Additional capacity and security of supply is required with expected increases in demand from the Hunter Valley thermal coal market likely to see supply shortages increase to around 165 - 200 kilo-tonnes per annum (ktpa) by the end of 2015[4].

Figure 2-2 shows the forecasted demand for AN up to 2020. This increase in forecast demand will result in increased imports of TGAN from 2012 as demand exceeds the supply capability of locally manufactured TGAN. ANSOL is not globally traded and therefore cannot be imported.

Figure 2-2 Forecast Total AN Demand for NSW



AN Supply and Constraints

The two methods by which TGAN is normally supplied to the mining industry in the Hunter region are:

1. by importing the product in break-bulk or shipping containers through either Newcastle or Sydney Ports; or

2. by purchasing locally produced TGAN from the Hunter region.

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[3] IPL Internal Data
[4] Goldman Sachs June 2012

Both of these methods are currently subject to limitations. The importation of TGAN is limited by five factors. These are:

1. **Supply Availability:**

— In 2011 the global production of TGAN was approximately 11.3 million tonnes[5].

— The majority of this production was consumed within the region in which it was produced. The volume of TGAN traded globally is relatively small at approximately ten percent of global production[6]. Producers have a preference to supply local consumers rather than export. Export volumes available from individual producers are small and producers are reluctant to commit to long-term supply contracts.

2. **Shipping Constraints:**

— TGAN cannot be shipped in bulk due to product quality being adversely affected by exposure to moisture and bulk handling equipment. TGAN must be bagged prior to shipment and shipped as either break-bulk or in containers.

— The number of ships that will carry TGAN is limited by:

- o Cargo compatibility issues;
- o Small cargo size; and
- o Port access restrictions.

3. **Port Access and Import Volume Restrictions:**

— Port access in Australia for break-bulk shipments of TGAN is limited to:

- o Port Alma in Queensland;
- o Newcastle in NSW; and
- o Kwinana and Port Hedland in Western Australia.

— The Port of Newcastle currently has an import volume restriction of 3,000 tonnes (t) per shipment.

4. **Storage Constraints:**

— Storage of TGAN is covered by the following regulations:

- o *Work Health and Safety Regulation 2011*;
- o *Explosives Regulation 2005*; and
- o *Protection of Environment Operations Regulation 2009*.

— Available TGAN storage capacity determines the frequency of import shipments and ultimately the volume that can be supplied to the market.

— Currently the storage capacity in Newcastle for IPL TGAN imports is limited to 4,060 t on Kooragang Island and 4,000 t in the rest of Newcastle.

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[5] British Sulphur - Ammonium Nitrates Market Outlook to 2020
[6] Global Trade Information Services

5. Customer Requirement for Security of Supply:

— In order to maintain coal output, the coal mine operators in the Hunter Valley require a reliable and consistent supply of TGAN.

— TGAN suppliers need to be able to respond at short notice to demand fluctuations due to market conditions, weather and mine conditions.

— A TGAN import supply chain, where it can take three to six months from time of order to delivery, cannot meet customer requirements for security of supply.

Based upon the current situation in relation to supply availability, shipping constraints, port access, import volume restrictions and storage constraints, TGAN imports into Newcastle are restricted to 60,000 to 80,000 tonnes per annum (tpa). This volume is insufficient to meet the future TGAN requirements of the Hunter Valley coal mining operations. TGAN import quantities are only able to meet short-term supply shortfalls and are not a reliable or long-term solution for meeting TGAN demand in the Hunter Valley.

Local TGAN production is also limited by the fact that there is only one supplier in the area and this supplier has a limited production capacity. The supplier in question had to close its ageing TGAN plant in late 2011 following a number of environmental incidents. After approximately six weeks of plant closure, the TGAN reserves in the Hunter Valley started to run low which in turn resulted in lower coal production for both the domestic and export markets. The existing supplier has only recently received regulatory approval for a modified expansion of its existing facility with a date for commencement of operations yet to be announced.

In response to the restrictions on importation and local production of AN, IPL has recognised that there is a strategic need for investment in an additional AN manufacturing capacity in the Hunter Region to reliably and competitively meet future customer requirements. This investment could potentially be achieved in a number of ways; therefore IPL formulated a number of objectives to guide the development of a preferred Project from a social, environmental, financial and technical perspective.

2.3 Project Objectives

The four Project Objectives that IPL used to help determine the nature, location and design of the preferred Project are:

1. ensure thermal coal production in the Hunter Region is supported to maintain the economic benefits to the local region and the State;
2. develop a sustainable and secure solution to meet the medium and long term market demand for AN in the Hunter region;
3. maintain a primary focus on safety by only considering a Project that would be considered by the relevant experts and regulators to present an acceptable level of safety for employees, the local communities and the environment; and
4. introduce competition into the AN market in the Hunter region.

These objectives were used to help evaluate a number of options for the Project before a preferred location and design was selected for assessment in this EIS.

2.4 Alternatives

2.4.1 Introduction

A number of alternatives were considered to meet the strategic need outlined above. First options regarding the Project itself were considered. Once it was established that a new AN Manufacturing Facility was the only viable option (given importation and existing manufacturing constraints), options regarding the location of a new AN manufacturing facility were considered. Finally a number of design options for the Project were considered. These options led to the Project which is proposed in this EIS and outlined in detail in **Chapter 4 Project Description**.

The process for consideration of alternatives and the various options evaluated are discussed below.

2.4.2 Project Alternatives

Option 1: Take No Action

An option was considered to take no action.

Discussion

This scenario would not allow for the planned expansion of the Hunter Valley mining sector as described in the preceding section. It is predicted that should mining continue to expand at the projected growth rate, there would be a shortfall in the AN needed to supply the mines. Should this option be pursued and no action be taken, it is likely that there would be a detrimental impact on the mining industry in the Hunter region. This impact would be felt at both the local and State level and may even impact the economy of the country. This option would not meet the Project Objectives outlined above and is not considered a viable option.

Option 2: Increase AN imports

Currently approximately 40,000 t of the AN used in the Hunter region mining industry is imported through the Ports of Newcastle and Sydney. In theory TGAN imports could be increased to meet some of the forecast increase in local demand.

Discussion

This option would eliminate the need to increase the local production capacity of TGAN in the short term and allow more TGAN throughput via the Port of Newcastle facilities. There is a possibility that this would have a positive impact on the port through the creation of new jobs in the area due to the increased utilisation of the port.

However there are a number of obstacles to the importation of more AN. These include:

1. The supply and logistical constraints outlined in **Section 2.2**, make it difficult to source, transport or store sufficient quantities of TGAN, from sources outside the Hunter region;
2. There are a limited number of export sources for large quantities of TGAN;
3. It is difficult to get TGAN exporters to commit to long term supply contracts due to fluctuations in the market elsewhere in the world;
4. There is a limited number of ships with the required safety and operational specifications to carry the TGAN to Australia;
5. Port restrictions at Newcastle limit the import shipment size to 3,000 t per shipment; and
6. TGAN storage is limited in the local region.

Whilst this option would potentially meet Project Objective 1 in the short term, it would not meet Project Objective 2 to provide a long term, secure and sustainable solution to the predicted shortfall in AN in the Hunter Valley. This option is best used to supplement existing AN facilities during periods of high demand or low production. Therefore this option does not satisfy the Project Objectives and as such is not considered viable in the medium to long term.

Option 3: Build a new AN manufacturing plant in the region

This option would involve building a new AN manufacturing plant in the Hunter region to meet the local demand.

Discussion

Development of a new AN manufacturing plant had the potential to satisfy all of the Project Objectives, in that:

1. This option would allow AN production to be increased in the Hunter region. This in turn would allow the forecast demand for AN in the region to be met in the medium and long term.
2. Any new plant would need to be built to high safety and environmental standards. This was considered possible and achievable. The location of a new plant and whether it could be safely constructed and operated was carefully considered. IPL's experience in other parts of the world indicated that the construction of an AN manufacturing facility that would satisfy requisite authorities in relation to safety was feasible and achievable.
3. This option would provide two AN manufacturers in the Hunter Region, which would increase the security of AN supply should production at one facility be reduced or stopped.
4. Development of a new plant by IPL would increase competition into the AN market in the Hunter Region, increasing market efficiency. This would help support economic outcomes in the thermal coal industry into the future.

Therefore it was concluded that this option met or had the potential to meet, all of the Project objectives and warranted further consideration and assessment by IPL.

2.4.3 Project Location Alternatives

Introduction

Locating a new AN manufacturing plant required a number of factors to be considered. The plant could, potentially, be located anywhere in the region. However, the design and viability of the plant, as well as the safety of its operation, requires access to certain infrastructure and resources.

Project Location Criteria

The decision to locate the new plant was assessed against the following nine criteria that reflect those requirements mentioned above:

1. safety of the plant in its proposed location;
2. access to ammonia;
3. accessibility of the plant for effective logistics from the source of the ammonia to the plant;
4. accessibility for effective logistics from the AN plant to the customers;
5. access to skilled labour;

6. the plant's capital and operating cost;
7. the availability of suitable industrial land;
8. the availability of site services (e.g. water and power); and
9. sales flexibility (domestic sales and/or product export).

These criteria are discussed below and are then used to assess a number of location options for a new AN plant. This assessment is shown below in **Table 2-1**.

The safety of the Project in each location was considered as a key factor. As noted in **Section 2.3**, a key objective of the Project was to ensure that a new plant could be built and operated safely in any potential location. Community consultation highlighted this issue as a key concern.

As discussed above, IPL's experience from other parts of the world indicated that construction and operation of an AN manufacturing facility that did not compromise the safety of the surrounding population or environment was feasible. It was noted that a specific Hazards and Risk study would be required in order to confirm this conclusion. The results of this more detailed Hazards and Risk analysis are presented in **Chapter 9 Hazards and Risk**.

A key driver for any decision on the location of the Project was based around access to ammonia. Ammonia is the principal feedstock for AN, and any AN plant requires security of supply of this critical input. Ammonia can either be transported to an AN plant (e.g. by pipeline, ship etc.) or can be manufactured at the same location, but in a separate plant, using natural gas as a feedstock. The possibility of constructing an ammonia plant as part of the Project was considered. The volume of gas required for a suitably sized ammonia plant is 6,400 terajoules per annum. Accordingly, for this option to be viable, a competitive, long term supply of a large volume of natural gas is required.

The current situation in the Hunter Valley in relation to supply of commercial quantities of gas is as follows:

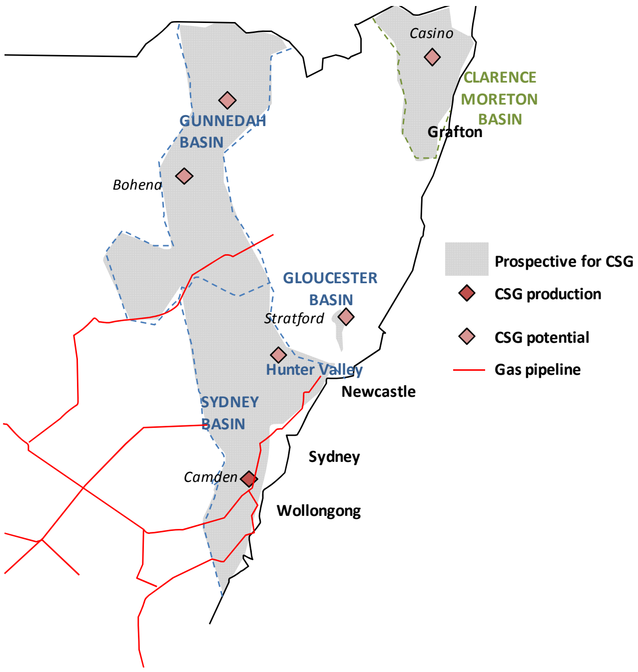
1. New South Wales currently imports the majority of its gas requirements via pipeline from South Australia, Victoria and Queensland. Current forecasts indicate that pipeline capacity into NSW may reach capacity in the short to medium term[7].
2. Coal seam gas is not available in the short to medium term. Whilst a number of potential sources of coal seam gas exist in NSW, none will be commercial within the decision timeframe for this Project. (refer to **Figure 2-3**). As part of the feasibility study, potential gas supply from existing Hunter Valley coal mining operations was assessed and the following was concluded:
   - the availability of gas from the coal mines is inconsistent and could not be guaranteed;
   - the timeline for availability of any gas is greater than five years; and
   - no single area can provide sufficient quantity of gas for viable ammonia production.
3. There is no existing gas pipeline infrastructure in the upper Hunter Valley. Without pipeline infrastructure it is not possible to import gas into the upper Hunter Valley.

[7] Gas Statement of Opportunities, AEMO, 2011

4. A new natural gas storage facility located at Tomago is currently under construction and forecast to be operational in 2015. The facility has a storage capacity of 1,500 terajoules of LNG. The facility has been built as buffer capacity to ensure continuity of gas supply to Newcastle, during periods of seasonal demand variability and supply disruption. The facility does not increase the overall supply volume or competitiveness of gas to NSW customers. This facility was not considered to be a viable source for consistent supply of a large volume of natural gas for an ammonia plant.

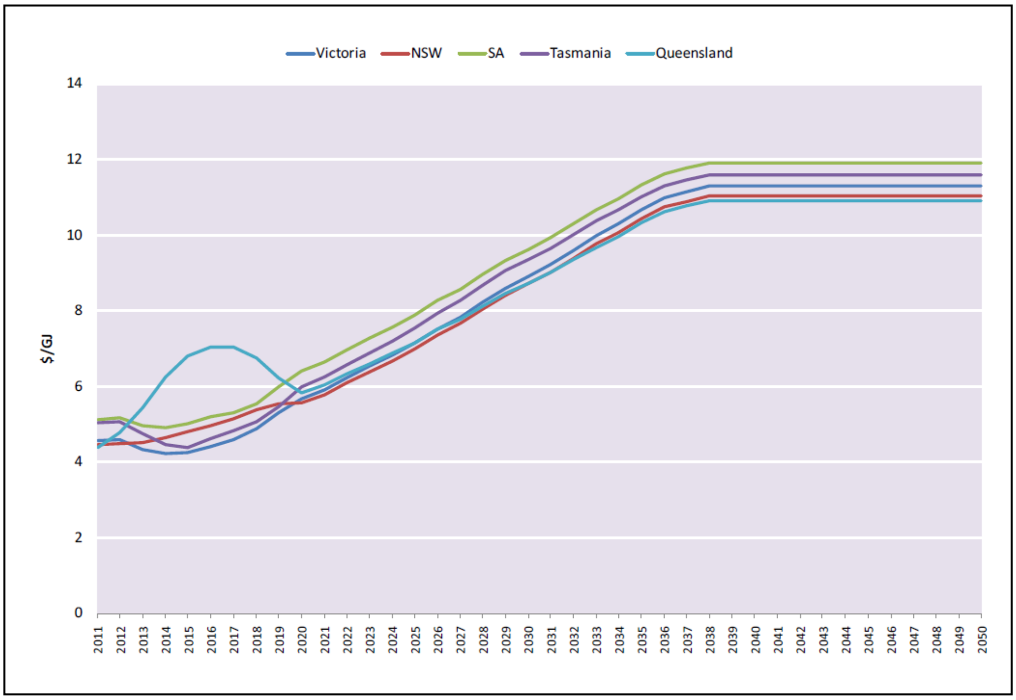
5. Australian gas suppliers are unwilling to enter into long term domestic supply contracts at competitive rates for large volumes of natural gas. Gas prices in Australia are high relative to global prices, and are expected to increase further as major Australian gas suppliers focus on developing their gas reserves for export LNG projects. This situation applies more broadly across all of Eastern Australia. The capital cost for an ammonia plant is high and requires a long term, competitive gas supply to be economically viable. Typically ammonia plants are built in regions where long term gas cost is <US$3 per gigajoule (GJ). As shown in **Figure 2-4**, gas prices in Eastern Australia are currently >US$4 per GJ and are forecast to increase.

Figure 2-3 Gas Pipeline Infrastructure and Potential CSG Projects in NSW[8]



[8] Source: NSW Department of Primary Industries

Figure 2-4 Forecast Gas Prices Across Eastern Australia[9]



For these reasons ammonia manufacture is practically and economically not possible and was not considered further for the Project.

This means that ammonia would need to be sourced either from an existing ammonia plant with spare capacity or by importation via ship. Once sourced it would need to be transported to the Site, unless the new AN plant was located at the same location as either the ammonia plant or the port.

NSW does not currently have any existing ammonia plants with sufficient, available capacity to provide enough ammonia to ensure that IPL's proposed new AN plant would be viable. The most viable option is, therefore, to import ammonia and either:

1. store ammonia at the port and transport it to a new AN plant close to the customers; or

2. locate the AN plant adjacent to the port storage facility and transport the AN to the customers.

To import ammonia, specialised ships are used which require access to deep water ports. Equally, ammonia needs to be moved directly from the ship to a storage facility before being transported or used. This means that an ammonia storage facility is required at the port.

Three deep water ports exist in NSW at Sydney, Wollongong and Newcastle. To meet the criterion for accessibility for effective logistics from the source of the ammonia to the plant, Newcastle Port was the obvious choice, due to its proximity to the Hunter region and because ammonia is already imported at this location. Using either of the other ports would involve significant truck movements to transport the ammonia (a potential transport hazard) or development of a new pipeline (with its associated environmental and economic implications).

[9] Source: Australian Treasury (2011) Carbon Pricing and Australia's Electricity Markets, SKM MMA

Ammonia is a gas at room temperature and must be continuously refrigerated or pressurised in order to be transported by road as a liquefied gas. A traffic accident during transport of ammonia, could lead to a potentially toxic gas leak. TGAN is transported as solid prills and is not as hazardous as ammonia if spilt in a traffic accident. Accordingly from a safety viewpoint, the transport of TGAN is considered less hazardous and therefore preferable to the transport of ammonia.

Consideration of three locations

Given the criteria and discussion above, IPL identified and then assessed three locations for siting the Project:

1. **Kooragang Island** – If the Project was built in this location, it would be adjacent to the ammonia storage facility at the port and would result in AN being transported to the Hunter region.
2. **Hunter Valley** – If the Project was built here it would be close to the customer base and would result in ammonia being transported by truck from the ammonia storage facility at the port.
3. **Tomago** – If the Project was built here it would involve transporting ammonia from the ammonia storage facility at the port by truck or by a new pipeline to the Project, and then transporting AN to the Hunter region.

To assess each of these options the nine criteria above were considered for each location. A qualitative judgement was made in each case. This judgement was based on a relative assessment between the three alternative sites.

Table 2-1 below presents the results of this of the alternative sites assessment.

Table 2-1 Consideration of Project Location Options

Criteria	Kooragang Island	Hunter Valley	Tomago
1. Safety of the plant in its location	Prior to completing a detailed Hazards and Risk analysis, IPL believed that it was possible to safely construct and operate the Project on Kooragang Island. This would be confirmed through completion of more detailed studies.	Prior to completing a detailed Hazards and Risk analysis, IPL believed that it was possible to safely construct and operate the Project in the Hunter Valley. This would be confirmed through completion of more detailed studies.	Prior to completing a detailed Hazards and Risk analysis, IPL believed that it was possible to safely construct and operate the Project in Tomago. This would be confirmed through completion of more detailed studies.
2. Access to ammonia	Ammonia import via pipeline onto the Kooragang Island site.	Ammonia import via pipeline onto the Kooragang Island site.	Ammonia import via pipeline onto the Kooragang Island site. Ammonia cannot be imported directly onto a Tomago site due to insufficient draft in the north arm of the Hunter River.
3. Accessibility for effective logistics from the source of the ammonia to the plant	This is the most efficient and lowest risk option with ammonia being transferred via a short pipeline.	Ammonia has to be transported via truck from Kooragang Island site to Hunter Valley plant. A large number of Ammonia truck movements would introduce a greater level of transportation risk to the Hunter Region.	Ammonia has to be transported via truck or pipeline from port to plant. The pipeline would have to go through or around the Hunter Wetlands National Park. A large number of Ammonia truck movements would introduce a level of transportation risk to the roads around Newcastle and Tomago.

Criteria	Kooragang Island	Hunter Valley	Tomago
4. Accessibility for effective logistics from the TGAN plant to the customer	TGAN to be transported via truck utilising the upgraded Hunter Expressway.	TGAN to be transported locally via truck.	TGAN to be transported via truck utilising the upgraded Hunter Expressway.
5. Access to skilled labour	The City of Newcastle provides good access to skilled labour.	Skilled labour from outside the Hunter Valley will be required.	The City of Newcastle provides good access to skilled labour.
6. Capital and operating cost	This option is an integrated site and provides the lowest capital and operating cost.	Construction and operations on two sites leads to higher capital and operating cost.	Construction and operations on two sites leads to higher capital and operating cost.
7. Land availability	IPL own a suitably zoned industrial site on Kooragang Island with existing operations which complement the Project.	Availability of suitably zoned land is uncertain.	Land is likely to be unsuitable as it located on Tomago Sandbeds which provide about 20% of lower Hunter's drinking water.
8. Site services availability (water and power)	Water and power are available at this location.	Water availability is uncertain. Power is available at this location.	Water and power are available at this location.
9. Sales flexibility (domestic and/or export)	The proximity of the site to the road network and port provide flexibility for domestic sales or international export of TGAN.	The site has access to the road network but TGAN would need to be trucked to port for international export.	The proximity of the site to the road network and port provide flexibility for domestic sales or international export of TGAN.

Following a consideration of all three sites against the criteria outlined above, and after considering objectives and conclusions of the Options Analysis presented in **Section 2.4.2**, Kooragang Island was selected as the preferred site for the following reasons:

1. The Site is located in an existing industrial area, is owned by IPL, has suitable land available and contains existing usable infrastructure.
2. The Site would be an integrated production facility with the majority of products transported off-site being finished products, TGAN and ANSOL.
3. The Site is connected to existing utility services such as water, natural gas and power supply with adequate supplies of each being available for the Project.
4. The Site, being located in Newcastle, has good access to skilled labour.
5. The Site is close to the Port of Newcastle and the proposed NPC bulk liquids berth. Its location also allows for import of large plant components during construction as well as export of excess AN to international markets while minimising traffic movements.
6. Building the Project in this location has lower capital and operating costs than an inland site. In addition it also does not involve building a standalone ammonia storage facility at the port and transporting large quantities of ammonia via truck or pipeline from the port to either Tomago or the Hunter Region. Ammonia is a dangerous good, requires purpose built trucks for transport and the transport of ammonia presents a greater risk to public safety than the transport of TGAN or ANSOL.
7. A single integrated production facility on Kooragang Island means that safety and environmental issues can be managed more effectively.

8. The distance from the Site to the nearest residential community is expected to ensure that there is not unacceptable risk to the local community. This expectation was confirmed by the assessments discussed in **Chapter 9 Hazards & Risks**.

2.4.4 Project Design Alternatives

Given that the preferred location for the Project is at Kooragang Island, IPL considered designing an appropriate facility for the Site. This involved the selection of appropriate plant technology. This is discussed in more detail below.

Technology Selection Criteria

IPL undertook an objective based review to select the preferred NA and AN plant technologies. The choice of technology was assessed against the following six criteria to ensure that plant safety and performance was consistent with world class standards:

1. process safety risk;
2. plant environmental risk;
3. plant efficiency;
4. capital cost of the plant;
5. operating cost of the plant; and
6. integration of the plant.

Based on these six criteria, IPL selected dual pressure technology for production of nitric acid and pressurised, recirculated, neutralisation technology for production of AN.

Implementation of the Project would utilise a fully integrated world class solution including technology, engineering, procurement and construction. This fully integrated approach for the AN plant and the associated NA plant infrastructure, facilitates IPL taking a holistic approach to the overall project design and implementation.

Mono vs Dual Pressure

A key technology choice was the selection of the NA plant. Two proven technologies were considered for the NA plant:

1. mono pressure; and
2. dual pressure.

Most NA plants currently operating in Australia are mono pressure plants. Dual pressure NA technology is newer improved technology which has a number of environmental and operational advantages when compared to mono pressure systems. These benefits include:

1. **Lower consumption of key raw materials**, i.e. ammonia and platinum catalyst. Lower consumption provides both an operating cost and an environmental benefit. More efficient ammonia consumption means that per tonne of AN, less ammonia is used and by-product emissions are reduced. In addition, less ammonia is purchased and transported resulting in a lower overall carbon footprint.

2. **Longer run times and fewer shut downs**. This provides both an operating cost and environmental benefit. Nitrogen oxide (NO_x) emissions are higher during shut downs and start ups. Fewer shut downs and start ups means lower NO_x emissions. Fewer shut downs and start ups also helps provide for a safer working environment due to less frequent maintenance activity on the Site.

3. **Lower power consumption**. The addition of a generator to the dual pressure plant means that the excess steam produced can be converted to electrical power to be used on-site. This minimises the purchase of external power as well as minimising the environmental impact and carbon footprint of the operation.

4. **Product Quality**. The dual pressure process also helps lower the nitrogen dioxide (NO_2) content in the NA produced.

However, dual pressure NA technology has a significantly higher capital cost than mono pressure systems. As such, the environmental and operating benefits above had to be weighed against this increased capital cost.

After an assessment by the Project team of the benefits versus the capital cost, the team decided to move forward with dual pressure technology, notwithstanding the cost, because of the significant environmental and operational benefits.

Ammonium Nitrate Reaction

When selecting an ammonium nitrate plant design, there are a number of choices to be made, the first one being the type of reactor, i.e. pipe reactor or recirculation reactor. Pipe reactors are commonly used for smaller plant capacities and a recirculation vessel for larger capacities. Recirculation reactors are more widely designed by the ammonium nitrate technology suppliers. This type of technology is used to allow a safe operating window in terms of temperature, composition and solution pH.

The reaction pressure has to be selected to ensure that the reaction runs at low temperature and low Ammonium Nitrate Solution concentration. On the other hand, the steam pressure is maintained high enough to make it valuable contributor of process steam to heat and vaporise several process streams in the plant. The higher pressure reaction system is therefore valuable contributor to making this process energy efficient.

After assessment by the Project team of the process safety and energy efficiency offered by this recirculation high pressure neutraliser technology, the company decided to move forward with pressurised recirculating reactor technology for the ammonium nitrate manufacturer.

Reduction in Water Consumption

A number of measures to reduce water demand were also considered as part of the design process. The ongoing cost of potable water for the Project is predicted to be a significant cost. Therefore a number of options were considered. The most viable of these was to use water from the Hunter Estuary to cool the Project components instead of using a Cooling Tower Package. Relatively cool water would be pumped out of the south arm of the Hunter River and would be put through a number of heat exchangers to remove heat from the Project's process water. The warmed water would then be returned to the river at a higher but acceptable temperature. After a number of preliminary investigations and consultation with Environmental Protection Agency (EPA), it was decided that this approach had too many environmental constraints to meet regulatory requirements. Therefore a Cooling Tower Package was chosen as the preferred design.

Other Technology Options

Other technology options have also been included as part of the evolving design to account for potential biophysical, environmental, economic and social constraints. These include:

1. Primary and secondary abatement technologies to limit the generation of the greenhouse gas - nitrous oxide (N_2O). It is estimated that these technologies would reduce the N_2O emissions by up to 93% below those for an uncontrolled plant. This reduction represents the Best Available Technology and is benchmarked against other similar facilities as part of the assessment within **Chapter 14 Greenhouse Gas**;
2. A Selective Catalytic Reduction (SCR) process downstream of the tail gas expansion unit to treat NO_x emissions;
3. Provision of a start-up heater for the NA plant NO_x abator to reduce NO_x emissions during start ups;
4. Provision of a number of scrubbers at different stages of the process to remove particulate matter and ammonia emissions; and
5. Provision of a flare system to safely treat ammonia vent emissions.

Other smaller measures have been included in the Project design to help reduce water consumption. Key amongst these is the continued reuse of water in the process and cooling towers and the collection of condensate from certain processes to minimise the production of demineralised water.

Construction Options

In addition to the evolution of the design, IPL also assessed two construction options:

1. Construction of the Project components on-site; or
2. Delivery of pre-fabricated modules.

Construction of the various Project components on-site would have involved a larger number of deliveries to and from the Site during construction. This option would have potentially resulted in increased waste generation during construction, larger construction laydown areas, more equipment, a longer construction timescale and potentially louder and more frequent noise which may have an impact on the local community.

After preliminary investigations and community consultation, it was decided that traffic was a key issue on Kooragang Island and noise was a key issue for the community in Stockton. Therefore to reduce construction traffic, construction timescales, potential waste and potential noise impacts, a modular approach to construction of the Project was chosen.

Ecology Considerations

An ecological survey of the Lot was completed on the 31 August 2011 (refer to **Chapter 18 Ecology**). This survey identified few ecological constraints on the Lot. The only habitat of any value was the mature Morton Bay Fig Trees (*Ficus* sp.) along the eastern boundary of the Lot bordering Greenleaf Road.

Following this survey the concept design for the Project was reviewed. This review identified that a new road entrance onto the Site was being considered, and that its construction would involve the removal of some of these trees. Following discussions with IPL, the design was changed and all the mature Morton Bay Fig Trees have been retained.

2.5 Conclusions

IPL has considered a number of options in order to meet the strategic need for a more reliable and secure source of AN in the Hunter region.

IPL has recognised that if this strategic need is not met, there could be an adverse impact on the growth of the mining operations in the Hunter Valley as well as direct and indirect economic benefit that this industry provides to NSW.

To address the strategic need, IPL examined three viable options, namely, take no action, increase AN imports or to construct a new AN plant. An examination of these options against a set of objectives concluded that the most appropriate option for the Hunter region and NSW would be construction of a new AN plant.

Options regarding the location of that new AN plant were then examined. A number of specific safety, environmental, social, economic and infrastructure constraints were identified and three potential locations for the AN plant were evaluated. The result of this evaluation concluded that Kooragang Island was the most appropriate location for a new AN plant in order to safely and effectively service the strategic need for AN at mining operations in the Hunter Valley region.

The evolution of the Project design at Kooragang Island has been driven by IPL's desire to put forward a world class AN plant. In coming up with the final Project design, project layout and construction methodology, IPL has considered the feedback obtained through stakeholder and community consultation as well as the results of the various expert technical studies. The key issues raised as a result of the stakeholder and community consultation are presented in **Chapter 7 Consultation**.

After consideration of the options above, and the various expert studies discussed throughout this EIS, the Project presented in this EIS document is considered to be a viable, safe and sustainable option to secure the Hunter region mining industry's medium and long term AN requirements.

3 Project Location and Existing Environment

3.1 Introduction

This chapter provides a brief description of the location and history of the Site along with a description of the existing environment in the local area. The chapter includes a description of:

- where the Project is located;
- existing environment on the Lot;
- location of the Site within the Lot and surrounding lots; and
- a summary of the existing environment of the surrounding area.

3.2 The Lot and the Site

The Lot is located on the south eastern end of Kooragang Island, north of Walsh Point, within the City of Newcastle. The Lot boundary is outlined in blue in **Figure 3-1**. The Lot is legally known as Lot 3 on DP1117013 and is approximately 36.8 hectares (ha) in size. The Lot is owned by TOP Australia Ltd, a wholly owned subsidiary of IPL.

The Lot is approximately 3 kilometres (km) from the Central Business District (CBD) of Newcastle, NSW and approximately 800 m from the suburb of Stockton. A location plan showing the context of the Lot in relation to the surrounding areas is provided in **Figure 1-1**. A more detailed plan showing the existing facility on the Lot and surrounding land uses is provided in **Figure 3-1**.

The part of the Lot on which the majority of the Project would be constructed and operated is referred to as the Site. The Site is outlined in red in **Figure 3-1**. It includes a large area that at present does not have any specific purpose. This part of the Lot is bordered by a number of trees along the eastern boundary.

The north west part of the Lot is occupied by South Spur Rail Services Pty Ltd for P&O operations and not subject to any proposed works and therefore has not been considered for the purposes of this EIS. The use of this area would remain unchanged.

In addition, a small part of the Lot in the south is occupied by Air Liquide Australia Ltd. This operation would not be affected by the Project. Therefore this area has not been considered within this EIS and this operation is excluded from the Site.

3.3 Lot History

The reclamation of Kooragang Island began with a NSW Government public works scheme called the Hunter River Islands Reclamation Scheme which started in 1951. The islands within the Hunter River delta were joined together with dredged sand and silt material in a process that was completed in 1961. Since the completion of the land reclamation, Kooragang Island has been used for industrial purposes. The first landowner on this part of Kooragang Island was Australian Fertilizers Ltd. The industrial heritage of the Island has played a key role in the development of the region and in shaping the neighbouring communities of Newcastle, Mayfield and Stockton. A more complete history of Kooragang Island is provided in **Appendix M Heritage Impact Assessments**.

In 1964 Greenleaf Pty Ltd (Greenleaf) began to use the Lot commercially as the first tenant on the newly created Kooragang Island. In 1966 rock grinding operations and sulphuric and phosphoric acid plants were commissioned on the Lot.

In 1969 Greenleaf built and commissioned a high analysis phosphorus fertiliser plant adjacent to the Eastern Nitrogen Ltd site, using ammonia from that site to produce Mono Ammonium Phosphate and Di Ammonium Phosphate fertilisers.

The Lot continued to be used in this manner for 30 years from 1969 to 1989 when production of phosphoric acid and high analysis phosphorus fertilisers ceased. In September 2009 the Rock Mill was decommissioned.

Since this time, the Lot has been in constant use in its current form as a primary distribution centre for the proponent.

In compiling this EIS, URS requested from the NCC on 19 August 2011, copies of all records of Development Applications and building approvals for the Lot. That search identified the following applications and approvals. The first two numbers indicate the year in which the application or approval was issued, withdrawn or approved:

- 99/0901 – Demolition of existing double storey skillion addition and erection of two storey addition to existing fertiliser manufacture plant (approved);
- 99/2770 – Alterations and additions to an existing industrial building to accommodate the receival, repacking, storage and bottling of gas refrigerants (approved);
- 00/1570 – Upgrading of the distribution and packaging of fertilisers, erection of a weigh bridge and additions to existing buildings (approved);
- 01/2513 – Erection of a heavy vehicle filling and repackaging plant for existing aqueous ammonia storage (approved);
- 01/2514 – Construction of a new tanker loading facility (approved);
- 05/1111 – Demolition of building and external equipment (approved);
- 06/2260 – Subdivision of one lot into three (approved);
- 07/0686 – Demolition of buildings including change room, workshop, control room and compressor house (approved);
- 08/1046 – Industrial storage and distribution warehouse (refused); and
- 11/0060 – 2 Lot Subdivision (withdrawn).

There are a number of existing development consents for the Site. Upon approval of the Project, IPL would seek to consolidate any consents where necessary.

Source: Aerial Imagery - Nearmaps 2011

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PROPOSED AMMONIUM NITRATE FACILITY

CURRENT SITE LAYOUT

URS

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Figure: 3-1

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3.4 The Site and Existing Operations

The part of the Lot referred to as the Site is currently used as a primary distribution centre (PDC) by IPL. This existing facility is operated by IPL and all consents and licences are in the name of IPL. The Site currently receives and stores solid fertilisers, before blending, bagging and dispatching both bulk and bagged fertiliser. This existing operation currently handles approximately 155,000 tonnes of product per annum (tpa) and dispatches this material in both 25 kilogram (kg) bags and Flexible Intermediate Bulk Containers (FIBCs).

Bulk operations are performed in two interconnected bulk sheds that are approximately 18 m high and which are located in the approximate centre of the Site. Bagging operations are performed in a dedicated bagging shed on the Site. Extensive conveyor systems exist for both bulk shed and bagging operations to transport materials around the Site. Within the bulk sheds, bulk tippers are located that discharge product into bulk storage bays. From the storage bays, product is loaded with front-end loaders via hoppers into blending units. The load out building on the Site is approximately 10 m high and has access to allow product to be prepared for removal from the Site via road transport.

In addition to fertiliser, the PDC stores, handles and dispatches approximately 20,000 tpa of Sulphuric Acid (via road tanker) and 20,000 tpa of Technical Grade Ammonium Nitrate (TGAN). Bulk Sulphuric Acid is imported by ship, unloaded at Kooragang Island berth and transferred by pipeline into three large storage tanks located on the Site.

The Site comprises a complex of ten main buildings that are shown on **Figure 3-1**. These buildings are as follows:

- Bagging/Storage Warehouse;
- Shed 1: Bulk Storage – 25,000 tonnes (t) of Bulk High Analysis Fertiliser;
- Shed 2: Bulk Storage – 20,000 t of Bulk High Analysis Fertiliser;
- Shed 3: Bulk Storage – 15,000 t of Bulk High Analysis Fertiliser;
- Shed 4: Dangerous Goods (DG) Storage – 2,000 t of TGAN;
- Shed 5: DG Storage - 2,060 t of TGAN;
- Central Office - Customer service, dispatch and management offices;
- Granulation / Rock Grinding Plant (currently decommissioned);
- Rock Mill Control Room (currently decommissioned); and
- Seminar Centre – Management offices and training room.

The existing operation typically operates a single shift daily from 7 am to 4:30 pm, five days per week. Occasionally these hours are extended to accommodate seasonal fluctuations in market demand. Security guards operate permanently on the Site, twenty four hours a day, seven days a week.

In addition, a separate section of the Site is occupied by Scott Corporation Pty Ltd and used a transport depot for Chemtrans operations and IPL's Big N operations.

The IPL operations on the Site are subject to an existing Environmental Management strategy that regulates the potential impact of the current Site activities. The existing Environmental Management strategy ensures that the existing facility complies with the requirements of the Environmental Protection Licence (EPL).

3.5 The Surrounding Area

3.5.1 Surrounding Land Uses

Since its creation Kooragang Island has been used predominantly for industry and port related activities, and these uses remain today. The importance of the area for these uses is highlighted by its zoning as part of the Three Ports Site within *State Environmental Planning Policy (Major Development) 2005*. Most of the buildings on Kooragang Island are industrial in nature. Industrial buildings also make up a key feature of the wider area to the south and west of the Lot.

The industrial operations surrounding the Lot include:

- to the south, an Ammonium Nitrate Facility operated by Orica Australia Pty Ltd;
- to the west and east, beyond Heron and Greenleaf Roads, the land is owned by Newcastle Port Corporation. The Corporation sublets lots to various third parties including:
  - P&O Ports Ltd;
  - Sawmillers Exporters Pty Ltd;
  - Cement Australia Pty Ltd;
  - Westham Dredging Pty Ltd;
  - Transfield;
  - Kooragang Bulk Facilities Pty Ltd; and
  - Hydro Aluminium.
- to the north, Eastern Star Gas Ltd (now Santos) has recently purchased from IPL a vacant parcel of land.

The Hunter Wetlands National Park is located to the north end of Kooragang Island, approximately 545 m from the Site. The wetlands were listed as a Ramsar site on 21 February 1984 (Ramsar site number 287). The Ramsar Convention is an international treaty for the conservation and wise use of wetlands and their resources. Consideration of the Ramsar site and other wetland areas is provided in **Chapter 18 Flora and Fauna (Ecology)**.

3.5.2 Residential Areas

The nearest residential properties are located at Stockton, approximately 800 m to the south east of the Lot boundary. Stockton is located on the opposite side of the harbour from Newcastle CBD. According to the 2011 census, it is home to approximately 4,200 residents[1].

Other residential areas are located approximately 1.5 km to the north east in Fern Bay and 2 km to the south west in Mayfield. Fern Bay is a mixture of low-density semi-rural residences with some recent subdivisions. Mayfield was home to approximately 9,070 people at the time of the 2011 census[2].

[1] http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC12159?opendocument&navpos=220
[2] http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC11492?opendocument&navpos=220

3.5.3 The Existing Road Network

The Lot is bordered on its eastern and western sides by Greenleaf Road and Heron Road respectively. These roads are owned and managed by Newcastle Port Corporation (NPC). Neither road is a classified road and so both are considered private roads.

Kooragang Island is served by State Highway 121 which enters the island via bridges to the north east and north west of the Lot. To the north east, Teal Street and Nelson Bay Road cross the Stockton Bridge over the north arm of the Hunter River while to the north west, the Tourle Street Bridge crosses over the south arm of the Hunter River. Cormorant Road transects Kooragang Island, linking the Stockton and Tourle Street bridges. The Lot is currently accessed from Heron Road which leads off Cormorant Road. Greenleaf Road connects to the end of Heron Road, before connecting with Teal Street to the north of the Site.

3.5.4 Other Proposed Developments

As noted above, Kooragang Island and its surrounding areas have had industrial and port related land uses for a number of decades. Whilst the type of industry has changed, the recent expansion of the mining operations in the Hunter Valley has meant that activity at the Port of Newcastle and the associated infrastructure has continued to grow and develop. Notable proposed developments in the local area include:

- Dredging and remediation of the Hunter River c/o Newcastle Ports Corporation;
- Kooragang Coal Loader Project c/o Newcastle Coal Infrastructure Group;
- PWCS Coal Loader Expansion T4 Project c/o Port Waratah Coal Services Ltd;
- Orica Expansion Project c/o Orica Australia Pty Ltd;
- Newcastle Gas Storage Facility c/o AGL Energy Ltd; and
- Bulk Fuel Storage and Dispatch Facility c/o Marstel Terminals Newcastle Pty Ltd.

The potential impact of these various developments when considered alongside the Project has been assessed where relevant and summarised in **Chapter 22 Cumulative Effects**.

4 Project Description

4.1 Introduction

This chapter provides an overview of the key components of the Project along with a detailed description of each of the associated activities. It includes:

- an overview of the Project;
- a description of the Project components and the Ammonium Nitrate (AN) manufacturing process;
- a description of the associated Project infrastructure; and
- approximate staff requirements, operating hours and transport movements.

The location of the Project has been described in detail in **Chapter 3 Project Location and Existing Environment** and is shown in **Figure 3-1**. The Project has been located and developed following consideration of a number of factors, which are outlined in **Chapter 2 Project Need and Alternatives**.

4.2 Project Overview

Incitec Pivot Limited (IPL) is proposing to construct and operate a new AN Plant on Kooragang Island, Newcastle including Nitric Acid (NA), Ammonium Nitrate Solution (ANSOL) and Technical Grade Ammonium Nitrate (TGAN) manufacturing facilities to produce approximately 350,000 tonnes per annum (tpa) of AN for sale to customers.

The Project would be located on the Site, located on Kooragang Island, NSW. The existing IPL, Air Liquide, Chemtrans and P&O operations on the Lot would be retained, with the Project being located on unused land on the centre and east of the Lot.

Ammonia would be the primary feedstock for the process of AN manufacture. The Project proposes to import ammonia by ship. Specialist ships would unload ammonia via a new pipeline and unloading arm at the new NPC bulk liquids unloading berth located adjacent to berths K2 and K3. The bulk liquids berth is being developed by Newcastle Port Corporation as part of its broader Port development program to support both existing and proposed operations on Kooragang Island and surrounding areas.

Ammonia from the bulk liquids berth would be piped onto Site and stored in a new ammonia storage tank. The imported supply of ammonia would be supplemented via road tankers from existing IPL ammonia manufacturing facilities in Queensland. The ammonia would then be used as a feedstock to produce NA in a new NA Plant. The ammonia and NA would then be used to produce ANSOL in a new ANSOL Plant. This ANSOL would be either used to produce TGAN or stored as ANSOL for transport by truck to IPL's Warkworth facility. TGAN would be stored on-site as prill and transported by truck to customers mainly in the Hunter Valley. The ammonia storage and road tanker facilities would also be utilised to meet regional farming requirements.

Figure 4-1 shows the proposed Site layout for the Project. **Figure 4-2** presents a more detailed view of the key Project components. **Figure 4-4** provides a graphical illustration of the chemical manufacture process.

The emissions and effects related to the Project are assessed in **Chapters 9 - 22** of this EIS.

Source: Base maps from IPL, drawing AUG-00-131-PP-0000.dwg, received 20 April 2012. Aerial Imagery supplied by NearMaps.

Existing Structures			
1	Shed 1	12	Existing Weighbridge
2	Shed 2	13	Sulphuric Acid Inland Pipe
3	Shed 3	14	Existing Amenities Building
4	Shed 4 - DG Store		
5	Office/Seminar Center		
6	Bagging/Storage Warehouse		
7	Redundant Wax Tanks		
8	Sulphuric Acid Loadout		
9	Sulphuric Acid Storage Tanks		
10	Existing Entrance		
11	Operations Office		

Project Components			
1	Ammonia Tank	12	Substations
2	NA Plant	13	Contaminated Water Retention Pond
3	AN Plant	14	Waste Water System
4	TGAN Prill Store & Bagging	15	Proposed Entrance
5	NH_3 Flare	16	Proposed Weighbridge & Security
6	Cooling Tower Package	17	TGAN Container Store
7	NA Storage	18	Emergency Exit
8	ANSOL Storage and Handling	19	Ammonia Ship Berth
9	Administration Building	20	Modified Truck Parking
10	Workshop/Warehouse	21	Waste Water Discharge
11	Control Room		

N W E S

0 40 80 160 240 320 Meters

Datum: GDA94
Grid: MGA Zone 56

Legend

- Site_Boundary
- Proposed Waste Water Discharge
- Existing Drainage
- Proposed Drainage
- Lot Boundaries
- Proposed Internal Roads
- Proposed Structure
- Proposed Pipelines

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

PROJECT LAYOUT

URS

File No: 43177771.051.mxd Drawn: STB Approved: HQ Date: 27/08/2012

Figure: 4-1

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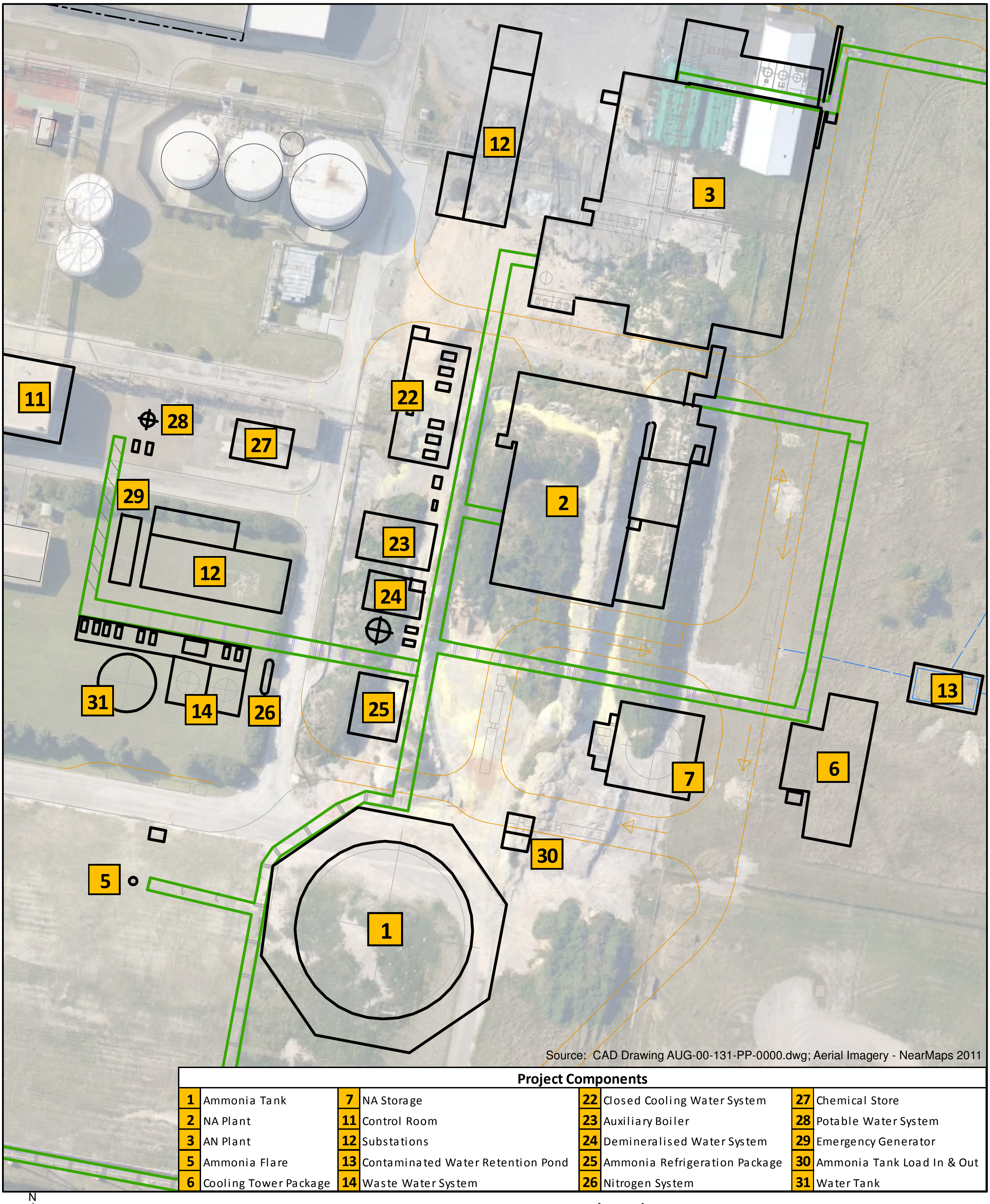

Source: CAD Drawing AUG-00-131-PP-0000.dwg; Aerial Imagery - NearMaps 2011

Project Components

1	Ammonia Tank	7	NA Storage	22	Closed Cooling Water System	27	Chemical Store
2	NA Plant	11	Control Room	23	Auxiliary Boiler	28	Potable Water System
3	AN Plant	12	Substations	24	Demineralised Water System	29	Emergency Generator
5	Ammonia Flare	13	Contaminated Water Retention Pond	25	Ammonia Refrigeration Package	30	Ammonia Tank Load In & Out
6	Cooling Tower Package	14	Waste Water System	26	Nitrogen System	31	Water Tank

N W E S

0 5 10 20 30 40 Meters

Datum: GDA94
Grid: MGA Zone 56

Legend

- Proposed Structures
- Proposed Pipelines
- Existing Drainage
- Proposed Drainage
- Proposed Internal Roads

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

PROJECT LAYOUT DETAIL

URS

File No: 43177771.054.mxd Drawn: STB Approved: HQ Date: 24/08/2012

Figure: 4-2

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4.3 Operational Scenarios

4.3.1 Steady State

Normal operating conditions for the Project are referred to as ‘steady state’. During ‘steady state’ various equipment, catalysts and reactions would run at optimal temperature and under optimal conditions ensuring that the Project components are running at peak efficiency. Under ‘steady state’ conditions emissions and energy requirements would be optimised.

4.3.2 Start up and Shut down

Start up and shutdown conditions fall outside the usual operational scenario. During these events, it is acknowledged that the plant would run below peak efficiency. Under these conditions, certain equipment would require external steam from the Auxiliary Boiler. This boiler would be fired with natural gas. The result of this dip in efficiency would be an increase in certain NOx emissions and an increase in natural gas usage.

During operation, start up and shutdown conditions of the NA Plant are expected to occur three to four times a year after the initial commissioning period. Each start up is expected to last approximately 12 hours. Shut down events are expected to last for approximately one hour. Start ups and shutdowns are required for NA plant catalyst changes and maintenance.

The selection of dual-pressure NA technology significantly reduces the requirement for start up and shutdown as it allows for much longer durations between catalyst changes. Within the dual pressure process, catalyst will typically last eight to ten months as compared to three to four months for mono-pressure technology.

The commissioning stage is described in detail as Stage 4 of the Construction Program within **Section 5.2.** Start up and shut down operational scenarios would apply to the Facility during the commissioning period.

4.4 Project Components and Process

4.4.1 Ammonia Import and Storage

Anhydrous liquid ammonia would be brought to Site either by ship or by road tankers. Deliveries by ship would take place at the bulk liquids berth located between the Kooragang Island berths K2 and K3. These berths are owned by NPC. Approximately 160,000 tpa of anhydrous ammonia (158,000 for manufacture of AN and a small quantity for other local consumers) would be imported to the Site by ship in deliveries of 15,000 to 23,000 t. Each ammonia ship would be unloaded at 1,100 tonnes per hour. The berthing and connection of the ship would take approximately six to eight hours, followed by 24 hours to unload and six hours to disconnect and depart.

A new insulated pipeline system consisting of two independent, but similar, pipes would connect the proposed ammonia unloading arm and infrastructure at the bulk liquids berth to a new ammonia tank in the southern part of the Site (refer to **Figure 4-1**). Each ammonia pipe would carry 50 percent of the total unloading flow. The ammonia unloading flow between the ship and the tank would be controlled by pressure in the tank. This new pipeline system would cross Heron Road and the disused railway in the west of the Site on a pipeline gantry before lowering to ground level and running above ground on sleepers. The pipeline system would travel west to east, parallel to the Site boundary for approximately 270 m and would then head north for approximately 40 m. At this point the pipeline system would join to the proposed ammonia tank. The ammonia unloading pipelines would be emptied of liquid ammonia after each delivery by purging with ammonia vapour and then maintained at the same pressure as the storage tank (near atmospheric).

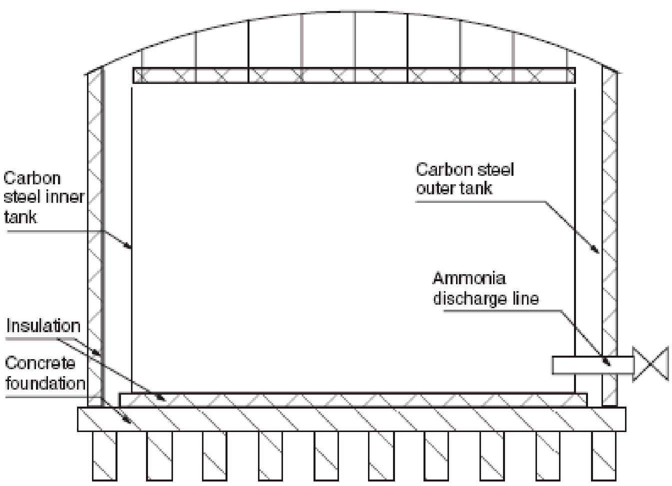
In addition to the ammonia shipments, anhydrous ammonia would also be delivered to the Site by road tanker from IPL's operations in Queensland. Approximately 20,000 tpa of ammonia would be delivered by road during the 'off-season' of September to February each year in preparation for increased demand from farmers in northern and western NSW between March and August.

The ammonia tankers arriving from Queensland would unload at a new ammonia road tanker loading and unloading facility. This facility would consist of two independent lines that would link the road tanker to the ammonia storage tank. The ammonia would be transferred from the tanker utilising high pressure vapour ammonia from the refrigeration system to discharge the liquid ammonia into the ammonia unloading pipeline. The unloading operating temperature and pressure conditions would be controlled by the refrigeration system and the storage tank pressure control system in order to ensure that the tanker unloading operation is carried out at the lowest practical operating pressure and temperature conditions.

Ammonia would be stored on the Site in a 30,000 t atmospheric storage tank at minus 33ºC. The ammonia storage tank would be approximately 42 m in height from the ground surface and 45 m in diameter. The tank would be a double wall double integrity tank to secure against any loss of containment of ammonia (refer to **Figure 4-3**). The outer tank would be approximately 1.5 m from the inner tank and would be designed to be capable of containing the refrigerated liquid and vapour in the unlikely event that the inner tank leaked. The insulation would be on the outside wall of the outer tank to ensure that both the outer and inner tanks remain under refrigeration conditions and close to minus 33ºC temperature.

This double integrity design ensures that in the unlikely event of the inner tank leaking the outer tank and the refrigeration system design would be able to contain and liquefy the ammonia vapour generated, preventing any potential discharge to atmosphere. If the inner tank leaked an alarm would alert the staff in the control room. The ammonia storage tank would comply with the industry standard API 620 Appendix R plus additional IPL global standards. The bulk ammonia storage tank would be designed to comply with the highest level of importance (level 4) defined in AS1170.4 for earthquake and wind forces.

Figure 4-3 Indicative Ammonia Storage Tank Design



The ammonia would be kept as a liquid in the storage tank at minus 33ºC by a refrigeration system that consists of two equal capacity packages operating in parallel. This system would be activated by a pressure control system that would control two compressors and a condenser. The Project would use the refrigeration system to return any ammonia vapour to a minus 33ºC liquid within the storage tank. During normal storage this process would run intermittently when required and would only require the use of one refrigeration package. However, during ship or tanker unloading the process would run continuously and would require the use of both refrigeration packages.

As a further safety measure, the ammonia storage tank would also be connected to an elevated flare. The flare would have natural gas pilots and would combust any ammonia vented from the storage tank that could not be handled by the refrigeration system. Heavy flaring would be very rare and caused by equipment failure or abnormal operations. Duplicate refrigeration units and emergency power supply systems would be included to reduce the likelihood of flaring. The design ensures that the risk of ammonia release to the environment is as low as reasonably practicable. The flare would be tested during the commissioning phase, and heavy flaring would be expected less than once a decade.

From the storage tank, liquid ammonia would be sent to the Nitric Acid plant, the Ammonium Nitrate plant and the ammonia road tanker loading facility.

4.4.2 Nitric Acid Production

The Project would be based on the high efficiency dual pressure process technology.

NA can be produced from ammonia using either mono pressure or dual pressure process. Although higher in capital cost than a mono pressure process, the dual pressure process has higher ammonia conversion efficiency, lower catalyst consumption and results in longer catalyst life. The NA plant would have a nominal NA production capacity of 760 tonnes per day (tpd) when running at 100 percent capacity and up to 280,000 tpa[1].

The NA plant would be located to the north of the ammonia storage tank and to the immediate south of the central point of the Lot (refer to **Figure 4-1**). The footprint of the NA plant would be approximately 42 m x 50 m. The majority of the components within the NA plant would be less than 25 m in height from the ground surface. However, the Absorption Tower would be approximately 51 m in height from the ground surface and approximately 4.6 m in diameter.

The NA plant would operate on the basis of continuous manufacture with an input of ammonia and an output of NA. A description of the nitric acid process through the various components of the NA plant is provided below.

Ammonia Oxidisation Reactor

Liquid ammonia for the NA plant would be sourced from the ammonia storage tank. The ammonia would be filtered by the Liquid Ammonia Filters to remove any undesired particles, evaporated in the Ammonia Evaporator using chilled water from the Chilled Water Closed Circuit system, vaporised with steam in the Ammonia Auxiliary Vaporiser and stripped of any remaining impurities (i.e. water and oil) in the Ammonia Stripping Vessel. The ammonia gas would then be superheated in the Ammonia Superheater and filtered again in the Ammonia Gas Filter before being transported via pipeline to the Ammonia Gas / Air Mixer.

[1] NA plant capacities are based on 100 percent concentration whereas NA storage capacities based on solution concentration of less than 100 percent (nominally 60 percent)

Air from the atmosphere would be filtered, compressed and preheated to form Process Air before being mixed with ammonia vapour, in the mixer, in a ratio of 10.2 : 1 ammonia : air. The ratio of air to ammonia would be carefully controlled by matching the ammonia and air flow rates within the Ammonia Gas / Air Mixer. This ammonia / air mix would then be sent to the Ammonia Oxidation Reactor (AOR). Here a platinum / rhodium alloy catalyst would be used to cause the ammonium vapour and hot air to react and create nitric oxide (NO) gas and water vapour.

This is explained by the following chemical reaction:

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O + Heat$$

Nitrous oxide (N_2O), nitrogen and water would also be produced in small quantities during this process as unwanted by-products. These by-products would be controlled using a secondary catalyst to reduce the levels of nitrous oxide and greenhouse gas emissions. This is explained by the following equation:

$$2N_2O \rightarrow 2N_2 + O_2$$

The hot reaction gases (approximately 885ºC) would then be cooled by passing them through a series of heat exchangers including:

- Vertical Boiler inside the AOR – with the heat being used to produce superheated steam to drive the NA air compressor turbine.
- Tail Gas Superheater – with the heat being used to raise the temperature of the tail gas for energy recovery at the Tail Gas Expander.
- Recovery Boiler – with the heat using to produce steam.
- Economiser – with the heat used to produce steam from the Boiler Feed Water before entering the Steam Drum and Boilers.
- Two Tail Gas Heaters – with the heat used to improve energy recovery at the Tail Gas Expander.

The Tail Gas Superheater, Recovery Boiler and Economiser would be part of a single heat exchange train to help reduce piping, space requirements and associated maintenance. This configuration would also maximise recovery of energy produced and minimise use of electricity and natural gas.

The nitric oxide (NO) in the hot reaction gases would be oxidised to nitrogen dioxide (NO_2) as the gases are cooled. This is explained by the following equation:

$$2NO + O_2 \rightarrow 2NO_2$$

Absorption Column

The cooled nitrous gases would then be cooled down to 50 – 55ºC with cooling water in the Low Pressure (LP) Gas Cooler Condenser. As part of this process a weak nitric acid (30 percent) would be formed by the reaction of nitrogen dioxide and condensed water. This weak acid would then be separated from the cooled nitrous gases in the Process Gas Droplet Separator and would be sent to the Absorption Tower using the Weak Acid Pumps.

The cooled nitrous gases leaving the Process Drop Separator would be mixed with secondary air from the Bleaching Tower before entering the Process Gas Compressor which raises both the pressure and the temperature of the gases. A second group of heat exchangers recover this energy from the High Pressure (HP) nitrous gases. The recovered energy would be used to heat the Boiler Feed Water in the Boiler Water Heater and the tail gas in the Tail Gas Preheater. The HP Gas Cooler Condenser cools and condenses the HP nitrous gases producing condensed acid alongside the remaining gases. Both the gas and liquid would then be sent to the Absorption Tower.

The absorption of NO_2 in water takes place within the Absorption Tower. The tower consists of a number of perforated trays. The trays at the top of the tower are refrigerated with chilled water from the ammonia evaporation process. Trays lower down in the tower have coils with cooling water circulating within them. The purpose of cooling the trays in the absorption tower would be to remove the heat caused by NO oxidisation and acid production, which in turn, enhances acid absorption and NO_x abatement.

To produce nitric acid at 60 percent, the HP nitrous gases are released at the bottom of the Absorption Tower and flow upward through the various trays. At the same time water would be released from the top of the tower and work its way downwards. This 'water' is a mixture of demineralised water and clean process condensate from the AN plant which would ensure that the water produced by the Project is reused and wastewater generated is minimised. At each tray level outlet the NA concentration increases as the solution moves down the tower. Both the weak (30 percent) and 60 percent Nitric Acid produced earlier in the process are also added into the Absorption Tower at appropriate tray level. This process results in an approximately 60 percent concentrate NA at the bottom of the Absorption Tower, shown by the following reaction:

$$3NO_2 + H_2O \rightarrow 2HNO_3 + NO + Heat$$

The NA produced at the bottom of the Absorption Tower would be sent to the Bleaching Tower to remove any unwanted nitrous gases. The NA would be released at the top of the Bleaching Tower and would flow downward over a number of sieve trays. Compressed 'Secondary Air' from the Air Compressor would be cooled to 100^0C in a Secondary Air Cooler and would be passed in the opposite direction to the NA over the Bleaching Tower sieve trays. This process removes the majority of the unwanted nitrous gases from the NA. The NA would then be sent to the NA Storage Tank and the unwanted nitrous gases are sent back to the Process Gas Compressor.

Tail Gas Vent Stack

Gases left over from the oxidisation and absorption processes are referred to as tail gas. The tail gases would leave the top of the absorption column with less than 500 parts per million by volume (ppmv) of NO_x. Before being sent to the $DeNO_x$ Reactor for NOx abatement and the Tail Gas Expander to recover any energy, the tail gases would be passed through a number of heat exchangers as described above.

The heated tail gases would be mixed with ammonia in the Ammonia Gas / Tail Gas Mixer and sent to the $DeNO_x$ Reactor, where selective catalytic reduction (SCR) takes place to decrease the NO_x concentrations in the tail gas to below 50 ppmv. The air quality assessment has been conservatively based on 75ppm of NO_x. These exothermic reactions heat the tail gases further.

During start up of the plant, the tail gases would need to be externally heated until the plant was running at steady state, as the gases must be at a minimum temperature before entering the $DeNO_x$ Reactor. Therefore during start up the tail gases would be heated by a high pressure steam in the Tail Gas Start-Up Heater. Once the tail gases reach the required temperature through normal operation of the plant, the Tail Gas Start-Up Heater would be bypassed.

The tail gases would be heated again through the Tail Gas Superheater and sent to the Tail Gas Expander. Here the tail gases would be passed through a gas turbine to recover the energy before being released into the atmosphere through a Stack.

An electric generator is also installed in the NA compressor train. With additional high pressure steam from the Auxiliary Boiler, the generator will provide 7.5 MW of electricity to power the Site at full production.

NA Storage

NA would be stored in the atmospheric Nitric Acid Tank which would have a maximum capacity of approximately 3000 t. The NA tank would be designed in accordance with *AS 3780 – Storage and Handling of Corrosive Substances.* It would be located in an appropriately sized, dedicated bunded area for the secondary containment of NA. Pumps would also to be located within a separate bunded area and splash guards would be installed on any pipe flanges for pipework containing NA. The tank vent flows to the Vent Sealing Vessel, which would act as a scrubber. Demineralised water would be used to absorb any nitrous gases that are vented. This solution would pass through the Vent Washing Vessel before being recirculated again to the NA tank.

4.4.3 Ammonium Nitrate Production

The proposed plant would be based on the ammonium nitrate process technology using pressurised recirculating neutraliser. The plant would have a nominal production capacity of 1060 tpd and 350,000 tpa AN[2]. The AN plant consists of two main parts:

- AN Liquor Plant – where the AN would be produced in a neutralisation process and concentrated in an evaporation process to produce ANSOL; and
- AN Prill Plant – where approximately 80 percent of ANSOL would be turned into TGAN.

The AN plant would be located directly north of the NA plant (refer to **Figure 4-1**). The footprint of the AN Liquor Plant would be approximately 27 m x 27 m, whereas the footprint of the AN Prill Plant would be approximately 40 m x 36 m. The majority of the components within both plants would be less than 25 m in height from the ground. The exception would be the Prill Tower which would be approximately 61 m in height from the ground and 12 m x 12 m in area.

The plant would work on the basis of continuous manufacture with inputs of ammonia and NA and an output of ANSOL and TGAN. A description of the AN process through the various components of the plant is provided below.

Neutralisation Reactor

Liquid ammonia would be pumped from the ammonia storage tank where it would be vaporised in the Ammonia Evaporator, passed through an Ammonia Liquid / Vapour Separator to remove any liquid droplets and then superheated in the Ammonia Reheater. This vapour would then be fed into the Neutralisation Reactor alongside a commensurate flow of NA. The flow of the ammonia vapour would be controlled by the pH and flow of NA into the reactor.

In the Neutralisation Reactor, ammonia and nitric acid would be reacted together to form ANSOL. This reaction is represented as follows:

$$HNO_3 + NH_3 \rightarrow NH_4NO_3 + \text{Heat}$$

This exothermic reaction provides enough energy to produce large amounts of steam. The steam would be separated and collected at the top of the reactor and sent to the Process Steam Scrubber. In this scrubber any remaining AN mist carried by the steam would be removed by spraying a diluted ANSOL against the flow of the steam. The clean steam would be used to evaporate and heat ammonia gas, to concentrate the ANSOL and to produce a vacuum by means of the Steam Ejector. The design would

[2] AN plant capacities are based on 100 percent concentration whereas ANSOL storage capacities based on solution concentration of less than 100 percent (nominally 88 percent)

minimise need for fresh steam and hence avoid burning of natural gas and also minimise water consumption. Excess steam could be used in other processes on the Site or be condensed in the Clean Process Steam Condenser. The ANSOL from the Process Steam Scrubber would be fed back into the Neutralisation Reactor.

Evaporation

The AN solution would then flow under pressure to the ANSOL Flash Vessel where it would undergo a process known as flash evaporation. This would allow the concentration of the solution to be increased from 78 to 85 percent. This flash evaporation would also produce steam which would be scrubbed in the Clean Process Steam Scrubber to remove entrained droplets of ANSOL and ammonia gas before being condensed in the Clean Process Steam Condenser. A small addition of nitric acid would increase the absorption and removal of ammonia gas from the process steam. The ANSOL passes by gravity to a Diluted ANSOL Vessel.

The 85 percent ANSOL would then be pumped to the Falling Film Evaporator where it and 30 percent ANSOL from the AN Prill plant would be mixed. This mixture would form a film on the walls of the Evaporator and process steam from the Neutralisation Reactor on the shell side would provide the heat required to further concentrate the ANSOL. The concentrated ANSOL (approximately 96 percent) would be collected in the Concentrated ANSOL Solution Vessel. From here it would either be sent to the AN Prill plant or to the ANSOL Mixer where 88 percent ANSOL would be produced and sent to storage.

The steam used in the evaporation process would be scrubbed in the Clean Process Steam Scrubber, condensed in the Clean Process Steam Condenser and then stored in the Clean Process Condensate Tank. Any ANSOL that is produced following scrubbing would be recycled back into the process to reduce AN losses.

Prilling and Drying

The prilling process allows the ANSOL to form into solid porous spheres which can be safely transported and used in the mining process. An internal additive would be mixed with process condensate, filtered, stored and, when required, pumped to the Prilling Tower Head Vessel. Here the additive would be mixed with the 96 percent ANSOL. The purpose of the additive is to aid in the crystallisation process. The ANSOL / additive mixture would then be passed through a number of spray nozzles. As the mixture falls, the counter current flow of air up through the Prilling Tower would cool and solidify the droplets into AN prill.

The warm air stream leaving the top of the Prill Tower would be scrubbed with weak AN solution to remove entrained AN dust, ANSOL and any free ammonia. The scrubber would also cool the air stream allowing recycling, thereby further reducing emissions.

A small amount of air from the scrubber would pass through a second stage of scrubbing, before being discharged via the vent stack. The second stage scrubber would consist of a primary venturi scrubbing and secondary packed column scrubbing to ensure maximum scrubbing efficiency. The two stages of scrubbing would eliminate the majority of pollutants in the discharged air.

The prills would be taken by conveyor to a series of drums that would cool and dry the prills. The heat in the prill would be removed by the Fluidised Bed Cooler by means of a number of fans. The counter-current air flow in the pre-drying and drying drums would allow any remaining water to be evaporated before progressively drying and hardening the product. The air leaving the drums would be sent to the venturi scrubber and then the Dryer Air Scrubber to reduce air emissions. Once scrubbed the air would then be sent to the AN Stack.

Once the prills are dried they would be screened. Over and under-sized prills would be recycled to the Concentrated ANSOL Vessel to be reprocessed. 'On size' product would be cooled in the Fluidised Bed Cooler using air from the atmosphere that would have its humidity reduced and be cooled by exchange with ammonia vapour. This air would go on to be used in the drying drums.

After cooling, the prills would be sent to the Coating Drum to be coated with an anti-caking additive and transferred by conveyors to the bulk store.

4.4.4 Product Distribution and Storage

ANSOL storage and distribution

An ANSOL Storage Tank would have a maximum capacity of 1,650 t and would store 88 percent ANSOL for export by b-double road tankers to IPL's Warkworth site in the Hunter Valley. The tank would be fitted with a LP steam heating coil to maintain temperature, and demineralised water would be provided to reduce temperature and maintain correct dilution at 88 percent. The tank would use ammonia from the Ammonia Refrigeration System to help maintain pH. The tank would be designed in accordance with *AS 4326 – Storage and Handling of Oxidising Agents.*

The tank would be located in an appropriately sized, bunded area for secondary containment. The pumps for the tank would also be located within a bunded area. The ANSOL from the tank would be sent to a separate load out facility with an ANSOL Loading Arm, which would be used to load the tankers. Approximately 20 percent of the AN manufactured would be dispatched from the Site as ANSOL.

TGAN Prill Storage and Distribution

The bulk store would have storage capacity for approximately 5,000 t of Technical Grade Ammonium Nitrate (TGAN). The bulk store would be constructed with reinforced concrete walls and be configured with two off 2,250 t slumped piles with sufficient separation. A load out system would load the TGAN into bulk tippers for dispatch to customers, primarily in the Hunter Valley.

TGAN would also be transferred by conveyor to a bagging plant, where it would be loaded into one tonne bulk bags for export and domestic sale. The bags would be stored in shipping containers for export and an existing bag store (1,000 t) for domestic sale. Container storage capacity would be 5,000 t with containers stored in 500 t stacks with sufficient separation.

The bulk store would also include a bay for off-specification TGAN. This bay would be able to store up to 500 t of off-specification TGAN. Once stored, the off-specification TGAN would be examined for consistency. If possible, it would be blended with the on-specification TGAN bulk storage product. If not deemed acceptable, it would be removed from the Site by IPL for use in the production of AN emulsion or fertiliser at IPL's Warkworth plant.

Ammonia Distribution

Approximately 20,000 tpa of ammonia would be distributed from the Site by road tankers to customers in the regional footprint during the 'Big N' fertiliser season from March to August. Tankers would connect to the ammonia loading and unloading facility. A low pressure steam heater would be used to heat the ammonia as it is pumped from the storage tank to the tanker. Any ammonia vapours from the road tanker filling operation would be sent to the ammonia refrigeration system.

Waste ANSOL

Waste ANSOL that cannot be recycled would be stored in a 145 t tank before being concentrated to approximately 70 percent for fertiliser sales. ANSOL waste from a number of processes would be stored in Waste Weak ANSOL Tanks before being pumped to the ANSOL Concentrator Column. The ANSOL waste would be concentrated in the column by heating the solution to 90ºC using a heat exchanger and introducing ambient air to the base of the column from the Stripping Air Blower. The process of evaporation by the air concentrates the waste ANSOL. When the concentration reaches 70 percent the solution would be pumped to the Concentrated Waste ANSOL Tank. Before leaving the column the air would be scrubbed with fresh weak ANSOL and process water.

The Concentrated Waste ANSOL would be stored in this tank until being sent to a separate load out facility with a specific loading arm to load the tankers. The waste ANSOL would be loaded into road tankers and sent to the IPL Warkworth site for conversion to liquid Urea Ammonium Nitrate (UAN), then sold as fertiliser to the agriculture industry.

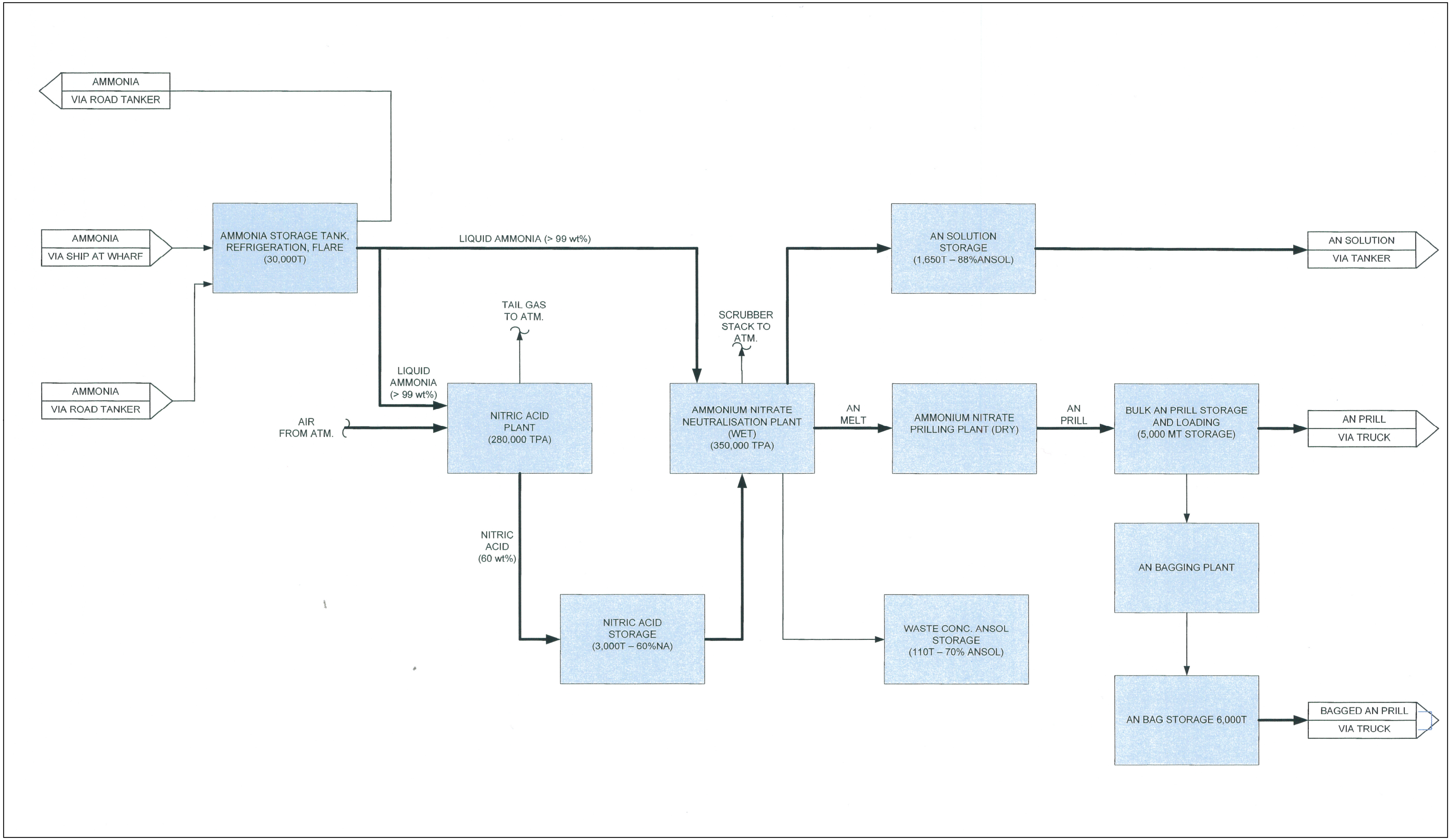
Waste production would be minimised through effective quality control.

Process Condensate

Liquids produced as a by-product of the NA / AN production process would be collected and stored for reuse in the NA Absorption Tower. The pH of these liquids would be adjusted to suit acid production. Any AN in the condensate would be minimised though the various processes outlined above.

Additives and Coating Agent Storage

The AN plant requires prill additive (Galoryl AT 725 or equivalent) and coating agent (Galoryl ATH 626 or equivalent). Both additives are classified as a non-hazardous substance and a non-dangerous good, according to National Occupational Health and Safety Commission (NOHSC) Criteria, and Australian Dangerous Goods (ADG) Code. These additives and coating agents would be stored in a dedicated bunded building adjacent to the AN prill plant. The additives would be stored in 205 litre drums and 1,000 kg bulk bags prior to preparation via melting or dissolving in the additive preparation tanks.



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PROPOSED AMMONIUM NITRATE FACILITY

PROJECT PROCESS FLOW CHART

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Figure: 4-4

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4.5 Associated Infrastructure

4.5.1 Introduction

In addition to the main Project components, the Project requires various associated structures, systems and storage mechanisms. This associated infrastructure is described below. A number of these components are also shown on **Figure 4-1**.

4.5.2 Cooling System

As described above, a number of the Project components require cooling in order to operate efficiently. This cooling would be provided by the interaction of two systems:

- Closed Cooling Water System; and
- Cooling Tower System.

These two systems would be linked by Plate Heat Exchangers.

The Closed Cooling Water System comprises a number of pumps, filters and the Closed Cooling Water Expansion Drum. The water in the system would be demineralised water. The system would supply cooled water from the Plate Heat Exchangers to all the process and utility units within the NA and AN plants. The only exceptions would be the Surface Steam Condenser and the Ammonia Refrigeration Package, which are cooled by the Cooling Tower System.

The Plate Heat Exchangers would be designed to cool down the water in the Closed Cooling Water System from 43ºC to 33ºC. Heat would be removed from the Closed Cooling Water System via the heat exchangers and transferred to the Cooling Tower System.

The Cooling Tower System consists of an open cooling water circulating system. The system consists of pumps, filters, a chemical dosing package and the cooling tower. The make-up water to the Cooling Tower System would be supplied by Hunter Water via the local water authority mains.

The water in the Cooling Tower System would be subject to chemical treatment prior to use. This treatment would involve adding antiscale, microbiocide, biodispersant, pH adjustment and a corrosion inhibitor. The water would be pumped to the Plate Heat Exchangers and would be heated to 38ºC. The water would then be sent to the cooling tower. The Cooling Tower would be a counterflow induced draught tower type with three cells in order to chill the water from 38°C to 28°C. Cooling water would be recycled in the open system. A side stream from this process would be removed and sent to the Waste Water System as Cooling Water Blowdown.

4.5.3 Auxiliary Boiler Package

The Auxiliary Boiler would be used to produce Low Pressure (LP) Steam for the NA and AN plant and the High Pressure (HP) Steam required for start up of the NA plant. The boiler could also be used to provide steam to generate power via the NA compressor electrical generator unit. The boiler feed water would be provided from the NA plant. An oxygen scavenger would be added to the water to reduce corrosion, and phosphate would be added to reduce scaling. The quality of the boiler feed water would be continuously measured to control conductivity and pH. The Auxiliary Boiler operates using natural gas. After combustion the waste gases would be routed to the Stack to be vented to atmosphere.

4.5.4 Instrument Air and Plant Air System

An Air Compressor Unit would be installed as part of the Project to provide compressed air to various Project components. The Air Compressor Unit would consist of two air compressors, a main compressor, which would operate during normal Project operation, and the make-up compressor, which would work during start up / shutdown conditions of the NA plant.

Air for the Air Compressor Unit would be sourced from the atmosphere and would undergo two stages of compression and would have any condensed moisture removed. At this point the air would be considered ‘Plant Air’. This Plant Air would be upgraded to ‘Instrument Air’ through an addition process of filtering and drying to ensure that any oil, water, liquids or particles are removed. Instrument and Plant Air are supplied to different Project components through separate distribution systems. The power supply to the two compressors would be backed up by the emergency diesel generator in order to ensure the safe shutdown and the continuity of supply of instrument air to critical plant control instrumentation.

4.5.5 Water Supply and Management

Water Supply

Water would be taken from the Hunter Water Corporation mains. This water would be used as potable water on Site and would also be used for firewater and feed for the Service Water System and Cooling Tower make-up. Water would also be converted into demineralised water for use in the processes and boilers. The Project is expected to require 180 kL/hr of water during normal operation. A maximum of 220 kL/hr of water would be required during plant start up / shutdowns. This requirement has been discussed with Hunter Water Corporation which has confirmed that the Project’s water requirements can be met and would not result in undue pressure on, or shortages with, the existing supply.

Potable Water

Potable water would be taken from the Hunter Water Corporation mains and stored within new drinking water storage facilities on the Site. The Site is already served by a local water authority main. The potable water system would provide water for:

- eye washes and safety showers;
- use in the administration and service buildings; and
- Site ablutions in addition to those already provided to the existing facilities.

Stormwater

At present stormwater falling on the impervious areas on the western side of the Site is collected and discharged pursuant to an Environmental Protection Licence (EPL) granted by the EPA into the south arm of the Hunter River.

For the Project, stormwater that falls on newly impervious areas would be collected in spoon and kerb drains diverted into three systems depending on the likely level of contamination.

The three grades of stormwater and the associated systems which would be implemented for the Project are described below:

1. Contaminated Stormwater - New plant areas which could make significant contribution to stormwater pollutant levels if not controlled, i.e. process areas, product loading areas, areas vulnerable to spills and floors of some plant and chemical storage areas, would be completely contained in bunds and hold at least a one-in-ten year 24 hour rainfall event. Bunded areas are shown on **Figure 4-5**. All

stormwater in these areas would be either recycled or managed in the wastewater system. These areas would be roofed where practicable.

2. First Flush Stormwater - Stormwater run-off from new plant areas where process materials could be present and moderate surface contamination is possible would be diverted to a first flush collection system. A first flush retention pond would capture the first 10 mm of rainfall from the potentially contaminated external paved areas. The water collected within the first flush pond would be tested and if found to be contaminated, would be pumped to the wastewater tanks for treatment and discharged through the plant wastewater system. If the water in the pond was found to be clean, it would be pumped into the stormwater drainage system. Dependent on composition, stormwater may also be pumped from the first flush system to the Cooling Water System as make-up water. The first flush system and containment within plant areas would also be designed to capture typical firewater run offs in an emergency for at least 20 minutes. **Figure 4-5** shows the location of the first flush areas and the first flush retention pond.

3. Clean Stormwater - New plant areas which are considered to be 'clean' and unlikely to be contaminated with process materials include light vehicle roads, roofed areas, certain hard stand areas and grassed areas. These areas would be physically separated from potentially contaminated areas by kerbing, interception drains, grading etc. Runoff from these areas would be collected in a new stormwater drainage system. Runoff from the new plant areas and the new storage and loading areas east of 12th Street (refer to **Figure 4-1**) would be collected and consolidated into two stormwater pits in the east of the Site. These pits would then lead to new pipes that would carry the stormwater to existing stormwater drains on Greenleaf Road. These drains discharge into the north arm of the Hunter River. These stormwater pits would be fitted with an emergency isolation valve that would divert any spills or contaminated storm/fire into a contaminated water retention pond. The isolation value would be controlled from the proposed Control Room. The clean stormwater system for the areas to the west of 12th Street would link to the existing stormwater system and would then discharge to the south arm of the Hunter River.

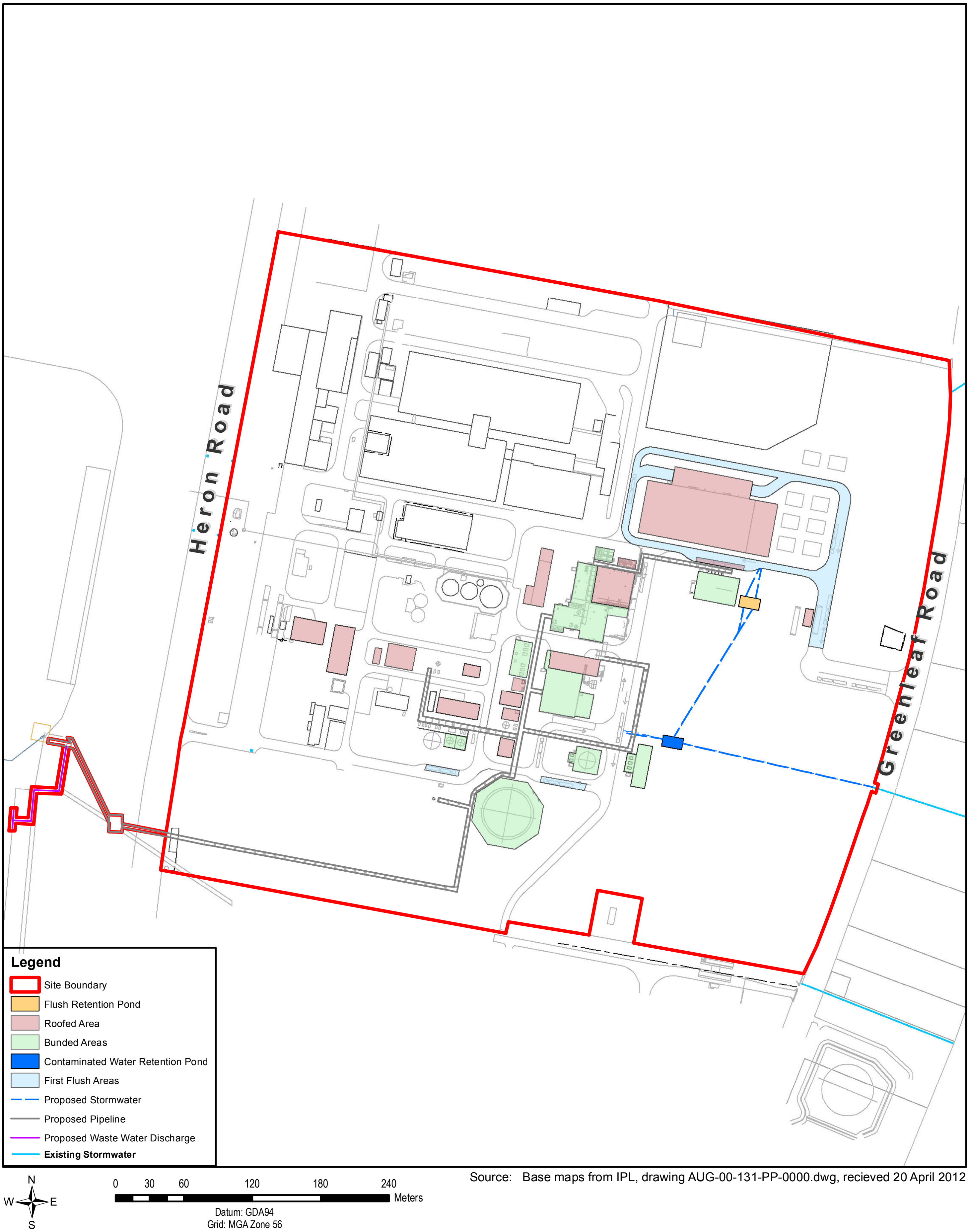
Wastewater

Wastewater from various process and sources on the Site would be collected in two 400 m^3 tanks as part of the Wastewater System. This wastewater has four main sources:

- Cooling Tower Blowdown;
- Pumped waste waters from plant areas that, following testing, cannot be incorporated into the Waste ANSOL process;
- Contaminated stormwater; and
- Neutralised waste streams from the demineralised water package.

The Wastewater System would take process waste streams that cannot be concentrated or recycled, then treat this wastewater and either dispose of this wastewater via an outfall under an EPA licence, or store it for disposal to an authorised third party contractor.

Wastewater to be discharged under licence would pass through a proposed wastewater outfall pipe. The proposed wastewater outfall would cross Heron Road on an elevated pipe-rack at the south east corner of the Site then enter the south arm of the Hunter River beneath the NPC K2 Berth. The pipe would descend approximately 10 m below AHD before connecting to a diffuser consisting of four nozzles spaced approximately 3 m apart which would discharge the wastewater stream into the Hunter River.



Source: Base maps from IPL, drawing AUG-00-131-PP-0000.dwg, recieved 20 April 2012

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

FIRST FLUSH AND BUNDED AREAS

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File No: 43177771.055.mxd Drawn: STB Approved: WM Date: 27/08/2012

Figure: 4-5

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Before discharge or disposal, the first stage in the Waste Water System would be to pass the wastewater through the Oil Separator Package. The role of this package would be to separate any oil from the rest of the wastewater entering the system. The oil would be collected in drums and disposed offsite. Less than 1,000 litres of oil are expected to be removed from the Site each month.

Wastewater coming from the Oil Separator Package would enter one of the two Neutralisation Tanks. Once ready, a Neutralisation Mixer would add an acid or an alkali to neutralise the wastewater before disposal. At this point the treated wastewater would be tested. If the wastewater meets the Environmental Protection Licence (EPL) limits, then it would be discharged to the south arm of the Hunter River. If not, the wastewater would be sent by road tankers to an authorised offsite disposal facility.

Demineralised Water

A small water treatment plant of 20 m^3/hr capacity would be built to produce demineralised water for use during the NA production process. Storage for 200 m^3 of demineralised water would be provided as part of the Project.

Demineralised water would be converted to steam by a natural gas packaged boiler. This steam would be used mainly for NA compressor start-up and subsequent generation of power. The steam would also be used in the NA and AN plants for heating purposes. Steam condensate would be collected and stored in a suitably designed tank for reuse.

Demineralised water would also be supplied to various boilers as ‘boiler feed water’ after passing through a de-aeration process. Condensate from this process would be collected and recycled to minimise the production of demineralised water.

Fire Water

A fire water tank with minimum 90 minutes capacity, fire water pumps, ring main, monitors, hydrants and hose boxes would be installed as part of the Project.

4.5.6 Other Utilities

Diesel

Diesel would be stored on the Lot in an existing double skinned relocatable containerised tank. Diesel in this tank would be used for fuelling light vehicles, forklifts, portable equipment and the emergency generator. The Project is expected to require approximately 24 kL pa of diesel.

Diesel would be transferred to vehicles by diesel bowser, the bowser being of a standard size used for light vehicles. Diesel would be transferred from the delivery vehicle via the delivery vehicles pump(s) on a Fuel Transfer Slab.

Nitrogen

Nitrogen would be delivered to the Site in packaged gas cylinders. Nitrogen would be used when purging various Project components and during operation of the Project.

Natural Gas

The Site is currently supplied with Natural Gas. The existing infrastructure servicing the Lot would be suitable to service the Project. During normal operation the Project is expected to require 75 GJ/hr of natural gas. A maximum of 170 GJ/hr of natural gas would be required during start up / shutdown.

Electricity

During normal operation the Project is expected to require less than 2 MW of electricity from the grid, as the various exothermic reactions, the generation of steam and the operation of an electrical generator would provide enough energy to power the proposed development. Electricity would be required during start up and shutdown of the NA plant. A maximum requirement of 10 MW may be required from the grid during this period.

4.6 Associated Structures and Components

In addition to the plant structures and storage buildings outlined above, additional buildings would be required for the operation of the Project. These would mainly be located on the western side of the Site and would include the following:

- control room and laboratory;
- administration building;
- workshop and warehouse;
- substation and transformers;
- packaged chemical storage shed; and
- motor control centres.

4.7 Staffing Requirements and Operating Hours

The Project would employ an additional 60 full time staff, increasing the number of IPL employees on the Site to 100. The new staff would include skilled chemical process technicians, specialist maintenance technicians, supervisors, engineers and plant managers. In addition, contractors would be required for maintenance, security and transport jobs.

The Project would operate 24 hours a day, seven days a week.

4.8 Security

The Site currently holds a licence for the storage of Security Sensitive Ammonium Nitrate (SSAN) in accordance with the *NSW Explosives Regulation 2005*.

The Site has a Security Plan, approved by NSW Workcover, which details the security measures that are implemented. The Security Plan and measures for the Site would be upgraded to incorporate the Project. Access from the existing operations to the proposed operations on the Site would be restricted.

4.9 Truck Parking

The Project would require a modification to the truck parking area currently occupied by Chemtrans. IPL would also park empty ammonia road tankers in this area.

4.10 Transport Movements

The Project would result in a number of new transport movements. These new transport movements comprise:

- ammonia deliveries by ship to NPC Kooragang berth;
- ammonia deliveries by road to the Site;
- ammonia deliveries by road from the Site to offsite facilities;
- ANSOL deliveries by road from the Site to offsite facilities;
- TGAN deliveries by road from the Site to offsite facilities;

- TGAN exports by ship to international markets;
- diesel and nitrogen deliveries by road;
- waste ANSOL deliveries by road from the Site to offsite facilities;
- waste removal movements by road;
- general deliveries by road to the administration building and warehouse; and
- employee movements by road to and from the Site.

Further details regarding ship and road movements during operation of the Project are provided in **Chapter 15 Traffic and Transport** and **Appendix J Transport Impact Assessment**.

As part of the Project, a new road entrance to the Site would be created off Greenleaf Road, just south of the Cycle Club hut (refer to **Figure 4-1**). This new road entrance would include a single storey gatehouse, security gates and a new weighbridge and would provide immediate access to both the TGAN Storage and Load Out facility and the ANSOL Storage and Loading facility. All surface transport movements related to the Project except for employee movements and warehouse deliveries would be through the new Greenleaf Road entrance.

Employees and certain contractors would park in the existing car park on site located close to the existing Heron Road entrance to the Lot. This car park has room for approximately 160 cars, with additional car parking found within the existing Site.

5 Construction

5.1 Introduction

This chapter provides an overview of the construction phase for the Project. It outlines:

- the construction programme for the Project;
- construction plant and equipment which would be used for the Project;
- estimated construction staff and hours of work;
- construction traffic generated by the Project;
- construction waste generated by the Project;
- environmental management measures to be implemented during the Project; and
- Project decommissioning.

IPL is proposing to construct the Project using a number of pre-constructed modules that would be delivered to the Site by ship and then barge. This approach has the benefit of allowing part of the construction work to take place offsite and away from residential areas. It also reduces the amount of construction related traffic on the surrounding road network, as the modules would be brought to Site via the Custom Transportable Buildings (CTB) berth on Kooragang Island, opposite the eastern part of the Site on Greenleaf Road. This approach is discussed further below.

The capital cost for the engineering, procurement and construction of the Project is estimated to be $600 million. Further details regarding the costs of the Project are provided in **Chapter 21 Socio-Economics**.

5.2 Construction Programme and Stages

5.2.1 Programme and Stages Overview

The construction phase of the Project is expected to last approximately 28 months. Construction would be expected to start in the first quarter of 2013. Prior to construction commencing, all necessary permits and approvals would be sought and gained.

For the purposes of this assessment, the construction phase has been divided into four main construction stages. The four construction stages are:

- Stage 1 ─ Site preparation;
- Stage 2 ─ Civil and structural works;
- Stage 3 ─ Modules erection and overall activities; and
- Stage 4 ─ Commissioning.

The construction phase of the Project will be described according to these four broad stages. **Figure 5-1** highlights the duration of each of the construction stages. Each of these construction stages are discussed further below.

Figure 5-1 Construction Programme

	Months	Construction Stages			
		Stage 1	Stage 2	Stage 3	Stage 4
YEAR 1	1	■			
	2	■			
	3	■			
	4	■			
	5	■			
	6	■			
	7		■		
	8		■		
	9		■	■	
	10		■	■	
	11		■	■	
	12		■	■	
YEAR 2	13		■	■	
	14		■	■	
	15		■	■	
	16		■	■	
	17		■	■	
	18		■	■	■
	19		■	■	■
	20		■	■	■
	21		■	■	■
	22			■	■
	23			■	■
	24			■	■
YEAR 3	25			■	■
	26				■
	27				■
	28				■

5.2.2 Stage 1 – Site Preparation

During this first stage the Site would be prepared for construction activities. The existing operations on the Lot would remain throughout the construction phase. The existing operation would be separated using fencing from the construction works areas for the Project. A number of gates between the existing facilities and the construction works areas would allow personnel and construction vehicles to access the construction work areas initially. However, as part of the Site preparation works, a new entrance off Greenleaf Road would be created. Construction personnel would enter the Site from Heron Road via the existing Site entrance. Modules and other construction traffic would enter the Site via the new entrance on Greenleaf Road.

The Site would be prepared for construction during this stage. Where required, land would be graded and if necessary certain vegetation and waste would be removed from Site. Construction laydown areas, the internal road system, storage and stockpile locations, construction offices, key construction equipment and materials, security fencing and signage measures as well as other construction related facilities and structures would be identified and located on the Site.

The Site preparation stage is likely to last approximately six months.

5.2.3 Stage 2 - Civil and Structural Works

During this second stage the civil and structural work for the Project would be completed in order to prepare the Site for the delivery of various modules. These works would involve excavations, dewatering (if required), stockpiling of soils and other ground preparation activities. Other activities that would be completed during this stage include:

- piling and foundations;
- installation of underground utilities;
- preparation of concrete slabs for various Project components;
- construction of the stormwater system and internal road network;
- erection of steel structures to support the various modules;
- erection of other buildings and structures (e.g. load out areas, storage tanks, pipeline gantries, workshops, control room and other buildings, bulk AN store, etc.); and
- preparation of bunded areas.;

This stage is expected to last approximately 15 months; from month 7 to month 21. This stage would overlap with Stages 3 and 4.

5.2.4 Stage 3 - Modules Erection and overall activities

During this third stage various pre-constructed Project components would be brought to the Site and fixed into place. These pre-constructed Project components or 'modules' would be of various sizes and would be constructed in module yards offshore or in Australia. They would be shipped to Newcastle Harbour before being transferred to barges at the Western Basin berths. From here the modules would be transported to the Custom Transportable Buildings (CTB) berth at 64 Greenleaf Road for unloading. The method of transport would depend upon the size of the modules:

- Large modules would be moved from the CTB berth to the Site by Self Propelled Modular Transporters (SPMTs);
- Medium sized modules would be moved to the Site using hydraulic vehicles; and
- Smaller modules would be transported to the Site on flatbed or low bed trucks.

All movements from the CTB berth to the Site would be along Greenleaf Road. The modules would enter the Site at the new Greenleaf Road entrance.

Once on-site, the various modules would be fixed to the appropriate structures and joined to other Project components. During this stage all the necessary pipework for the Project would be installed alongside the necessary vessels, conveyors, scrubbers, pumps, fans, tanks, electrics and instrumentation. Certain components would be insulated and painted. Necessary permanent fencing, security, landscaping and signage would also be completed during this construction stage.

This construction stage is expected to last approximately 18 months; from month 9 to month 26. This stage would overlap with certain construction activities being completed in Stages 2 and 4.

5.2.5 Stage 4 - Commissioning

During this fourth stage a number of pre-commissioning and commissioning activities would be completed to thoroughly test the safety and reliability of the Project. All of the Project components would be tested. This testing would ramp up to the initial start up of the whole AN plant.

This construction stage is expected to last approximately 11 months from; month 18 to month 28. The start of this stage would overlap with certain construction activities being completed in Stages 3 and 4.

5.3 Construction Equipment

During the construction phase, various construction plant and machinery would be used. Most of these items would only be used during certain Stages of the construction phase. **Table 5-1** presents a list of the equipment that is likely to be used during each construction stage.

Table 5-1 Construction Equipment by Stage

Construction Equipment	Construction Stages			
	Site Preparation	Civil and Structural Works	Module Erection and Overall Activities	Commissioning
Heavy Vehicles	X	X	X	
Light Vehicles	X	X	X	X
Pile Driver / Caisson Drilling		X		
Clam Shovel Drop	X			
Large Bulldozer	X			
Scraper	X	X	X	
Dump Trucks	X	X	X	
Skid Steer	X	X	X	
Water Truck	X	X	X	
Roller	X	X	X	
Paver			X	
Jackhammer	X			
Small Bulldozer	X	X	X	
Backhoe	X	X	X	
Concrete truck		X	X	
SPMT			X	
Grinders		X	X	X
Electrical Welding			X	X
Diesel Welding / Generator	X	X	X	
Hydrotest Pumps			X	
Flushing Pumps / Pipes			X	X
Flushing Compressors			X	X
Steam blowing				X
Cranes – 50 t		X	X	X

Construction Equipment	Construction Stages			
	Site Preparation	Civil and Structural Works	Module Erection and Overall Activities	Commissioning
Cranes – 150 & 400 t			X	
Forklift		X	X	X
Manlift			X	X
Material Movement Truck	X	X	X	
Test Electrical Movement			X	X

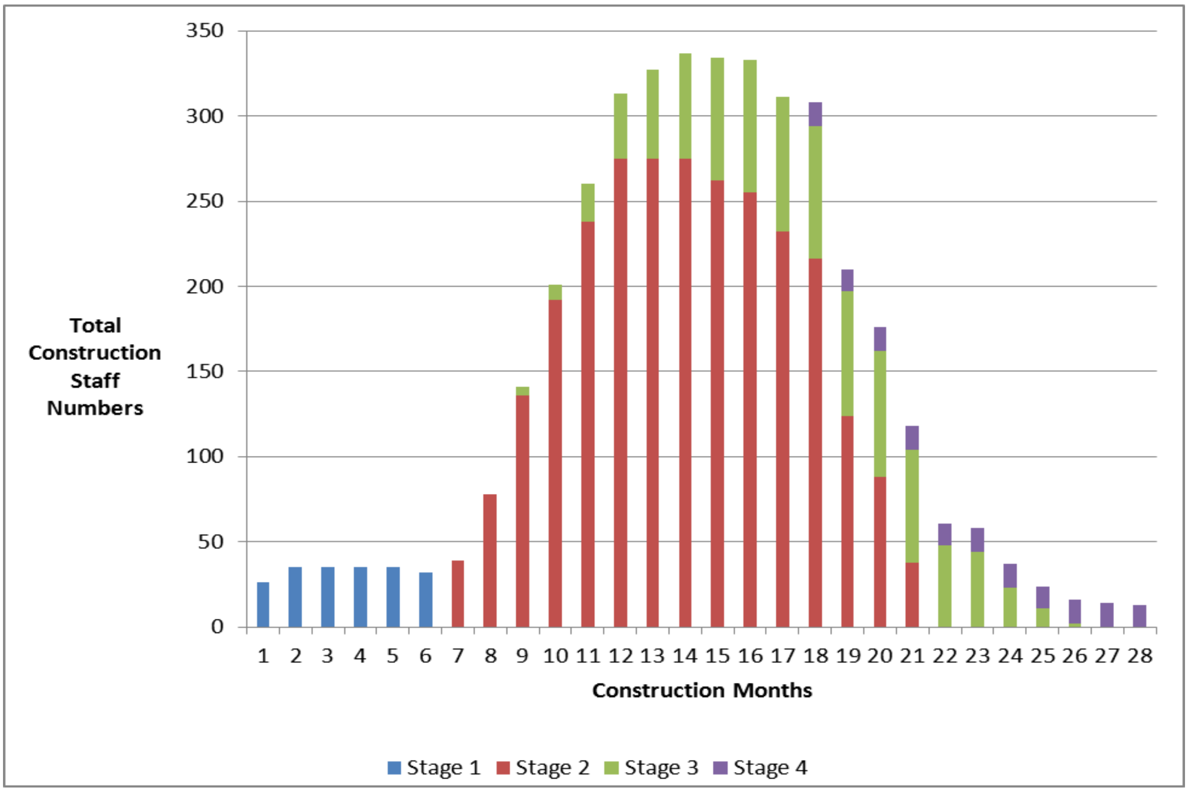
5.4 Construction Staff and Hours

5.4.1 Construction Staff

During construction the number of personnel on the Site would increase significantly. At present the existing operation employs approximately 40 people. These employees would continue to work on the Site in their current capacity throughout the construction phase of the Project.

The number of construction staff on-site would vary throughout the construction phase. During the Site preparation stage between 30 and 40 construction staff would be required. This would ramp up to a peak of approximately 330 construction staff, with over 300 construction staff working on the Project between months 12 and 18. Towards the end of the construction programme, during the commissioning stage, only a small number of construction staff would remain on-site. **Figure 5-2** presents the likely construction staff profile for each construction stage over the 28 month construction programme.

Figure 5-2 Construction Staff Profile by Stage



5.4.2 Construction Hours

The majority of the construction activities for the Project are planned to take place from 7 am to 6 pm from Monday to Friday and 8 am to 1 pm on Saturday. Construction work would only be conducted outside these hours if the work could be completed with no perceivable noise impact at the nearest residential areas. Where construction work does need to take place outside the normal Monday to Saturday hours above and perceivable noise impact at the nearest residential areas is expected, IPL would inform any potentially affected parties at least five days in advance. **Chapter 11 Noise and Vibration** and **Appendix F Noise and Vibration Impact Assessment** present the noise assessments for the Project.

5.5 Construction Traffic

5.5.1 Road Traffic

The construction phase of the Project would result in an increase in traffic going to and from the Site. In addition to construction staff movements, a number of light and heavy vehicle movements would be required during each construction stage for deliveries and disposal of materials. As discussed, the modular construction process and delivery of numerous Project components by ship and barge means that the number of road deliveries to and from Kooragang Island would be minimised.

During construction, IPL would operate a Park and Ride scheme for construction staff. Construction staff parking would be limited to 80 spaces on the Lot. All other staff would be brought to the Site by buses from a satellite car park or multiple pickups. Further details regarding traffic movements during construction of the Project are provided in **Chapter 15 Traffic and Transport** and **Appendix J Transport Impact Assessment**.

5.5.2 Sea Traffic

During the modules erection and overall activities stage there would be additional traffic in the Port of Newcastle as the modules are delivered to the port and brought to the Site.

The 60 modules are likely to be delivered to the port in a maximum of nine ocean going ships. From here barges would take the modules from the Western Basin berths to the CTB berth. A maximum number of 30 barge trips would be required, but the actual figure is likely to be less. Increases in sea traffic associated with the Project are not anticipated to have a significant impact on other users of the port.

5.6 Construction Wastes

Construction wastes would be produced throughout the construction phase. These wastes would mainly consist of inert construction debris as well as more hazardous wastes as the construction progresses. Waste streams generated by the Project would include:

- construction debris;
- scrap metal;
- wood, packing and paper;
- plastics;
- hazardous waste (oil, paints, contaminated soils);
- grey water; and
- domestic waste.

An assessment of the waste generated during the construction stage of the Project is included in **Chapter 16 Waste Management**.

5.7 Environmental Management

In order to mitigate against any environmental impacts from the Project, various environmental management techniques would be employed throughout the construction phase. These measures would be based on the mitigation measures provided within this EIS which are in turn summarised in **Chapter 23 Management and Mitigation Measures**.

These environmental management measures would be implemented through a Construction Environmental Management Plan (CEMP), which would be produced by IPL and/or their contractors and signed off by DP&I. Further details regarding the CEMP for the Project are found within **Chapter 23 Management and Mitigation Measures.**

5.8 Project Decommissioning

The expected life of the Project would be approximately 25 years. However, the Project is unlikely to be decommissioned whilst the mining industry remains in the Hunter Valley and is a significant user of Ammonium Nitrate as a precursor to its explosives.

Continued maintenance and upgrade works are likely to occur over the coming years which would mean that the Project would remain viable beyond the 25 year expected life. These works would be subject to relevant approvals and permits which would be applied for prior to the works being undertaken.

All decommissioning and restoration activities would be in accordance with applicable federal, state, and local permits, approvals and regulatory requirements and would be completed in accordance with existing licences and the relevant legislation and safeguards at the time.

Demolition and remediation works are subject to certain environmental approvals and safeguards, which would help ensure that any decommissioning work would be completed in a safe and appropriate manner.

6 Legislation and Planning Policy

6.1 Introduction

This chapter reviews the key Commonwealth and State legislation as well as the State, regional and local planning policies that apply to the Project in order to determine the approvals that would be required to allow the Project to proceed.

The key project approval required for the Project is consent under the *Environmental Planning and Assessment Act 1979* (EP&A Act). As the Project constitutes 'development' it requires consent under Part 4 of the EP&A Act. The Act provides a transparent and accountable method of regulating development within New South Wales. Under Section 79C, Part 4 of the EP&A Act, the Project must be evaluated against a range of considerations including environmental planning instruments, *Environmental Planning and Assessment Regulations 2000*, the likely environmental, social and economic impacts of that development, the suitability of the site, and the public interest.

Due to the size and nature of the Project, it is also classified as State Significant Development (SSD) under section 89C of the EP&A Act and Section 10, Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP S&RD). In order to comply with the requirements for assessing this type of SSD development, an Environmental Impact Statement (EIS) must be prepared and submitted alongside the Development Application (DA).

The SSD provisions were put into place to ensure that projects of State significance were assessed and determined at a State level. The Minister for Planning and Infrastructure is the determining authority for SSD projects such as this Project. However, when there are more than 25 objections to the application, or where the proponent has made a political donation, these powers are delegated to a Planning Assessment Commission (PAC).

In order to assist in the preparation and development of the EIS, a Preliminary Environmental Assessment (PEA) was prepared by IPL and URS and this was submitted to the Department of Planning and Infrastructure (DP&I) on 28th October 2011.

There are also other approvals required in addition to planning consent. This chapter reviews Commonwealth and State legislation as well as the State, regional and local planning policies that apply to the Project, to determine the approvals that would be required to allow the Project to proceed.

6.2 Commonwealth Legislation

6.2.1 Environment Protection and Biodiversity Conservation Act 1999

Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) states that an 'action' (which includes development) that has, will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) may not be undertaken without prior approval of the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities, as provided for under the provisions of Part 9 of the EPBC Act. The Act identifies the following matters as MNES for which Ministerial approval is required if they are significantly impacted:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (including Ramsar Wetlands);
- Listed threatened species and ecological communities;
- Listed migratory species protected under international agreements (e.g. CAMBA and JAMBA);

- Protection of the environment from nuclear actions; and
- Commonwealth marine areas.

Taking each of these in turn in relation to the Project:

- there are no World Heritage properties or National Heritage Places in the vicinity of the Site;
- the Project is not a nuclear action;
- there is a Ramsar wetland approximately 545 m to the north of the Site, and there are listed migratory species associated with the Ramsar wetland. However, as detailed in **Chapter 18 Ecology**, the Project is not likely to have a significant impact on the wetland nor listed migratory species. The Lot is highly modified and has low habitat value for native flora or fauna. No threatened ecological communities are found on the Lot and no threatened species would be significantly impacted by the Project; and
- the EPBC Act also requires Commonwealth approval for any activity that will, or is likely to have, a significant impact on Commonwealth land. The Lot is not Commonwealth land, and there is no Commonwealth land within close proximity of the Site that could be impacted by the construction or operation of the Project.

6.2.2 Australian Heritage Council Act 2003

The *Australian Heritage Council Act 2003* (AHC Act) establishes the Australian Heritage Council as an independent advisory body regarding National / Commonwealth heritage places and mandates the Council to maintain the Register of the National Estate (RNE) to promote the assessment and conservation of heritage items.

No items listed under the RNE are located on or adjacent to the Site (refer to **Chapter 19 Heritage**).

6.3 NSW Legislation and Planning Policy

6.3.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the *Environmental Planning and Assessment Regulations 2000* (EP&A Regulations) provide the framework for development and environmental assessment in NSW. The Project would have been one to which Part 3A of the EP&A Act may have applied, had Part 3A continued to operate. However, on 16 June 2011, the NSW Government introduced the EP&A Act Amendment Bill into the Parliament to repeal Part 3A of the EP&A Act and replace it with an alternative system for the assessment of projects of genuine State significance. That bill came into force as law on 1 October 2011.

Under the amended EP&A Act, a project is classified as State Significant Development, (SSD) pursuant to Section 89C, Part 4 of the EP&A Act, if it is declared as SSD by a State Environmental Planning Policy or declared SSD by order of the Minister for Planning in the Government Gazette. This Project meets the requirements of Section 10, Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP S&RD) and is, therefore, classified as SSD (DP&I Application Number SSD-4986).

Section 78(A) (8A) of the EP&A Act states that a '*development application for State significant development is to be accompanied by an environmental impact statement prepared by or on behalf of the applicant in the form prescribed by the regulations.*' Accordingly, this EIS has been prepared in line with the Director General Requirements (DGRs) and Schedule 2 – Environmental Impact Statements of the EP&A Regulations.

It is important to note that sections 89J and 89K of the EP&A Act outline authorisations that are not required for a SSD authorised by a development consent, and authorisations that cannot be refused if necessary for carrying out a SSD that is authorised by a development consent. Section 89J lists the Acts or sections of Acts relating to approvals which do not apply to SSD projects. These comprise:

- the concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that Part of that Act;
- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*;
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974*;
- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act repealed by that Act) to clear native vegetation or State protected land;
- a bush fire safety authority under section 100B of the *Rural Fires Act 1997*; and
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Section 89K states that approvals under the following Acts and sections of Acts must be applied consistently and cannot be refused when carrying out a project designated as SSD:

- an aquaculture permit under section 144 of the *Fisheries Management Act 1994*;
- an approval under section 15 of the *Mine Subsidence Compensation Act 1961*;
- a mining lease under the *Mining Act 1992*;
- a production lease under the *Petroleum (Onshore) Act 1991*;
- an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act);
- a consent under section 138 of the *Roads Act 1993*; and
- a licence under the *Pipelines Act 1967*.

The requirements of other legislation that is applicable to the Project are discussed in more detail below.

6.3.2 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) augment the EP&A Act and set out planning policies for various geographies and project types within New South Wales. The relevant SEPPs for this Project, and their requirements, are outlined below.

State Environmental Planning Policy (State and Regional Development) 2011

Clause 8, Part 2 *State Environmental Planning Policy State and Regional Development 2011* (SEPP S&RD) states that a project is to be determined as State Significant Development (SSD) if it is listed in Schedules 1 or 2 of the SEPP S&RD. Clause 10 of Schedule 1 relates to chemical, manufacture and related industries and includes development for the purpose of the manufacture, storage or use of dangerous goods in such quantities that constitute the development as a major hazard facility.

This Project meets the requirements of Clause 10, Schedule 1 of the SEPP S&RD as it relates to chemical industry and would manufacture, store and use dangerous goods in such quantities that constitute the development as a major hazard facility. Therefore, the provisions of the SEPP S&RD require that the Project be assessed as a SSD.

State Environmental Planning Policy (Major Development) 2005

The Site forms part of the *Three Ports Site* which was declared a State Significant Site, pursuant to Part 20 of Schedule 3 of *State Environmental Planning Policy (Major Development) 2005* (SEPP Major Development).

The Site is zoned SP1 Special Activities under SEPP (Major Development). Objectives of areas zoned SP1 are prescribed by Section 11, Part 20, Schedule 3 of SEPP (Major Development). The relevant objectives for the Lot and Project are outlined below:

- (d) to maximise the use of waterfront areas to accommodate port facilities and industrial, maritime industrial and bulk storage premises that benefit from being located close to port facilities,
- (f) to facilitate development that by its nature or scale requires separation from residential areas and other sensitive land uses,
- (g) to encourage employment opportunities.

The Project would maximise the use of the Lot by developing an industrial facility that would utilise the existing port facilities in Newcastle. The scale and nature of the Project means that it requires appropriate separation from residential areas. A Hazards and Risks assessment was completed using appropriately accepted criteria to see whether the current separation distances were adequate to ensure that the level of risk posed by the Project would be acceptable in terms of NSW regulations (refer to **Chapter 9 Hazards and Risk**). This study concluded that the risk posed by the Project was acceptable and would not be incompatible with the existing surrounding land uses.

Development of the Project is likely to increase employment opportunities on Kooragang Island which is one of the relevant planning objectives for this SP1 Zone, as discussed above

Sub clause 3, Section 11, Part 20, Schedule 3 of SEPP (Major Development) lists the types of development that are permissible with consent under areas zoned SP1 Special Activities. The Project would include development for the purpose of heavy industry. As prescribed by the *Standard Instrument (Local Environmental Plans) Order 2006*, 'heavy industry' means a building or place used to carry out an industrial activity that requires separation from other development because of the nature of the processes involved, or the materials used, stored or produced, and includes:

- hazardous industry, or
- offensive industry.

It may also involve the use of a hazardous materials storage establishment or offensive materials storage establishment.

As the Project falls within the definition of heavy industry it is considered permissible with consent within the *Three Ports Site* area, pursuant to SEPP Major Development.

State Environmental Planning Policy (Infrastructure) 2007

Schedule 3 of *State Environmental Planning Policy (Infrastructure) 2007* (SEPP Infrastructure) provides the Roads and Maritime Services (RMS) with the opportunity to comment on traffic generation arising from certain projects prior to determination by the consent authority. Schedule 3 lists traffic generating development which is to be referred to the RMS and includes industry:

- with a site size of 20,000 m^2 in area with access to any road; or
- 5,000 m^2 in area with access to a classified road or to road that connects to a classified road (if access within 90 m of connection, measured along alignment of connecting road).

The Project is located between Greenleaf Road and Heron Road with access off Heron Road. These roads are owned and managed by NPC. They are not classified roads. Teal Street, to the north, is a classified road (108) by the RMS.

The Project is being assessed as State Significant Development and, as such, would be referred to RMS for comment.

Impact of the Project on local transport infrastructure is discussed in **Chapter 15 Traffic and Transport.**

State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) outlines the approach used in NSW for planning and assessing the risks and hazards associated with industrial development projects.

Under the policy, the permissibility of an industrial proposal is linked to its safety and pollution control performance. SEPP 33 applies to any proposals that fall under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'.

The policy states that:

- *"potentially hazardous industry" means a development for the purposes of any industry which, if the development were to operate without employing any measures to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality to (a) human health, life or property, or (b) the biophysical environment; and includes a hazardous industry and a hazardous storage establishment.*
- *"potentially offensive industry" means a development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*"

For development proposals classified as 'potentially hazardous industry', such as this Project, the policy establishes a comprehensive test, by way of a preliminary hazard analysis (PHA), to determine the risk to people, property and the environment in the study area and in the presence of controls. **Appendix D1** contains the PHA for the Project. The PHA concludes that the Project would not contravene any NSW land-use safety criteria from within the Hazardous Industry Planning Advisory Papers. This analysis is summarised in **Chapter 9 Hazards & Risks**.

State Environmental Planning Policy No 14 - Coastal Wetlands

State Environmental Planning Policy No 14 – Coastal Wetlands (SEPP 14) aims to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State.

Although the Project is not situated within a coastal wetland zone, there are known to be areas of Ramsar wetlands to the north of the Project and runoff from the Site would enter the Hunter River. The closest SEPP 14 Coastal Wetland is located approximately 750 m to the east of the Site and the closest Ramsar wetland is located 545 m to the north of the Site. Although there is considerable overlap between these two areas of wetland, the boundaries of the Ramsar wetlands and the SEPP 14 wetlands are slightly different. The location of the SEPP 14 wetlands and the Ramsar site are shown **Figure 18-3**.

The Project is not expected to have any adverse or significant impact on the Ramsar wetlands or the SEPP 14 wetlands. The Project's potential impact on wetland areas is discussed in **Chapter 18 Ecology**.

State Environmental Planning Policy No 55 - Remediation of Land

State Environmental Planning Policy 55 - Remediation of Land (SEPP 55) provides a State wide planning approach to the remediation of contaminated land.

Neither the Site nor the Lot are on the list of NSW contaminated sites notified to the NSW Office of Environment and Heritage (OEH) under Section 60 of the *Contaminated Land Management Act 1997*. The Lot also does not appear on the Contaminated Land: Record of Notices. It is noted that contaminated land is present on the land adjacent to the south of the Site (owned by Orica). This contamination is the subject of a Voluntary Remediation Agreement (VRA) with the Office of Environment and Heritage (OEH).

Remediation of land consistent with SEPP 55 is necessary if the land is found to be contaminated during the environmental investigations. The results of the relevant environmental investigations determined that the Lot is suitable for industrial uses without remediation. These results are discussed in **Chapter 12 Soil and Groundwater**.

State Environmental Planning Policy No 71 - Coastal Protection

State Environmental Planning Policy 71 - Coastal Protection (SEPP 71) commenced on 1 November 2002. The policy has been made under the Environmental Planning and Assessment Act 1979 to ensure that:

- development in the NSW coastal zone is appropriate and suitably located;
- there is a consistent and strategic approach to coastal planning and management; and
- there is a clear development assessment framework for the Coastal Zone.

The Coastal Zone extends along the entire NSW coastline, along all the shorelines including around bays and estuaries (except Sydney Harbour and Botany Bay), coastal lakes and up coastal rivers to the limit of tidal influence. Kooragang Island lies wholly within the NSW Coastal Zone Therefore SEPP 71 applies to the Site.

Part 4 of the SEPP specifies provisions relating to development control for development within the Coastal Zone including public access, effluent disposal and stormwater. The matters listed in Part 4 of SEPP 71 have been considered in the design and assessment of the Project and are discussed in **Chapter 4 Project Description** and **Chapter 13 Surface Water and Waste Water**.

NSW 2021, A Plan to Make NSW Number One

NSW 2021 is a ten year plan that replaces the State Plan as NSW Government's strategic business plan. It is based around five strategies: Rebuild the economy, Return quality services, Renovate Infrastructure, Strengthen the local environment and communities and Restore accountability to Government.

The aims that were created to meet the goal of rebuilding the economy include the establishment of 100,000 new jobs, and the growth of critical industries and investment. The Project would contribute to achieving the strategies outlined in this plan by creating more jobs in NSW, and supporting the growth of the State's mining industry.

6.3.3 Local Planning Policies and Instruments

Newcastle LEP 2012

Local environmental plans (LEPs) guide planning decisions within local government areas (LGAs). Through zoning and development controls, councils and other consent authorities manage the ways in which land is used. In deciding whether or not to approve the carrying out of an SSD project, such as this Project, the approval authority may, but is not required to, take into account the provisions of any Environmental Planning Instrument (EPI), including an LEP that would apply to the project if approved.

The Site is located within the Newcastle City Council (NCC) LGA. Therefore the policies of the Newcastle Local Environmental Plan (LEP) need to be considered.

The Site is zoned according to SEPP Major Development. Therefore the local zoning provisions of the Newcastle LEP are not applicable to the Project. In accordance with the requirements of Part 4 of the EP&A Act, the Project has given consideration to the relevant clauses of the Newcastle LEP. Where applicable the policies within the two LEPs are considered within the relevant EIS technical chapters, i.e. **Chapters 11 - 19**.

Other Local Planning Policies and Guidelines

The proponent has considered all other relevant local planning requirements relevant to the Project including the *Lower Hunter Regional Strategy 2006* and the *Newcastle and Kooragang Island Area Risk Assessment Study 1992*. The provisions of the *Hunter Estuary Coastal Zone Management Plan* (*Hunter Estuary Management Plan*, 2009), *Hunter Rivers Catchment Action Plan 2007*, and *Newcastle 2030* have also been considered.

Newcastle Development Control Plan 2012

The Project would be located on Kooragang Island, at a location within the *Three Ports Sites* as defined in Schedule 3 of *SEPP Major Development 2005.* As such it is not be covered by the provisions of the *Newcastle Development Control Plan* (DCP) *2012*.

Despite this, the DCP could be a consideration for the Project determination, particularly in areas where Project impacts could occur outside of the *Three Ports Sites* and within the area covered by the *Newcastle DCP 2012*.

The Sections of the DCP that are most relevant include:

- Section 3.12 Industrial Development; and
- Section 7.02 Landscape Open Space and Visual Amenity.

Section 3.12 of the DCP has been addressed throughout the EIS technical chapters, by closely examining the environmental impact of the outfalls from the Project, the impact of the industrial development on areas of land covered by the Newcastle DCP has been addressed.

Section 7.02 of the DCP has been addressed within **Chapter 17 Visual and Landscape** and within **Appendix K Visual Impact Assessment**.

6.3.4 Other NSW State Legislation

While the EP&A Act provides the framework for the planning and development approvals system in NSW, there are a number of other Acts, Regulations and Environmental Planning Instruments (EPIs) of relevance to the Project. Those relevant Acts and Regulations are discussed below and are addressed throughout this EIS.

Environmentally Hazardous Chemicals Act 1985

The *Environmentally Hazardous Chemicals Act 1985* (EHC Act) provides the legal framework to allow the regulation of a hazardous chemical throughout its entire life cycle.

Section 20 of the EHC Act stipulates that an authority may make a chemical control order (CCO) after assessing a chemical or a prescribed activity in relation to an environmentally hazardous chemical or a declared chemical waste. The CCO sets requirements for various activities including manufacturing, processing, distribution, use, sale, transportation, storage and disposal of chemicals and chemical wastes. This can include the requirement for a person to hold a licence for a prescribed activity.

A CCO may be issued to IPL in the future under the EHC Act, which may then require IPL to apply for a licence. IPL would ensure that any such licence is granted before undertaking any activities to which the licence relates.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (PoEO Act) provides for the issue of an Environment Protection Licence (EPL) for scheduled activities pursuant to Section 48 of the PoEO Act, in relation to pollution and waste disposal caused by development or operation of developments. Activities requiring an EPL are listed in Schedule 1 of the Act.

By issuing EPLs, the Act regulates pollution and waste disposal in NSW caused by development or operation of developments. The Project would require a licence pursuant to clause 8 of Schedule 1 as a Chemical Industries or Works facility. The Lot has an existing EPL licence (L11781). The current licence would need to be updated in order to accommodate the change in use and capacity.

The PoEO Act also provides for the management of water, air and noise pollution and the control of wastes. The mitigation measures outlined in the table of proposed management and mitigation measures (refer to **Chapter 23 Management and Mitigation Measures**) would be implemented to minimise the potential of the Project to result in pollution of the environment.

Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* relates to significantly contaminated land and enables the EPA to respond to contamination. Under the Act, the EPA is given power to declare land to be significantly contaminated, and may order a person to undertake preliminary investigations and management action in relation to that significantly contaminated land.

IPL would undertake activities in order to minimise risks of contamination arising from the Project, and would report any contaminated land to the EPA under circumstances outlined in Section 60 of the Act.

Explosives Act 2003

The *Explosives Act 2003* (Explosives Act) and *Explosive Regulations 2005* (Explosive Regulations) provide for the regulation and control of the handling of explosives and explosive precursors, and provide for the regulation of certain other dangerous goods. The WorkCover Authority of NSW is the regulatory authority for the purposes of the Explosives Act.

Part 3 of the Explosives Act provides for the issuing of licences authorising the carrying out of an activity that constitutes handling an explosive or explosive precursor as defined in the Explosive Regulations. It is noted that the Explosives Act does not to apply to transport of dangerous goods, which is covered by another scheme.

The Explosives Act and the Explosive Regulations require IPL to hold a licence for the manufacture and storage of Security Sensitive Dangerous Substances (SSDS) on the Site. The Site currently has storage capacity for up to 4,060 tonnes of Technical Grade Ammonia Nitrate (TGAN) which is prescribed as a SSDS.

IPL already holds a licence to manufacture SSDS at the Site. IPL would therefore be required to amend that licence to manufacture SSDS to cover new activities on the Site under Part 4 of the Explosive Regulations.

Work Health and Safety Act 2011

The *Work Health and Safety Act 2011* aims to '*secure the health and safety of workers and workplaces by:*
(a) protecting workers and other persons against harm to their health, safety and welfare through the elimination or minimisation of risks arising from work or from specified types of substances or plant, and

(b) providing for fair and effective workplace representation, consultation, co-operation and issue resolution in relation to work health and safety, and

(c) encouraging unions and employer organisations to take a constructive role in promoting improvements in work health and safety practices, and assisting persons conducting businesses or undertakings and workers to achieve a healthier and safer working environment, and

(d) promoting the provision of advice, information, education and training in relation to work health and safety, and

(e) securing compliance with this Act through effective and appropriate compliance and enforcement measures, and

(f) ensuring appropriate scrutiny and review of actions taken by persons exercising powers and performing functions under this Act, and

(g) providing a framework for continuous improvement and progressively higher standards of work health and safety, and

(h) maintaining and strengthening the national harmonisation of laws relating to work health and safety and to facilitate a consistent national approach to work health and safety in this jurisdiction'.

Workcover Authority of NSW has advised that the existing IPL facility on the Site is a Major Hazard Facility registered until 8 May 2016. IPL would ensure the licence for the Major Hazard Facility and the Safety Case relating to the Site would be amended to reflect the new Project on the Site.

Dangerous Goods (Road & Rail Transport) Act 2008

The *Dangerous Goods (Road & Rail Transport) Act 2008* (DG(RRT) Act) makes provision for safety in the transport of dangerous goods by road and rail as part of the system of nationally consistent road and rail transport laws.

Technical Grade Ammonium Nitrate (TGAN) is a porous prill. It is classified by the Australian Dangerous Goods Code as a Class 5.1 Dangerous Good - Oxidising Agent.

Part 2 of the DG (RRT) Act stipulates that both the vehicles and the drivers of trucks holding Dangerous Goods are sufficiently licensed. IPL would ensure that all licences are granted before the operational phase of the Project commences.

Pipelines Act 1967

The Pipelines Act 1967 stipulates the requirements surrounding transmission pipelines within New South Wales. Except under certain circumstances, under the Act, any person who wishes to construct and operate a pipeline for the purpose of any substance, must hold a licence, or be acting on behalf of the registered holder of a relevant licence.

An exemption from the requirement to hold a licence applies if the pipeline is constructed for the conveyance of dangerous goods within the meaning of the *Dangerous Goods (Road and Rail Transport) Act 2008*. IPL will therefore not be required to obtain a licence under this Act.

The Roads Act 1993

Under the *Roads Act 1993*, permission would ordinarily be required pursuant to s138 from the relevant road authority to carry out works in, on or over a public road.

The Site is located between Greenleaf Road and Heron Road with existing access off Heron Road. The Project would require connection to Greenleaf Road and would also result in the construction of a new ammonia pipeline and a new effluent pipeline over Heron Road.

Heron Road and Greenleaf Road are owned and managed by Newcastle Port Corporation (NPC). Both roads are not classified roads and are considered private roads. Teal Street, to the north, is a classified road (108) by the Roads and Maritime Services (RMS).

As the Project is classified as SSD, consent under s138 cannot be refused and must be substantially consistent with any approval given under the EP&A Act. IPL is in regular discussions with NPC and would ensure that all appropriate approvals are in place prior to Project works commencing.

Water Act 1912

The *Water Act 1912* (Water Act) facilitates development and use of water by controlling the extraction of water, the use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near sources in NSW. Surface water allocation is administered under Part 2 of the Water Act.

Any monitoring bores, excavation or dewatering with the potential to impact groundwater would require a licence under Part 5 of the Water Act. This licence would be acquired prior to commencement of works.

Water Management Act 2000

The *Water Management Act 2000* (WM Act) establishes a framework for managing water in NSW. The Act creates:

1. mechanisms for protecting and restoring water sources and their dependent ecosystems;
2. improved access rights to water; and
3. partnership arrangements between the community and the Government for water management.

One such mechanism is a Water Sharing Plan (WSP) which is a legal document prepared under the *Water Management Act*. These plans establish rules for sharing water between the environmental needs of the river or aquifer and water users, and also between different types of water uses such as town supply, rural domestic supply, stock watering, industry and irrigation.

The aquifer interference provisions of the WM Act have not been activated and the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources excludes any water contained in alluvial sediments downstream of the tidal limit. As such all groundwater on the Site is regulated under the Water Act.

The Project is situated on Kooragang Island. It would have a connection to an existing NPC berth via the proposed ammonia pipeline and would require stormwater outfalls and a wastewater outfall to the Hunter River. These outfalls would utilise existing stormwater outfalls where possible. No water abstractions are proposed. The Project would source its water requirements from the Hunter Water Corporation supply.

Section 89J of the EP&A Act outlines authorisations that do not apply to SSD. These authorisations include '*a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000.*'

The impact of the Project on ground and surface water is discussed in **Chapter 12 Soil and Groundwater** and **Chapter 13 Surface Water and Wastewater.**

Hunter Water Act 1991

The *Hunter Water Act 1991* legislated for the dissolution of the Hunter Water Board and the creation of the Hunter Water Corporation as a statutory State Owned Corporation. The Hunter Water Corporation is compelled to supply water, provide sewerage and drainage services, and dispose of wastewater within the Hunter River catchment.

Threatened Species Conservation Act 1995

Under the EP&A Act, impacts on threatened species listed under the *Threatened Species Conservation Act 1995* (TSC Act) are required to be assessed in relation to proposed projects. The TSC Act provides legal status for biota of conservation significance in NSW. The TSC Act aims to '*conserve biological diversity and promote ecologically sustainable development*'.

Chapter 18 Ecology provides the ecological impact assessment for the Project. The requirements of the TSC Act have been incorporated into this assessment. The assessment of potential impacts of the Project on species, population and communities listed under the TSC Act is in line with the requirements of this Act. This assessment has concluded that the Project will result in no significant impacts to the values protected by the TSC Act.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) relates to the conservation, development and sharing of the fishery resources of the State for the benefit of present and future generations.

Section 89J of the EP&A Act outlines approvals and legislation that do not apply to SSD such as this Project, including seeking a permit under sections 201, 205 or 219 of the FM Act.

However, the potential impact of the Project on the ecological values protected by the FM Act has been assessed in **Chapter 18 Ecology**. That assessment has concluded that no significant impacts to the values protected by the FM Act are expected as a result of the Project.

Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the protection of items of local, regional and State heritage significance. It contains a list of State Heritage Items and outlines the process of assessment for development that may impact items of heritage significance.

Section 89J of the EP&A Act outlines approvals and legislation that do not apply to SSD such as this Project. This includes an approval under Part 4, or an excavation permit under Section 139 of the Heritage Act.

However, an assessment of the potential impacts of the Project on heritage items in the area is provided in **Chapter 19 Heritage**. That assessment concludes that the Project is unlikely to have an adverse impact on any heritage features in NSW.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) provides for the preservation of land and the protection of that land, as well as the protection of flora and fauna and Aboriginal heritage.

Approval for an Aboriginal heritage impact permit under Section 90 of the NP&W Act is not required for SSD such as this Project, pursuant to Section 89J of the EP&A Act.

However, assessments of the potential impacts of the Project on heritage items and ecology are provided in **Chapter 18 Ecology** and **Chapter 19 Heritage**. No significant adverse impacts have been identified as being likely as a result of the Project.

Coastal Protection Act

The *Coastal Protection Act 1979* (CP Act) controls the use and occupation of the NSW coastal region, as well as facilitating certain coastal protection works.

The Site is affected by the operation of Sections 38 and 39 of the CP Act.

However, Section 89J of the EP&A Act states that any authorisations under the CP Act are not required for SSD such as this Project. Nevertheless, issues relating to coastal protection will be discussed in relevant sections throughout this EIS.

Maritime Service Act 1935

The *Maritime Services Act 1935* (MS Act) provides for the constitution of a board, The Maritime Services Board of NSW which is now called the Maritime Services Division of the RMS, to be charged with the administration of the *Navigation Act 1901* and certain other Acts as well as conferring and imposing certain other powers, authorities, duties and functions on that board.

Division 3A controls the construction of certain works in the Hunter River and requires the consent of the Maritime Services Division of the RMS for certain construction works. The Act requires any proponent to gain permission for the construction of any embankment, retaining wall, reclamation, wharf, dock, pier, jetty, landing stage, mooring apparatus, slip or platform, or to carry out dredging works.

The Project would not require permission under the MS Act, due to the nature of the activities proposed; however, consultation between IPL, RMS and NPC would be ongoing in relation to the Project.

Ports and Maritime Administration Act 1995

Clause (3)(b) of the Ports and Maritime Administration Act 1995 states that *“A Port Corporation* [such as NPC] *may: …conduct any business (whether or not related to its principal functions) that it considers will further its objectives.”* The objectives of Port Corporations includes ensuring that its port safety functions are carried out properly; maximising the net worth of the State’s investment in the Port Corporation; operating at least as efficiently as any comparable business and promoting and facilitation a competitive environment in port operations. (See Cl 9 Ports and Maritime Administration Act 1995).

Any pipelines within NPC land or connection to NPCs stormwater system would be subject to a licence. Any construction activities to be undertaken on NPC land would be required to coordinate with the NPC Operations Branch.

It is also noted that the use of the NPC owned roads to move prefabricated modules during construction would require a licence from NPC. This licence would be obtained prior to construction.

7 Consultation

7.1 Introduction

The DGRs state that; *'During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners'.* In preparing this EIS, IPL has produced the consultation strategy outlined below. Consultation activities were started before the Project was publicly announced and have continued throughout the preparation of this EIS.

The purpose of this strategy was to identify key stakeholders and understand their concerns. This included understanding the issues of the local community close to the Project, particularly given their understandable concerns following a number of environmental incidents on Kooragang Island. The key issues raised by residents in Stockton and Mayfield included issues around the risk of pollution, general impacts of industrial activity, and risks to community health and safety.

IPL also engaged with government, industry and other stakeholders throughout the Project inception and planning process. The outcomes of this consultation are outlined below.

Table 7-1 at the end of this chapter lists the various issues that were identified during consultation and shows where in this EIS these issues are assessed. For the key community concerns of Project safety, pollution and industrial activity, these environmental aspects are discussed in Chapters 9, 10, 11, 13 and 15 of this EIS.

This chapter describes the consultation methodology and outlines the groups and individuals that have been consulted in preparation of this EIS. The chapter is supported by a Community and Stakeholder Consultation Report which is included in **Appendix C Community and Stakeholder Consultation Report.**

7.2 Objectives of Stakeholder Consultation

The objectives of the stakeholder consultation process associated for the Project included:

- identify key stakeholders;
- improve community awareness of the Project and to understand their concerns and questions;
- communicate accurate and timely information concerning the Project and planning approval process to key stakeholder and local communities;
- help the community and other stakeholders to better understand the Project;
- provide opportunities for two-way communication between the Project team and stakeholders; and
- involve Government agencies in the Project design and planning of the Project.

Key messages for the Project, which were communicated during all communication and consultation activities, include:

- Since announcing the feasibility study, IPL has committed to early and honest discussions with the local community, especially those in close proximity to the Port.
- IPL values the opinions and issues raised by all residents and acknowledges that valid concerns need to be addressed for the Project to move forward.
- Kooragang Island has a long history of operating as an industrial zone and there is a need to find the right balance between the future prosperity of Newcastle and the local communities.

- The expansion of mining in the Hunter depends on a secure supply of ammonium nitrate. IPL is proposing a new plant bound by the highest safety provisions and strict environmental standards to guarantee that supply.
- Residents in the Hunter can be assured that IPL's proposed development will have to comply with state and federal health, safety and environmental protection and planning laws in seeking approval to proceed. IPL will use the best available technology to minimise potential adverse environmental impacts, creating a safe and reliable supply of AN to the Hunter Valley.

7.3 Stakeholder Identification

IPL's Community Relations Steering Committee undertook an extensive stakeholder identification process while preparing for the public announcement of the Project.

IPL subsequently engaged two communication agencies to assist it in the engagement of both the community and general public as well as the various government stakeholders. Details of these agencies and their roles are included in **Appendix C Community and Stakeholder Consultation Report**.

7.4 Government Agency Consultation

The DGRs of 1 December 2011 state that IPL must consult with the following government agencies:

- Office of Environment and Heritage (OEH);
- Department of Primary Industries (NSW Office of Water (NOW));
- Roads and Traffic Authority (now the Roads and Maritime Service (RMS));
- Newcastle Ports Corporation (NPC);
- Newcastle City Council (NCC); and
- WorkCover NSW.

To ensure that all interested stakeholders were satisfactorily consulted prior to the announcement of the Project, preliminary meetings were held between IPL and DP&I (in June and September 2011) and OEH (in July 2011). These meetings were followed by a Planning Focus Meeting (PFM) once the Project was announced. The PFM was held on 15 November 2011 between IPL, URS and the following organisations:

- DP&I Major Project Assessment, Industry and Mining;
- DP&I Major Hazards Unit;
- WorkCover NSW;
- NSW Fire Brigades;
- NSW Health;
- NSW Police;
- NOW; and
- NCC.

Meetings were also held with the following organisations following the PFM:

- DP&I, MHF WorkCover, Santos and Orica on 5 December 2011;
- DTI on 7 December 2011;
- Hunter Business Chamber on 18 December 2011;
- DP&I Major Hazards Unit on 30 January 2012;
- NPC on 1 February and 8 February 2012;
- EPA on 10 February 2012;
- DP&I, EPA, Workcover and NCC on 6 June 2012;
- EPA, OEH and DP&I on 14 August 2012.

Meetings were also held with:

- Hon. Tim Owen, Member for Newcastle;
- Hon. Craig Baumann, Member for Port Stephens;
- Mayor John Tate, Mayor of Newcastle;
- Hon. Barry O'Farrell, Premier of NSW; and
- Hon. Robyn Parker, NSW Minister for the Environment.

The Project team also conducted a number of conversations regarding the Project via telephone or email. That consultation included:

- Telephone and email conversations with the Heritage Team at OEH regarding the Heritage Assessments in November and December 2011;
- Telephone and email conversations with the DPI Office of Water regarding the wording of and application of their DGR comments in January 2012;
- Telephone conversations with DP&I and EPA regarding the Noise Assessment between January and February 2012;
- Telephone conversations with RMS to discuss the Traffic Impact Assessment between January and March 2012;
- Telephone conversations with the NCC traffic team to discuss the Traffic Impact Assessment between January and March 2012; and
- Telephone conversations with the Air Technical Advisory Services Unit at OEH to discuss Air Quality Assessment considerations in May 2012.

7.5 Community Consultation

A number of relevant community stakeholder groups have been identified with an actual or perceived interest in the Project. These consist mainly of residents, industry and community action groups. These groups are listed below and their roles are explained in **Appendix C Community and Stakeholder Consultation Report**:

- local residents;
- Indigenous groups;
- Kooragang Cycle Club;

- Stockton Community Action Group (SCAG);
- Correct Planning and Consultation for Mayfield Group (CPCFM);
- Kooragang Wetlands Rehabilitation Group;
- Hunter Bird Observers Club;
- Hunter Business Chamber;
- NSW Minerals Council;
- Hunter Water;
- Newcastle Ports Corporation;
- Jemena; and
- Ausgrid.

In order to maintain an open and effective dialogue with the community a number of channels have been opened. Working alongside IPL commissioned communication agencies, IPL has sought to ensure that the community is informed throughout the planning and EIS compilation stages of the Project. A number of communication channels have been used to ensure that this dialogue is maintained. These are outlined below.

7.5.1 Indigenous Consultation

The location of the Project on an entirely reclaimed section of an island means that impacts on aboriginal communities and their cultural heritage are not anticipated. No items of heritage importance are likely to be affected by the Project (refer to **Chapter 19 Heritage** and **Appendix M Heritage Impact Assessment**).

However, in order to confirm this, as part of the Heritage Impact Study:

- a search of the Aboriginal Heritage Information Management System (AHMIS) database was conducted;
- IPL consulted with the local site recorder, Mr Leonard Anderson. Mr Anderson, was the individual responsible for recording the heritage sites located on neighbouring Stockton Beach; and
- IPL also consulted with the Office of Environment and Heritage (OEH). See **Chapter 19 Heritage**.

7.5.2 Project Announcement

IPL's engagement program with the wider Newcastle community started with letter and Project Factsheet which were dropped into 3,100 letter boxes of Stockton and Fern Bay households on 27 and 28 October 2011 (refer to **Appendix C Community and Stakeholder Consultation Report**).

Key local stakeholders were also advised by telephone with a follow-up email.

A media release was also sent to local media which resulted in radio interviews on 27 October 2011 and front page news in the Newcastle Herald on 28 October 2011. The Project was also announced to the Australian Securities Exchange and through briefings to key Government Ministers' offices.

7.5.3 Community Presentations

IPL conducted community presentations. The community presentations were advertised in the Newcastle Herald on 9 November and 6, 10 and 12 December 2012. Two community presentations and discussions were held in Stockton on 10 November 2012 – one at 3.30pm and one at 7.00pm. The meetings were facilitated by FordComm. A total of 15 community members attended these presentations. A further community presentation was held in Mayfield on Monday 12 December 2011. Three community members attended.

At each of the community presentations information was provided about IPL and the Project using a Powerpoint presentation, IPL listened to issues raised by the community and answered questions.

7.5.4 Community Letters

A community letter was distributed on 17 and 18 December 2011 after the community information sessions discussed above to address issues raised and feedback given during the community presentation and discussion meetings. Another community letter was distributed on 7 July 2012 to provide a Project update. Copies of the letters are provided in **Appendix C Community and Stakeholder Consultation Report**. The letters were sent to:

- 9,700 households in Stockton, Fern Bay, Mayfield, Tighes Hill and Carrington;
- Newcastle City Ward 1 Councillors;
- key community and environment groups;
- Newcastle City Council officers; and
- NSW Government representatives.

7.5.5 Project Website

The Project website - http://iplkooragang.com.au/ - was used as the central point for information concerning the Project. Information provided on the website included the Preliminary Environmental Assessment report, DGRs for the EIS, the Project fact sheets, the community presentations and community letters etc.

From the 27 October 2011 to 28 August 2012:

- There have been 9,126 website visits.
- Eight people have posted one or more comments.
- There have been 50 website registrations.

7.5.6 Online Discussion Forum

An online discussion forum was established as part the Project's website. Stakeholder and community members were invited to register with the website and contribute to the discussion. By registering, people could receive information regarding the feasibility process, news and Project updates, and post questions to IPL's Project team and participate in the online discussion forum. IPL asked the following two questions on the Project's online discussion forum:

- Having read the factsheet for the Project and possibly the Preliminary Environmental Assessment, what issues do you foresee IPL will need to address?
- IPL has outlined an initial plan for community consultation, what improvements or changes could be made to better suit the communities neighbouring Kooragang Island?

Fifty community members registered with the discussion forum and seven people placed comments or questions, to which IPL responded.

The discussion forum was viewed 977 times between 27 October 2011 and 28 August 2012.

7.5.7 Community Liaison Group

A community liaison group (CLG) was established for the Project to provide an ongoing forum for the involvement of community representatives in understanding the proposed planning, construction and operation of the Project.

The CLG is made up of representatives from neighbouring residential areas, local business and environment groups.

CLG meetings provide opportunities for Project stakeholders to raise concerns and provide feedback directly to IPL management during the preparation of the EIS.

A copy of the Terms of Reference for the CLG is provided in **Appendix C Community and Stakeholder Consultation Report**.

The CLG's first meeting was held on 6 March 2012 and the second meeting was held on 26 April 2012. Both meetings were held at the Stockton Surfside Presbyterian Hall.

The CLG will continue to meet throughout the feasibility period. Should the Project's implementation be approved by IPL after the feasibility study, the CLG meetings would continue throughout construction and operation of the Project.

The objectives of the CLG are to:

- establish an effective and efficient two-way communication process between IPL and its community stakeholders;
- provide a communication channel with key community representatives that is clear, consistent and timely;
- develop community awareness with regard to the processes around the planning and assessment of the AN plant, and if approved, its construction and operation;
- develop and strengthen long term partnerships with key community stakeholders;
- provide an opportunity for the identification of issues and develop outcomes acceptable to both IPL and the community;
- ensure issues that are raised at the meeting are managed in a timely manner;
- share information between IPL and its community stakeholders;
- review and provide feedback on proposed communication mechanisms for the AN plant; and
- review and discuss IPL progress updates.

The CLG is chaired by former Cessnock City Council General Manager, Colin Cowan. Associate Professor John Lucas was accepted by the group as an independent technical specialist to act as a technical resource for the group.

The following organisations are represented on the CLG:

- Hunter Bird Observers Group;
- Newcastle Port Corporation;
- Stockton Community Action Group;
- Correct Planning and Consultation for Mayfield Group;
- Hunter Business Chamber;
- Four representatives from the Stockton community; and
- Newcastle City Council Ward 1.

CLG meetings are also open to members of the general public, who are welcome to attend as observers.

Meeting Notes from CLG meetings are made available on IPL Kooragang's website after approval by members of the group.

7.6 Aboriginal Stakeholder Consultation

The location of the Project on an entirely reclaimed section of an island means that impacts on Aboriginal communities and their cultural heritage are not anticipated. In order to confirm this expectation, a search of the Aboriginal Heritage Information Management System (AHMIS) database and consultation with the local site recorder was conducted as part of the Heritage Impact Study (refer to **Chapter 19 Heritage** and **Appendix M Heritage Impact Assessment**).

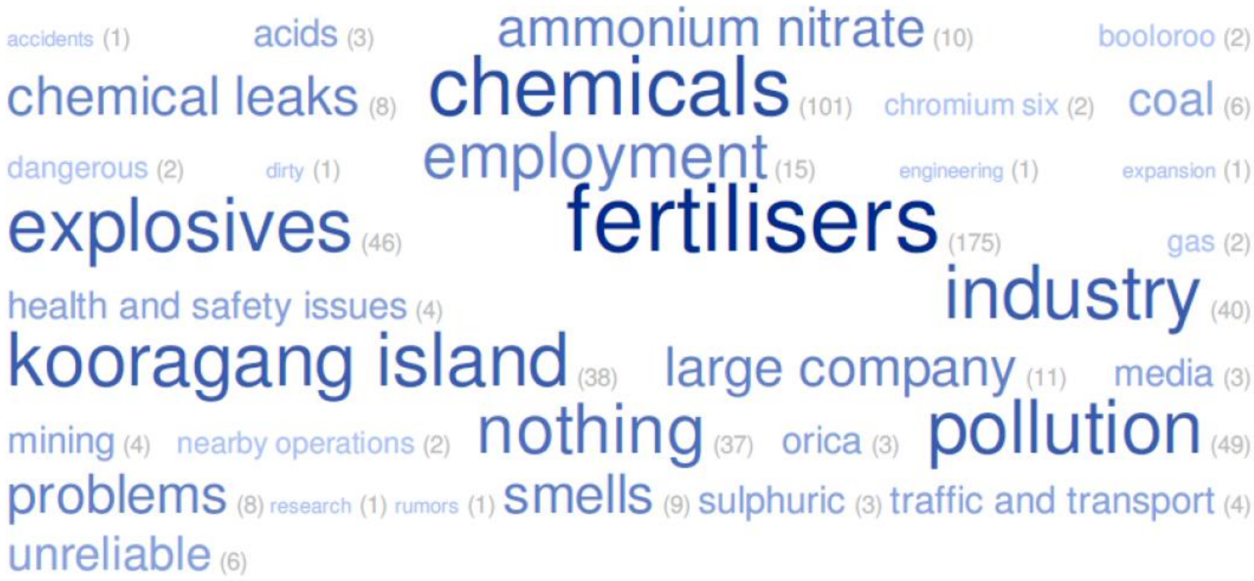
7.7 Community Perception Survey

IPL engaged Coakes Consulting to assist in designing and carrying out a community perception survey with randomly selected members of the Newcastle community. The purpose of the survey was to gauge the level of awareness of IPL and the Project in the wider community and gain an understanding of what people think about it. The survey was conducted by telephone during April 2012. A total of 663 people were interviewed across the following six sample areas:

- Area 1: Fern Bay (62 people);
- Area 2: Stockton (85 people);
- Area 3: Mayfield, Mayfield East, Mayfield West (101 people);
- Area 4: Wickham, Carrington, Maryville and Tighes Hill (102 people);
- Area 5: Newcastle, Newcastle East, Newcastle West, The Hill (100 people); and
- Area 6: the rest of the Newcastle LGA (213 people).

Figure 7-1 below shows the words or 'top of mind associations' that came to mind when the survey respondents were first asked about their perceptions of IPL. As shown in **Figure 7-1**, the most frequently mentioned word was 'fertilisers', followed by 'chemicals', 'pollution', 'explosives', and 'industry', demonstrating a link between the company and its operations on Kooragang Island.

Figure 7-1 Words That Come to Mind When Mentioning Incitec Pivot Limited



Key findings of the community perceptions survey included:

- 59 percent of respondents across all areas had heard of IPL;
- 65 percent of respondents across all areas were aware that IPL and Orica are separate companies;
- 69 percent of respondents across all areas were unaware of the Project;
- respondents from Area 2, which is closest to Kooragang Island, had the greatest level of awareness of the Project and held the most negative attitudes towards it;
- respondents from Area 6 held the most positive attitude towards the Project;
- 49 percent of respondents had concerns about the Project, which included the health and safety of surrounding residents, proximity of the plant to residential areas, and potential impacts on air quality; and
- the greatest perceived benefit of the Project is increased employment opportunities.

7.8 Consultation issues and Response

The DGRs state that the EIS must identify where the design has been amended in response to the issues raised during the consultation process. **Table 7-1** contains a list of all the issues raised during the consultation process and where each issue has been addressed in the EIS.

Table 7-1 Issues Raised During Consultation

Issue	Raised by	Addressed in EIS
The Project		
Why is there a need for the Project?	DP&I	Chapter 2
Is the Project based on an existing plant?	DP&I	Chapter 2
Why wouldn't the plant produce ammonia?	DP&I	Chapter 2
Certain groups are opposed to IPL's proposal and believe that IPL should relocate the Project closer to the Hunter Valley mining operations.	SCAG, CPCMG	Chapter 2
It is not appropriate to locate a plant producing material for explosives 1km from residences.	SCAG	Chapter 2 & Chapter 9
Will IPL's customers be coal mines?	Community member	Chapter 2
Will IPL buy ammonia from Orica? That means Orica has to expand.	Community member	Chapter 2 & Chapter 4
How is IPL going to take into account major infrastructure requirements?	Community member	Chapter 4
There is a strong feeling in the community that we don't want any more industry. This is not good for Stockton.	Community member	Chapter 24
What does IPL mean by bulk storage? And what is the location of the bulk storage and quantities stored?	Community member	Chapter 4
Concerned about the potential for ammonium nitrate to be stored in the bulk storages to come into contact with other hazardous material.	Community member	Chapter 4 & Chapter 9
How is IPL different to Orica?	Community member	Chapter 2 & Chapter 4
What are the benefits of the proposal?	Community member	Chapter 2 & Chapter 24
By which standard is IPL determining 'State of the Art' and 'best practice'?	Community member	Chapter 4
Planning and Approvals Process		
What does 'State Significant' mean?	Community member	Chapter 6
Has IPL got an approval for the Project?	Community member	Chapter 6
Consultation Process		
Consultation needs to take place throughout the process.	DP&I	Chapter 7 & Appendix C
The community information sessions were held at the same time as meetings with Orica, which resulted in poor attendance.	Community member	Appendix C
Consultation – that is you just talking to us and then it will end up going ahead anyway.	Community member	Chapter 2 & Appendix C
I have never seen such anger and concern about the development of industry on Kooragang Island. This feasibility study couldn't have come at a worse time.	Community member	Chapter 7 & Appendix C
Your plant is most unwelcome! Don't think the small number at this presentation is an indication of how people feel.	Community member	Appendix C
The community has a right to be part of the process	Community member	Chapter 7 & Appendix C
Concerned about the relationship between Orica and IPL (competitors) and the need for communication between the two parties.	Community member	Chapter 7 & Appendix C

Issue	Raised by	Addressed in EIS
Hazards and Risk		
The Project would need to consider the new work place health and safety regulations.	WorkCover	Chapter 23 & Appendix D
An Emergency Management Plan would need to be produced for the Project.	NSW Police	Chapter 23
Transport of dangerous goods needs to be considered.	DP&I	Chapter 9 & Appendix D
What about the risk of an earthquake?	WorkCover	Chapter 9 & Appendix D
Shipping risk needs to be considered.	DP&I	Chapter 9 & Appendix D
Any potential risks on Stockton Bridge need to be assessed.	DP&I	Chapter 9 & Appendix D
IPL needs to consult with Workcover and with the surrounding major hazardous facilities.	DP&I	Chapter 7, Chapter 9, Appendix C & Appendix D
A safety study needs to be completed with Orica.	DP&I	Chapter 9 & Appendix D
The 1992 Kooragang Island Risk Assessment Study places certain restrictions on additional development. This needs to be reviewed.	DP&I	Chapter 9 & Appendix D
Concerned about dangers to the community.	Community member	Chapter 9 & Appendix D
Concerned about potential impacts from a catastrophic explosion.	SCAG	Chapter 9 & Appendix D
The area affected by the explosion risk is significant and will affect residents and buildings and cause fatalities and injuries.	SCAG	Chapter 9 & Appendix D
Will there be a risk assessment conducted as part of the feasibility study and will we be able to look at it?	Community member	Chapter 9 & Appendix D
It is easy for IPL to say that you will do the best in safety and environment but we don’t trust the industries anymore.	Community member	Chapter 9 & Appendix D
What is the potential risk if an ammonium nitrate truck runs into a tanker full of fuel?	Community member	Chapter 9 & Appendix D
What is the potential for an explosion associated with the road transport of ammonium nitrate and how safe are the drivers and the residents?	Community member	Chapter 9 & Appendix D
What is the security like on Site?	Community member	Chapter 4
How safe is the import of ammonia coming into the Facility?	Community member	Chapter 9 & Appendix D
Air Quality		
The air quality impact assessment (AQIA) must demonstrate the Group B limits comply with PoEO limits.	OEH	Chapter 10 & Appendix E
The AQIA should demonstrate that ground level particulates comply with OEH policy, especially with regard to cumulative impact.	OEH	Chapter 10 & Appendix E
Licensing is to comply with section 45 of the PoEO Act and the EIS should address this. Load base licensing will be applicable to the Project and the EIS should identify the proposed likely load.	OEH	Chapter 10 & Appendix E
A ‘type 2’ assessment is required for the Project.	OEH	Chapter 10 & Appendix E
Questioned whether the facility is really ‘world class’ with an output of 50ppm of nitrogen dioxide.	SCAG	Chapter 10 & Appendix E
Concerned about air pollution including NO2, NOx and PM2.5 and PM10 particles.	Community member	Chapter 10 & Appendix E

Issue	Raised by	Addressed in EIS
Concerned about air quality impacts affecting community health.	Community member	Chapter 10 & Appendix E
Concerned about dust.	Community member	Chapter 10 & Appendix E
Noise		
The EIS will need to be prepared in accordance with the Industrial Noise Policy (INP). Specifically, noise assessments will need to ensure that they do not include the existing noise emissions from the current facility in its baseline and include one week of background monitoring data.	OEH	Chapter 11 & Appendix F
Concerned about noise pollution	Community member	Chapter 11 & Appendix F
Surface Water and Wastewater Impacts		
Concerned about potential change to ambient conditions, particularly as getting ambient quality data can be difficult.	OEH	Chapter 13 & Appendix H
Mixing zones in the estuary can be considered in the EIS but the licence limits will be set for the end of the pipe going into the estuary.	OEH	Chapter 13 & Appendix H
The licence for the plant would need to be a load based licence and the EIS needs to contain enough details to establish load limits for the new licence.	OEH	Chapter 13 & Appendix H
Orica has struggled to meet temperature licence limits. The presence of any sea grass in the estuary will influence temperature levels and the location of the discharge.	OEH	Chapter 13 & Appendix H
A discharge into the south arm of the Hunter River would be preferable to the north arm. Would like to see the results of a dispersion model before confirming this view.	OEH	Chapter 13, Chapter 18 & Appendix H
Stormwater discharge would need to comply with Section 120 of the PoEO Act. There may be a requirement for monitoring at the point of discharge.	OEH	Chapter 13 & Appendix H
Need to include isolation values to contain any 'dangerous goods'.	OEH	Chapter 4, Chapter 13 & Appendix H
If stormwater volumes increase significantly there may need to be consideration of scour at the end of the pipes.	OEH	Chapter 13 & Appendix H
The EIS should consider tidal movements, especially in relation to the Hunter wetlands.	OEH	Chapter 13 & Appendix H
The EIS needs to consider all practicable measures and a discussion needs to be included as to why the facility cannot have 'no discharges'.	OEH	Chapter 2
Greenhouse Gases		
What scopes will the greenhouse gas assessment consider?	Newcastle City Council	Chapter 14 & Appendix H
Traffic and Transport		
Traffic impact assessment should be undertaken in accordance with RMS guidelines.	RMS	Chapter 15 & Appendix I
There should be no direct access to the Site from State roads	RMS	Chapter 4
How many additional truck movements would there be?	NSW Police	Chapter 15 & Appendix I
How will your product be moved – by truck? How many truck movements per day?	Community member	Chapter 15 & Appendix I
Concerned about driving along Cormorant Road with an additional 30 trucks, unless IPL is going to build another road.	Community member	Chapter 15 & Appendix I
There are already traffic problems on Kooragang Island. Concerned that another development will make it even worse.	Community member	Chapter 15 & Appendix I
Heritage		

Issue	Raised by	Addressed in EIS
Heritage assessments will need to comply with OEH Heritage guidelines and policies.	OEH	Chapter 19 & Appendix M
There are three phases for Aboriginal Heritage: due diligence, ground disturbance/investigation and consultation. The EIS would need to comply with these policies.	OEH	Chapter 19 & Appendix M
Due diligence can be undertaken by any practitioner however the latter two phases must be undertaken by a recognised Heritage consultant.	OEH	Chapter 19 & Appendix M
Socio Economics		
No money from industry in the area goes back to the community	Community member	Chapter 21
Questioned how many local people IPL would employ.	Community member	Chapter 21
Concerned that IPL's priority is profit before people. This is no longer acceptable.	Community member	Chapter 2, Chapter 9 and Appendix D
Concerned about property devaluation.	Community member	Chapter 21
Cumulative Impacts		
Concerned about the cumulative effect of the Orica modification, IPL's proposed new AN manufacturing plant and the LNG Terminal proposals on the Eastern Star Gas site on the Kooragang Island risk contours. If the cumulative risk contours reached Stockton it would be a significant concern.	DPI	Chapter 23 & Appendix D
The cumulative risk of hazards needs to be considered.	WorkCover	Chapter 23 & Appendix D
We already have all the polluting industries here, particularly coal.	Community member	Chapter 22

8 Environmental Scoping Assessment

8.1 Summary of Potential Issues Identified

In order to assess the potential impacts of the Project, key issues have been identified through:

- receipt of the DGRs for the Project (refer to **Chapter 1 Introduction** and **Appendix A1 DGRs**);
- identifying key issues from community and stakeholder consultation (refer to **Chapter 7 Consultation**);
- reviewing relevant legislation and planning policy (refer to **Chapter 6 Legislation and Planning Policy**);
- identifying the sensitivities of the local environment (refer to **Chapter 3 Project Location and Existing Environment**); and
- understanding the characteristics of the Project (refer to **Chapter 4 Project Description** and **Chapter 5 Construction**).

The issues that have arisen as a result of this process are listed alphabetically below:

- Air Quality & Odour;
- Flora & Fauna;
- Greenhouse Gas;
- Hazards & Risks;
- Heritage;
- Noise & Vibration;
- Resource Implications;
- Soil & Water;
- Socio Economics;
- Surface Water & Wastewater;
- Traffic & Transport;
- Visual; and
- Waste.

8.2 Prioritisation of Potential Issues

The risk assessment that was conducted for the Project has been based on recognition that a more detailed assessment would be required for the biophysical, environmental, economic and social aspects with the highest potential likelihood and greatest potential consequences. A qualitative risk assessment has been conducted based upon the guidelines outlined in AS/NZS 4360:2004 and AS/NZS ISO 31000:2009. This assessment and the assessment methodology used are outlined in **Section 24.1** of **Chapter 24 Evaluation and Justification**.

Table 8-1 uses the results of the qualitative risk assessment to identify the key environmental issues in relation to the Project. This process has been used to help prioritise the scope of work for each environmental aspect.

Table 8-1 Prioritisation of Environmental Issues

High Priority Issues	Medium Priority Issues	Low Priority Issues
• Hazards and Risks **(Chapter 9)** • Air Quality & Odour **(Chapter 10)** • Noise & Vibration **(Chapter 11)**	• Soil and Groundwater **(Chapter 12)** • Surface Water and Wastewater **(Chapter 13)** • Greenhouse Gas **(Chapter 14)** • Traffic & Transport **(Chapter 15)** • Resource Implications **(Chapter 20)**	• Waste Management **(Chapter 16)** • Visual and Landscape **(Chapter 17)** • Flora & Fauna (Ecology) **(Chapter 18)** • Indigenous and European Heritage **(Chapter 19)** • Socio Economics **(Chapter 21)**

9 Hazards and Risks

9.1 Introduction

The DGRs list Hazards and Risk as a key issue to be addressed within the EIS. Lloyd's Register Rail Ltd (Lloyd's Register or LR) was engaged to undertake a Hazard and Risk Assessment for the Project.

The DGRs specifically require that the following be undertaken as part of the EIS:

"a summary of the results of a Preliminary Hazardous Analysis (PHA) undertaken for the proposed development. The PHA should be prepared in accordance with Hazardous Industry Planning Advisory Paper No.6 - Guidelines for Hazard Analysis*, and in particular:*

- *identify the hazards associated with the existing site and proposed development, as well as any external hazards (i.e. natural hazards) to determine the potential for off-site impacts;*
- *estimate the risks from the existing site and the overall site, including the proposed development;*
- *demonstrate that the proposed development complies with the criteria set out in Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning;*
- *estimate the cumulative impacts from the overall site and the surrounding potentially hazardous developments (existing and proposed) and demonstrate that the proposed development does not increase the cumulative risk of the area to unacceptable levels; and*
- *address all recommendations of the Department's Newcastle and Kooragang Island Risk Assessment Study relevant to the development.*

- an evaluation of the impacts of the transport of Dangerous Goods to and from the site in the surrounding area."

The recommendations included in the DP&I's 1992 *Newcastle and Kooragang Island Area Risk Assessment Study* were reviewed and found to be not applicable to the Project. This is due to a combination of reasons, including:

- the age of DP&I's study (many recommendations are no longer applicable or have already been implemented);
- some recommendations are for other parties (e.g. fire brigades, planning authorities); and
- many of the recommendations relate to upgrading of the existing facilities (some of which had never been subjected to the staged approval process under SEPP No. 33).

The assessment was conducted by Lloyd's Register in two parts. Part one comprises a Preliminary Hazards Analysis (PHA) included as **Appendix D1 Preliminary Hazard Analysis**. The second part is a Transportation Risk Assessment (TRA) included as **Appendix D2 Transport Risk Assessment**. This chapter summarises those two reports.

9.2 Hazard Analysis and Risk Assessment Concepts

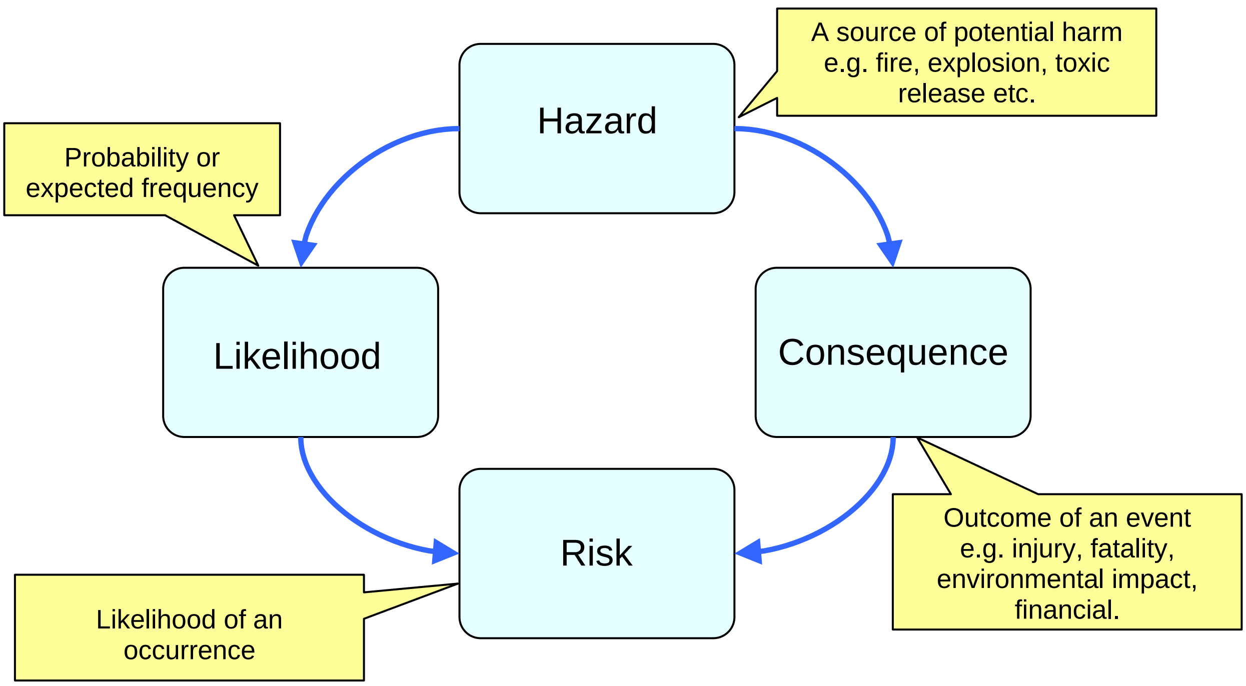
Hazard analysis combines either the known frequency, or the likelihood, that something may go wrong with an assessment of the potential consequences of an event for people, the environment or property if that event occurred. **Figure 9-1** shows the relationship between hazards, likelihood, consequence and risk.

The analysis may be qualitative or quantitative. Qualitative analysis ranks risk based on categories of likelihood and consequence, e.g. high, medium and low likelihood or consequence. Quantitative risk is assessed by detailed calculations of known frequency and consequence.

Results of quantitative risk analysis may be expressed as lines or “risk contours” on a map around an industrial site, describing the risk at a particular location. These risk contours are drawn on the very conservative assumption of continuous exposure outdoors to any hazardous event at that particular location for the entire year.

A one-in-a-million chance of an individual death occurring at a particular location is the globally accepted benchmark for the additional risk that industry imposes on a residential area. The results may be expressed as 1 x 10^{-6} p.a., which translates to one-in-a-million chance of that activity causing an individual death at that particular location in a given year, or one chance of fatality per million person years. This benchmark is low when compared to other risks that the public are exposed to every day in their normal lives. For example, the risk in NSW for simply travelling in a car is much higher and was 145 chances of a fatality per million person years (HIPAP 4, DP&I, 2011).

Figure 9-1 Hazards, Likelihood, Consequence and Risk



9.3 Preliminary Hazard Analysis

The PHA has been undertaken in accordance with the guidance provided by DP&I in *Hazardous Industry Planning Advisory Paper* (HIPAP) *No. 6 - Guidelines for Hazard Analysis 2011*. A quantitative assessment of the risk has been undertaken in accordance with the criteria published in *HIPAP No. 4 - Risk Criteria for Land Use Safety Planning 2011* and *HIPAP No. 10 – Land Use Safety Planning 2011*.

The PHA covers all activities carried out on the Site, including loading and unloading of ammonia and loading of TGAN and ANSOL. The PHAST-Risk software package was used for all consequence modelling and generation of risk contours.

Where assumptions have been included in the assessment, conservative assumptions have been used in order to maintain a precautionary approach.

9.3.1 Assessment Methodology

The process for completing the assessment can be described in five stages:

- a description of the processes relating to the existing operations on Site and the proposed operations;
- an identification of the possible hazards (HAZID) that are presented on the Site;
- an analysis of the consequences of incidents;
- an analysis of the likelihood and/or frequency of incidents; and
- an analysis and assessment of the risk.

From these five stages, an assessment of the level of risk associated with the existing operation and the Project can be undertaken. Risk analysis and assessment are separate tasks, although they are often undertaken at the same time. Risk analysis requires the scenario consequence and likelihood estimates to be combined and then summed across all the accident scenarios to generate a complete picture of the risk.

9.3.2 Risk Criteria

Having determined the risk from both the existing operation and proposed Project, it must then be compared with accepted risk criteria in order to assess whether or not the risk level being proposed is tolerable. Specific measures must be taken to reduce the risk to a tolerable level. Where this is not demonstrated, or if this is not possible, it must then be concluded that the proposed operation is not compatible with the existing surrounding land uses.

Both qualitative and quantitative criteria need to be considered in assessing the tolerability of risk. The criteria adopted for this assessment are outlined in the NSW DP&I's HIPAP No. 4: *Risk Criteria for Land Use Safety Planning*. Impairment criteria for injury have been developed for explosions, fires and toxic gas releases as well as for property damage and escalation.

Discussion of the Individual Fatality Risk criteria, the Injury Risk Criteria as well as Risk of Property Damage and Accident Propagation criteria considered within this study is outlined in Section 2.5 of **Appendix D1 - Preliminary Hazard Analysis.**

9.3.3 Project Description

The existing Site and the proposed Project are described in **Chapter 3 Project Location and Existing Environment** and **Chapter 4 Project Description.** Discussions with IPL identified that the following materials will be present in significant quantities as part of the proposed operation and have the potential for adverse off-site impacts:

- Anhydrous Ammonia (refrigerated and/or pressurised);
- Nitrogen oxides (NO_x);
- Natural Gas (Methane);
- Technical Grade Ammonium Nitrate (TGAN);
- AN Solution (ANSOL);
- Nitric Acid; and

- Sulphuric Acid.

Only TGAN and sulphuric acid are currently present on Site in significant quantities that have the potential for adverse off-site impacts as part of the existing operation.

9.3.4 Properties of Potentially Hazardous Materials

Ammonia

Ammonia is a colourless gas (normal boiling point is minus 33 deg. C) and is the main raw material for the production of Nitric Acid and Ammonium Nitrate. The gas has a pungent odour at relatively low concentrations. It is strongly alkaline, and can be irritating or corrosive to the eyes, respiratory system and skin. Exposure at relatively high concentrations may be fatal.

Natural Gas (Methane)

Methane is a colourless and flammable gas which is used as a fuel source on-site for gas fired appliances. Methane is flammable between concentrations of approximately 4.4% (LFL) and 16.5% (UFL) by volume when mixed with air. However, methane is a low reactivity gas and only a powerful spark or very hot surface (above 540 °C) will ignite the vapour if it is between these limits.

Nitrogen Dioxide

Nitrogen Dioxide (NO_2) is a toxic red, yellow or brown gas and is an intermediate formed during manufacture of Nitric Acid in the NA plant. Nitrogen dioxide is also the most toxic AN decomposition product that may form under conditions of confinement and high temperatures and thus be emitted from hot ammonium nitrate.

Technical Grade Ammonium Nitrate and Ammonium Nitrate Solution

Technical Grade Ammonium Nitrate (TGAN) is a white crystalline substance (porous prills). It has a melting point of 169 ºC and decomposes above 210 ºC.

Ammonium Nitrate Solution (ANSOL) is a colourless liquid, heated to approximately 110–120 ºC, and stored as an 88 per cent concentration in water.

There are three main hazards associated with ammonium nitrate (AN):

- fire due to its oxidising nature;
- decomposition; and
- explosion resulting from rapid deflagration or detonation.

While ammonium nitrate cannot burn, it readily supports combustion when mixed with combustible materials and it produces nitrogen oxides as decomposition products. When continually heated in a fire and not confined, AN will fume off at a constant temperature of approximately 290 ºC until all the ammonium nitrate has decomposed.

TGAN is not an explosive. However, it is one of the ingredients in explosives used in mining operations around Australia. In certain accident conditions, it is possible to cause TGAN or ANSOL to explode. The required conditions include:

- Heating. This is usually associated with a fire that continues for a significant period, melting a fraction of the ammonium nitrate, with initiation of an explosion by a subsequent mechanical shock.
- Nearby explosion. A nearby explosion can provide sufficient energy to cause ammonium nitrate to explode and contribute to the explosion overpressure.

- Pressure. When ammonium nitrate is confined during a fire, the decomposition gases cannot escape readily and increase the pressure. Where this pressure is sufficiently high (some atmospheres of pressure), the ammonium nitrate can decompose violently.
- Contamination. When ammonium nitrate is contaminated with organic materials, such as oil, or other materials, such as chlorides or zinc, its susceptibility to explosion through heating or nearby explosion is significantly increased.

The number of scenarios that can cause an explosion of ammonium nitrate / ammonium nitrate solution is small due to the above requirements. A number of the above requirements are usually required for an explosion. For example, heating of pure ammonium nitrate without confinement will not cause an explosion. Also, contamination without heating or nearby explosion will not cause the ammonium nitrate to explode.

Nitric Acid and Sulphuric Acid

Acids present on-site will include sulphuric acid (98%) and nitric acid (60%). Both of these acids are highly corrosive and strong oxidisers. Concentrated nitric acid may emit fumes of nitrogen oxide. However, the nitric acid present on-site is limited to 60% concentration and is not categorised as a 'fuming acid' (> 86%). Similarly, the sulphuric acid present on site is not categorised as a 'fuming acid'. Therefore, both acids are not included in the safety risk analysis, but are included in the analysis of risk to the biophysical environment.

The physical and chemical properties of these substances are detailed in Section 5.1 of **Appendix D1 - Preliminary Hazard Analysis.**

9.3.5 Identification of Major Accidents

A desktop review of the existing Site operations and proposed Project designs and process flows was conducted to provide inputs into the hazard identification (HAZID) process. In addition to identifying the hazardous materials, the following information must be determined in order to fully assess the impacts of a release of hazardous material:

- How the hazardous material is released (e.g. hole in pipe, rupture of vessel etc);
- The condition of the material prior to release (e.g. compressed gas at a specific temperature and pressure);
- The area/s into which the material is released (e.g. within a bunded area, into seawater, inside a confined area);
- Ambient conditions in the area where the material is released (e.g. air temperature, wind speed and direction, atmospheric stability);
- Location of ignition sources around the release point; and
- Duration of release before it is isolated.

Previous incident data was considered during the hazard identification step. In particular, the explosion at Toulouse in 2001 was considered. This incident led to a number of significant changes to international and Australian regulations and new codes of practice for the storage of AN to prevent a recurrence, for example: the *SAFEX Good Practice Guide: Storage of Solid Technical Grade Ammonium Nitrate* (2010), *EFMA Guidance for the Storage of Hot Ammonium Nitrate Solutions* (2005) and *Australian Standard AS4326 - The Storage and Handling of Oxidising Agents* (2008). IPL has advised that the Project will embrace and meet all the current relevant Australian regulations, standards and codes of practice and International SAFEX Code of Practice for the safe storage of TGAN and ANSOL.

The HAZID information was used to develop a detailed list of potential Major Accident Events (MAEs). Potential MAEs are defined as a sudden occurrence (including in particular a major emission, loss of containment, fire, explosion or release of energy) involving a hazardous material that poses off-site danger or harm to people, property or the environment, whether immediate or delayed.

The MAE Register for the proposed Project operations is provided in **Table 9-1** and the MAE Register for the existing Site is provided in **Table 9-2**.

Table 9-1 MAE Register for Proposed Operations

Major Accident Event			End Event/s
Number	Description	Notes	
1	Release of fuel gas (Methane) from pipework to flare pilots or gas fired equipment		Jet Fire, Flash Fire
2	Release of Ammonia (liquid) from marine unloading/loading arm	Only applicable during unloading of ship	Exposure to toxic gas / vapour
3	Release of Ammonia (liquid) from pipework to storage tank from berth		
4-6	Release of Ammonia (gas or liquid) at road tanker un/loading area from tanker, loading arm or pipework	Pressurised or refrigerated ammonia	Exposure to toxic gas / vapour
7-9	Release of Ammonia (liquid) at road tanker loading area due to overfill or drive-away		Exposure to toxic gas / vapour
10-13	Release of Ammonia (gas or liquid) from pipework to road tanker un/loading area from bulk storage tank		Exposure to toxic gas / vapour
14	AN explosion on a truck		Explosion
15	ANSOL explosion in a road tanker		Explosion
16	Release of Ammonia (gas or liquid) from bulk storage tank		Exposure to toxic gas / vapour
17-18	Release of Ammonia (gas or liquid) from pipework to AN / NA plants from the bulk storage		Exposure to toxic gas / vapour
19-20	Release of Ammonia (gas or liquid) from refrigeration unit		Exposure to toxic gas / vapour
21-24	Release of Ammonia (gas) from: inlet of refrigeration unit to LP compressor KO drum; LP compressor to inlet of flash vessel; flash vessel; or HP compressor to outlet of HP oil filter		Exposure to toxic gas / vapour
25	Release of Ammonia (liquid) from ammonia condensate accumulator		Exposure to toxic gas / vapour
26-30 & 41-43	Release of Ammonia (gas or liquid) at NA plant		Exposure to toxic gas / vapour
31	Release of NH_3/Air from pipework to inlet of oxidation reactor at NA plant		Exposure to toxic gas / vapour
32-40	Release of NOx/Air at NA plant		Exposure to toxic gas / vapour
44	Release of tail gas at NA plant		Exposure to toxic gas / vapour
45-52	Release of Ammonia (gas or liquid) at AN plant		Exposure to toxic gas / vapour

Major Accident Event			End Event/s
Number	Description	Notes	
53-59 & 74-75	ANSOL explosion at AN plant or storage tank		Explosion
60-64	AN explosion in prill tower, pre-dryer, dryer, fluidised bed cooler or coating tank at AN plant		Explosion
65-67	AN Explosion in AN (solid) storage area		Explosion
68-69	Decomposition of AN due to fire at AN (solid) storage area		Exposure to toxic gas
70	Decomposition of AN due to conveyor fire		Exposure to toxic gas
71	Decomposition of AN due to a fire on an AN Truck		Exposure to toxic gas
72-73	Release of NOx/Air from absorber at NA plant (Due to failure of feed water pump or low level in Absorber)		Exposure to toxic gas / vapour
76	Release of Ammonia (liquid) due to overfilling of bulk storage tank		Exposure to toxic gas / vapour
77-78	Explosion in converter at NA plant due to formation and ignition of flammable H_2/Air or NH_3/Air mixture and release of NOx (Due to process control failure).		Explosion and exposure to toxic gas / vapour

Table 9-2 MAE Register for Existing Site

Major Accident Event			End Event/s
Number	Description	Notes	
79-80	AN Explosion in existing AN (solid) stores	Only MAEs for existing facility.	Explosion

Natural environmental events were also considered as part of the hazard identification study in Section 5.3 of **Appendix D1 Preliminary Hazards Analysis**. This section considered flooding, earthquakes and strong winds.

The conclusions of the flooding assessment in **Appendix H Water Management Report** show that the proposed Project design would mean that the likelihood and consequences of flooding are minimal and do not require further consideration within the PHA.

The bulk ammonia storage tank would be designed to comply with the highest level of importance (level 4) defined in AS1170.4 for earthquake and wind forces. The final design of the tank / foundations were not available for the PHA, however, design to AS1170.4 should ensure that the tank can withstand a 1 in 1000 year earthquake or wind force (as per Table F2 of AS1170.4).

More detailed design of the ammonia storage tank and associated pipework and foundations would be required to understand how these Project components would respond to a 1 in 10,000 year or 1 in 100,000 year earthquake or wind force and the corresponding effect on various risk contours identified below. Due to this uncertainty, it has been recommended that a detailed structural analysis be undertaken on the final design to determine the potential for leaks from the storage tank and associated pipework and that these events be included in the final hazard analysis (as relevant).

9.3.6 Consequence Analysis

Correlations between exposure to hazardous materials and the effect that such exposure has on people and the environment are used to calculate the impacts or consequences of the identified hazards. The physical consequences of a hazardous release are generally dependent on a number of variables. Those variables are the quantity released, the rate of release, and, for fire and explosion events, when ignition occurs. The consequences of a number of scenarios have been examined in the PHA. These scenarios are outlined below and explored within **Appendix D1 Preliminary Hazard Analysis**.

Release of Potential Hazardous Materials as Gas / Liquid / Vapour

The physical consequences of a release of potentially hazardous material (e.g. toxic gas, flammable gas, flammable liquid, etc.) from a pipe, vessel, etc. are generally dependent on the: quantity released; the rate of release; and, for fire and explosion events, when ignition occurs.

A release of liquid onto the ground may form a pool and/or accumulate in a bund/sump. If the liquid is volatile, then a vapour cloud may form and disperse in the air. Similarly, a release of gas (from pressurised equipment) may form a gas cloud and disperse in the air. The vapour / gas dispersion rate depends on the wind speed and atmospheric stability conditions. The dispersion of flammable or toxic gas / vapour is modelled to produce a concentration profile in three dimensions (downwind, crosswind and elevation). For releases that are constant over time, this can be represented by a set of contours of constant concentration (isopleths) on a plan drawing and/or summarised in a tabular format.

If the vapour / gas is toxic, or an asphyxiant, then the potential may exist for injury or fatality if exposed (typically via inhalation). If the flammable gas-air mixture is ignited, then a flash fire or a vapour cloud explosion (VCE) may occur. A VCE can only occur in a partially confined and/or congested plant. If the release is a flammable gas/vapour under pressure, ignition will produce a jet fire. A jet fire generates heat radiation, which can be modelled using the surface emissivity of the flame to produce contours of heat radiation levels. Fires impinging on adjacent equipment may cause structural failures and incident escalation.

The only flammable gas present on Site is natural gas which is piped directly to the Site as a fuel source. The hazards associated with a natural gas release include a jet fire and flash fire. The level of heat radiation from a jet fire determines the consequence of the hazard, whilst with a flash fire; it will result in fatality for anyone within the range of the lower flammability limit of the flammable gas cloud.

The processes and precautions involved in the manufacturing process and storage protocols are outlined in detail within **Appendix D1 Preliminary Hazard Analysis**. The risk contours for each representative scenario associated with a release of a potential hazardous material are summarised in **Section 9.3.7** below.

The consequences of a fire on people and property as per HIPAP No. 4 are presented in the **Table 9-3**.

Table 9-3 Effect of Fire on People and Property

Value	Effect/s
Heat Radiation [kW/m^2]	
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)

Value	Effect/s
Heat Radiation [kW/m^2]	
12.6	Significant chance of fatality for extended exposure. High chance of injury Melting of plastics (cable insulation). Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure. Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure.
23	Likely fatality for extended exposure and chance of fatality for instantaneous exposure Spontaneous ignition of wood after long exposure. Unprotected steel will reach thermal stress temperatures which can cause failure. Pressure vessel needs to be relieved or failure would occur.
35	Significant chance of fatality for people exposed instantaneously Cellulosic material will pilot ignite within one minute of exposure.
Flash Fire	
Within flammable cloud	Serious injury or fatality. Probability of fatality is generally taken to be 100%.
Outside flammable cloud	No fatality or injury.

Ammonium Nitrate / Ammonium Nitrate Solution Explosion

AN is not an explosive. However, it is one of the precursor ingredients in explosives used in mining operations around Australia. Uncontaminated and unconfined AN is very difficult to detonate. Neither flame, nor spark, nor friction can cause a detonation.

As noted in the 'End Events' columns in **Tables 9-1** and **9-2**, in certain accident conditions, it is possible to cause AN to explode. The design of the proposed Project has therefore included a number of precautionary measures to reduce any explosion risk associated with the manufacture and storage of TGAN and ANSOL. A number of these design measures are listed in **Table 9-9** below. The processes and precautions involved in the manufacturing process and storage protocols are outlined in detail within **Appendix D1 Preliminary Hazard Analysis**.

TGAN is stored on site as bulk and bagged product. The storage is specifically configured with a number of smaller stockpiles with adequate separation to minimise the risk of sympathetic detonation between stockpiles of TGAN. The bulk store design allows for slumped and separated bulk piles of TGAN. The Dutch research institute, TNO, has concluded from simulation studies, that sympathetic detonation is extremely unlikely with this configuration, even for separation distances less than one metre[1]. Similar simulations have been performed by TNO to calculate the safe distance between stacks of bagged storage for different grades of TGAN. These distances and have been incorporated in the *SAFEX Good Practice Guide: Storage of Solid Technical Grade Ammonium Nitrate* (2010) and the Project would comply.

The consequences of an explosion on people and property as per HIPAP No. 4 are shown in **Table 9-4**.

[1] ERM, 2010, Public Environmental Review for Burrup Nitrates Pty Ltd

Table 9-4 Effect of Explosion on People and Property

Value	Effect/s
Explosion Overpressure [kPa]	
3.5	No fatality and very low probability of injury. 90% glass breakage.
7	Probability of injury is 10%. No fatality. Damage to internal partitions and joinery but can be repaired.
14	House uninhabitable and badly cracked.
21	20% chance of fatality for a person within a building. Reinforced structures distort. Storage tanks fail.
35	Threshold of eardrum damage. 50% chance of fatality for a person within a building. 15% chance of fatality for a person in the open. House uninhabitable. Wagons and plants items overturned.
70	Threshold of lung damage. 100% chance of fatality for a person within building or in open. Complete demolition of houses.

Toxic Gas from Fire Involving Ammonium Nitrate

As noted in the 'End Events' column in **Table 9-1**, in certain accident conditions, if AN is heated, it will decompose. If heated sufficiently (such as in a fire) together with contamination and/or confinement, then toxic nitrogen dioxide (NO_2) will be given off. Dispersion of the decomposition products from a fire involving AN can be modelled to produce a concentration profile in three dimensions (downwind, crosswind and elevation). This can be used to determine the dispersion of the gas and the potential for injury if exposed. The toxicity of a plume resulting from an AN fire would vary depending on the intensity of the fire. Various oxides of nitrogen are produced, with the specific mix of oxides dependent on a number of variables. Within **Appendix D1 Preliminary Hazard Analysis** a conservative assessment has been ensured by modelling nitrogen dioxide (NO_2).

9.3.7 Frequency and Likelihood Analysis

The likelihood of each representative MAE was estimated using:

- Published historical equipment failure (external leak) rate data;
- Historical AN fire and explosion frequency data; and
- Fault tree analysis.

The potential for events to escalate, i.e. for one event to cause one or more significant events, was also considered. The likelihood of escalation was estimated based on the consequence and likelihood analysis for AN explosion related MAEs. As with the data used in the consequence analysis, conservative best estimates were adopted for the likelihood analysis. Section 7 of **Appendix D1 Preliminary Hazard Analysis** discusses this analysis in more detail.

9.3.8 Assessment of Impacts

The assessment of the risk associated with the existing Site and the proposed development is determined against a number of risk criteria, namely:

- **Individual Fatality Risk** – risk of fatality for an individual located outside the Lot boundary (including residential areas, neighbouring industrial facilities, etc.).
- **Risk of Acute Toxic Injury** – risk of serious injury to sensitive members of the community resulting from exposure to a toxic chemical.
- **Risk of Irritation** – risk of irritation to eyes or throat or coughing to sensitive members of the community resulting from exposure to a toxic chemical.
- **Risk of Property Damage and Accident Propagation** – risk of property damage and accident propagation from either an explosion (i.e. the overpressure from the explosion exceeding 14 kPa) or from a fire (i.e. the heat radiation from the fire exceeding 23 kW/m^2).
- **Risk of Injury** – risk of injury from either an explosion (i.e. the overpressure from the explosion exceeding 7 kPa) or from a fire (i.e. the heat radiation from the fire exceeding 4.7 kW/m^2).
- **Societal Risk** – risk of fatality for a group of individuals.
- **Biophysical Risk** – risk of damage the Biophysical Environment.

For each representative scenario, criteria from HIPAP No 4 (DP&I, 2011) are used to understand what is considered to be an acceptable level of risk. For residential areas in NSW, DP&I has adopted a fatality risk level criterion of 1×10^{-6} p.a. (or 1 chance of fatality per million person years). For industrial areas in NSW the adopted criterion for fatality risk is slightly higher at 50×10^{-6} p.a. Other adopted individual risk criteria for different land uses in NSW are contained in HIPAP No. 4 (DP&I, 2011).

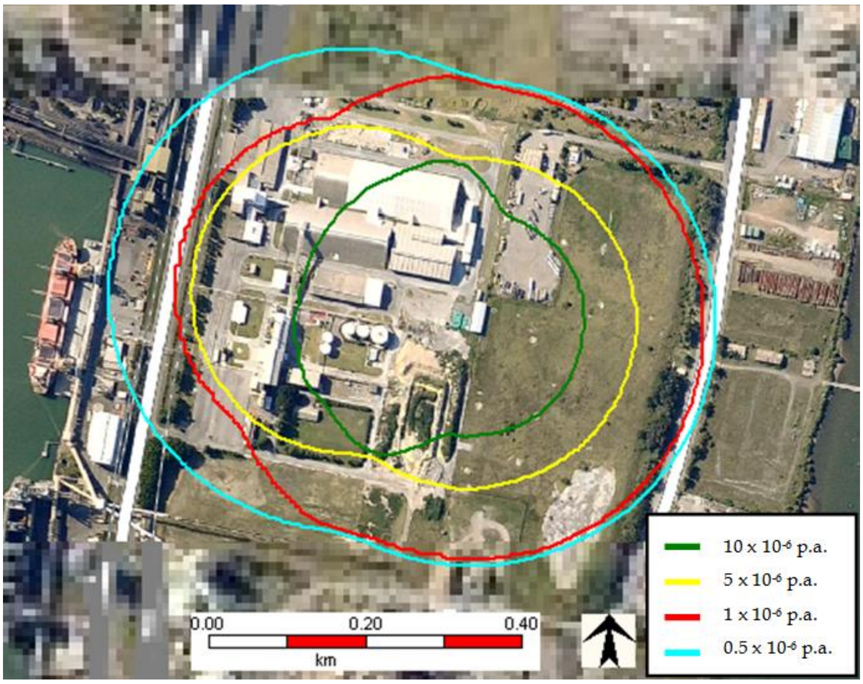
The consequence and likelihood results for the representative scenarios for each MAE were combined in a quantitative model to understand where the different land use criteria would be exceeded. For each risk criteria this model produced a 'risk contour' map in order to show different areas that would be subject to different levels of risk. The assessment of the risks associated with both the existing Site and the proposed development against these criteria has been taken from the PHA prepared by Lloyds Register (refer to **Appendix D1 Preliminary Hazard Analysis)** and is outlined below.

Risk Contours for the Existing Site

Individual Fatality Risk

The DP&I individual fatality risk criteria for sensitive (0.5×10^{-6} p.a.), residential (1×10^{-6} p.a.), commercial (5×10^{-6} p.a.) and open space (10×10^{-6} p.a.) land uses are complied with, as the relevant risk contours do not extend to these land uses. In addition, the relevant 50×10^{-6} p.a. contour for industrial land uses is not reached. Therefore, the existing Site complies with the DP&I individual fatality risk criterion for industrial land uses. The individual fatality risk from the existing Site is shown in **Figure 9-2**.

Figure 9-2 Individual Fatality Risk for the Existing Site



Risk of Property Damage and Accident Propagation (Exceeding 14 kPa Overpressure)

The 50 x 10^{-6} p.a. cumulative risk contour for risk of property damage and accident propagation due to overpressure (14 kPa) is not reached at all locations. Therefore, the existing Site complies with the relevant NSW DP&I risk criterion.

Risk of Injury (Exceeding 7 kPa Overpressure)

The 50 x 10^{-6} p.a. cumulative risk contour for risk of injury due to overpressure (7 kPa) is not reached at all locations. Therefore, the existing Site complies with the relevant NSW DP&I risk criterion.

Risk Contours for the Proposed Development

Individual Fatality Risk

The DP&I individual fatality risk criteria for sensitive (0.5 x 10^{-6} p.a.), residential (1 x 10^{-6} p.a.), commercial (5 x 10^{-6} p.a.) and open space (10 x 10^{-6} p.a.) land uses are complied with, as the relevant risk contours do not extend to these land uses.

The relevant 50 x 10^{-6} p.a. individual fatality risk contour for industrial uses is wholly contained within the boundary of the Lot. Therefore, the Project complies with the DP&I individual fatality risk criterion for industrial land uses. The individual fatality risk from the Project is displayed in **Figure 9-3**.

Figure 9-3 Individual Fatality Risk for the Proposed Development

Risk of Acute Toxic Injury

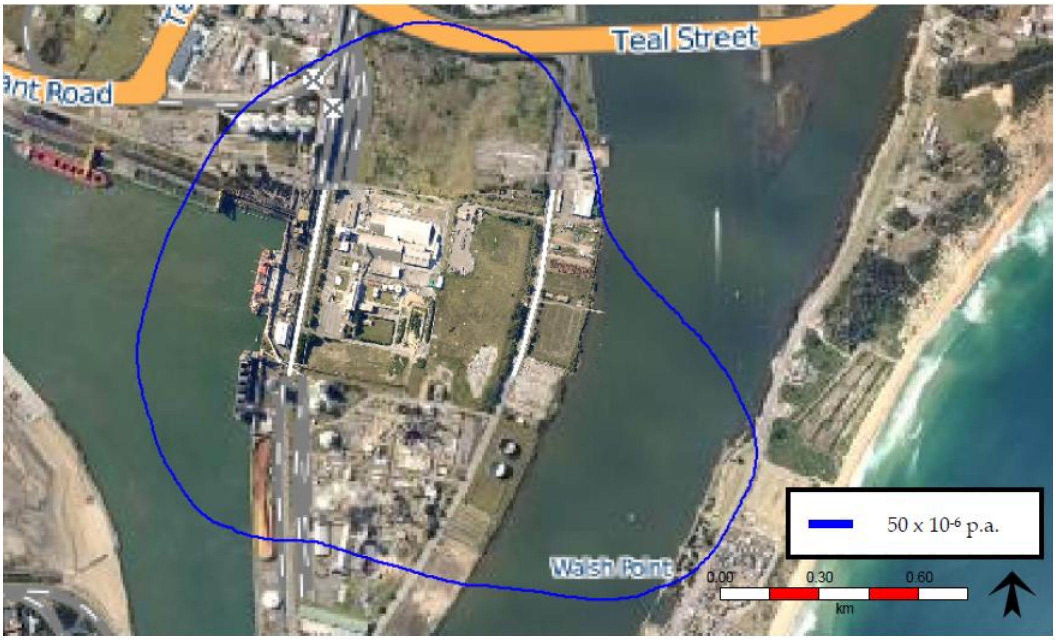
The 10 x 10^{-6} p.a. risk contour for acute toxic injury, which is the relevant risk criterion for residential land uses, does not extend to any residential area. Therefore, the proposed Project complies with the relevant DP&I risk criterion. This is illustrated in **Figure 9-4**.

Figure 9-4 Risk of Acute Toxic Injury for the Proposed Development

Risk of Irritation

The 50 x 10^{-6} p.a. risk contour for irritation, which is the relevant risk criterion for residential land uses, does not extend to any residential area. Therefore, the proposed Project complies with the relevant DP&I risk criterion. This is illustrated in **Figure 9-5**.

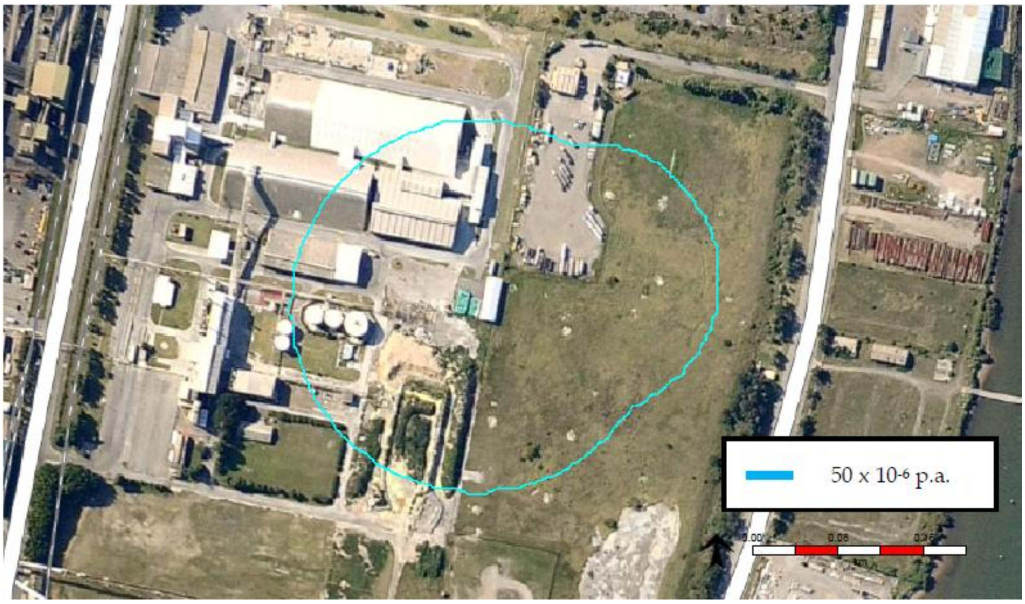
Figure 9-5 Risk of Irritation for the Proposed Development



Risk of Property Damage and Accident Propagation (Exceeding 14 kPa Overpressure)

The 50 x 10^{-6} p.a. risk contour for property damage and accident propagation due to 14kPa overpressure, which is the relevant risk criterion for industrial land uses, is wholly contained within the boundary of the Lot. Therefore, the proposed Project complies with the relevant DP&I risk criterion. This is illustrated in **Figure 9-6**.

Figure 9-6 Risk of Property Damage and Accident Propagation (Exceeding 14 kPa Overpressure) for the Proposed Development



Risk of Property Damage and Accident Propagation (Exceeding 23 kW/m2 Heat Radiation)

No credible MAEs were identified with the potential to cause risk of property damage and accident propagation due to heat radiation (>23 kW/m^2) off-site at greater than 50 x 10^{-6} p.a. This is primarily due to the large separation distance between the majority of the equipment containing flammable materials (i.e. natural gas) and the Lot boundary. Therefore, the proposed Project complies with the relevant DP&I risk criterion.

Risk of Injury (Exceeding 7 kPa Overpressure)

The 50 x 10^{-6} p.a. risk contour for risk of injury due to 7kPa overpressure, which is the relevant risk criterion for residential land uses, does not extend to any residential area. Therefore, the proposed Project complies with the relevant DP&I risk criterion. This is illustrated in **Figure 9-7**.

Risk of Injury (Exceeding 4.7 kW/m2 Heat Radiation)

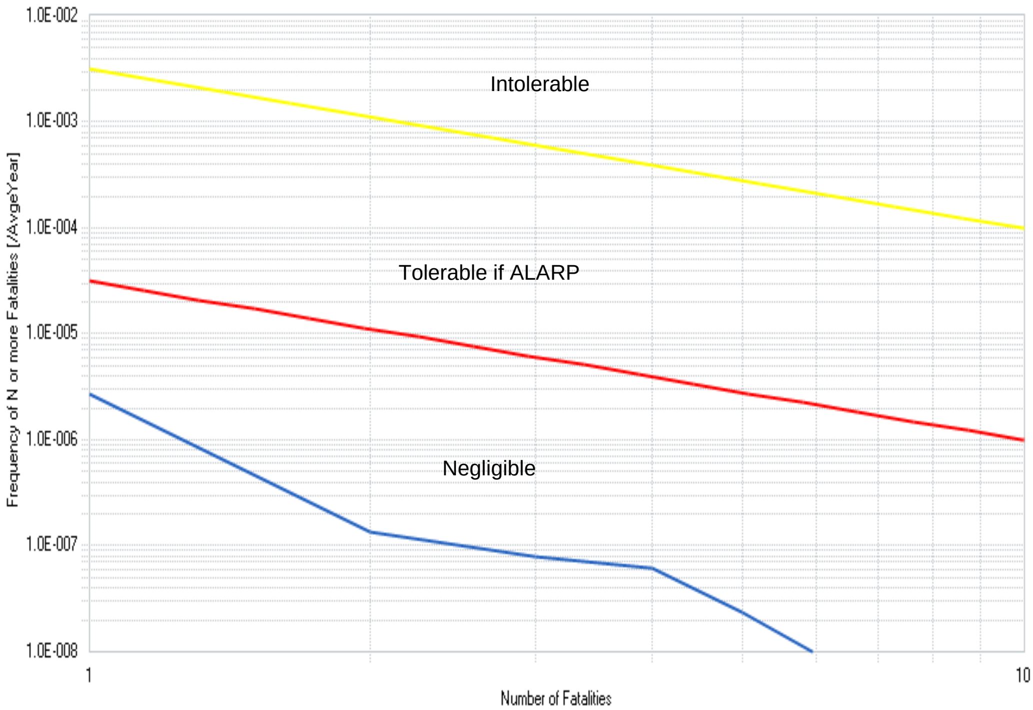
No credible Major Accident Events (MAEs) were identified with the potential to cause risk of injury due to heat radiation greater than 4.7 kilowatts per square metre (>4.7 kW/m^2) at residential areas. This is primarily due to the large separation distance between the Project and the nearest residential land uses. Therefore, the Project complies with the relevant DP&I risk criterion.

Figure 9-7 Risk of Injury (Exceeding 7 kPa Overpressure) for the Proposed Development

Societal Risk

Societal risk is a measure which takes into account the fact that society is intolerant of accidents, which though infrequent, have a potential to create multiple fatalities. Anticipated societal risk is illustrated on **Figure 9-8**.

Figure 9-8 Societal Risk for Residential Populations



In the negligible zone, below the red line, provided other individual criteria are met, societal risk is not considered significant. In the intolerable zone, above the yellow line, an activity is considered unacceptable even if individual risk criteria are met. Within the 'As Low As Reasonably Practicable' (ALARP) zone, the emphasis is on reducing risks as far as possible towards the negligible line. Provided other quantitative and qualitative criteria of HIPAP 4 are met, the risks from the activity would be considered tolerable in the ALARP region.

Societal risk results for the Project, shown as the blue line, are very low because the fatality risks attenuate significantly with distance from the Project. This level of risk falls below the negligible line and therefore societal risk is not considered significant.

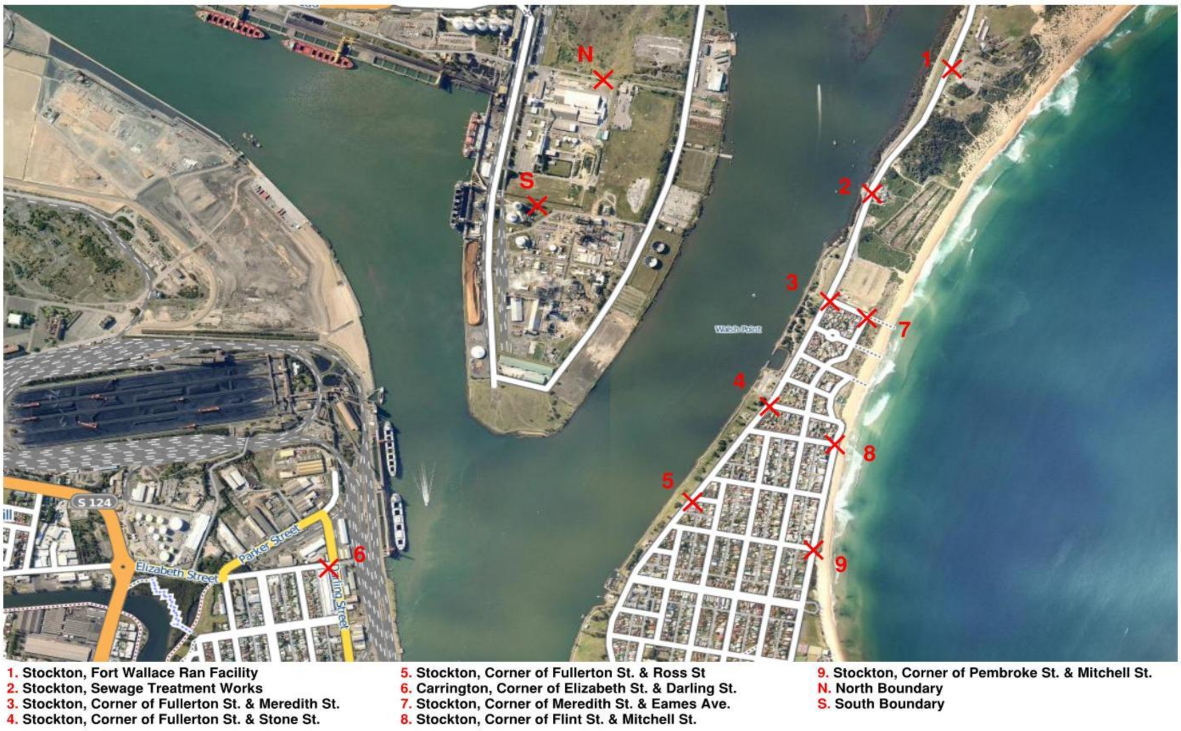
Biophysical Risk

Routine emissions from the Project are excluded from the scope of the PHA and thus only accidental releases are considered. The hazardous materials associated with the unlikely event of an accidental release of nitric or sulphuric acid from the Project are not considered to be a long term threat to the biophysical environment as they do not bio-accumulate, and are not extremely toxic to organisms in the environment. Although localised and short term damage to ecosystems could occur as a result of highly unlikely circumstances, no threat would be posed by the Project to the long term viability of local ecosystems. Therefore, the Project would comply with the NSW DP&I risk criteria.

9.3.9 Cumulative Effects

There are three potentially cumulative hazardous projects on the Kooragang Island: (i) Orica's existing AN plant; (ii) Orica's proposed expansion; and (iii) the Project. To assess the cumulative risk associated with these three projects, the cumulative individual fatality risk for these facilities was estimated at nine reference locations presented in **Figure 9-9**. The risk results for Orica's AN facility were provided by Orica and represent the most up-to-date risk results for this plant, including Orica's proposed expansion.

Figure 9-9 Reference Locations for Hazards and Risks CEA



The maximum cumulative individual fatality risk for Orica's AN plant and the Project is 0.036 x 10^{-6} p.a. at location 5 (residential area of Stockton) (refer to **Table 9-5**). This is significantly lower than the NSW DP&I risk criterion for residential land uses (i.e. 1 x 10^{-6} p.a.), which is applicable for a single proposed development. Therefore, it can be concluded that the Project would not increase the cumulative individual fatality risk to a level beyond established risk criteria.

Table 9-5 Cumulative Fatality Risk

Risk Ranking Point (No. and Description)	Individual Fatality Risk (p.a.)		
	ORICA	IPL	Total
1. Stockton, Fullerton St (Entrance Fort Wallace RAN Facility)	6.0E-11	1.9E-09	2.0E-09
2. Stockton, Fullerton St (Entrance to houses west of sewage treatment works)	4.2E-10	2.0E-08	2.0E-08
3. Stockton, Corner of Fullerton St. & Meredith St.	6.6E-09	2.7E-08	3.4E-08
4. Stockton, Corner of Fullerton St. & Stone St.	2.6E-08	9.0E-09	3.5E-08
5. Stockton, Corner of Fullerton St. & Ross St.	3.4E-08	2.2E-09	3.6E-08
6. Carrington, Corner of Elizabeth St. & Darling St.	1.2E-09	1.9E-10	1.4E-09
7. Stockton, Corner of Meredith St. & Eames Ave.	1.6E-09	1.4E-08	1.6E-08
8. Stockton, Corner of Flint St. & Mitchell St.	1.4E-09	3.7E-09	5.1E-09
9. Stockton, Corner of Pembroke St. & Mitchell St.	1.4E-10	5.3E-10	6.7E-10

9.4 Transport Risk Assessment

The Transport Risk Assessment (TRA) involves a semi-quantitative assessment of the risks involved in the transport of hazardous materials associated with the proposed Project.

9.4.1 Assessment Methodology

The objective of the TRA was to analyse and evaluate the hazards associated with the transport of Dangerous Goods, by road and by sea, to and from the proposed Project in the surrounding area. The risks were assessed in a semi-quantitative manner and the controls assessed using qualitative bow-tie analysis. Where appropriate, risk reduction measures were recommended.

Completion of the TRA involved the following steps:

1. A detailed review of the existing Site, the proposed Project, potential land and sea transport routes associated with the proposed Project and related transport methods (e.g. tanker or ship etc.);
2. Identification and description of the type, nature and quantity of any Dangerous Goods that is likely to be transported;
3. Identification of potential hazards and collation of a list of accident scenarios referred to as Major Accident Events (MAEs);
4. A Quantitative Consequence Analysis for each of the MAEs;
5. A Semi-Quantitative Likelihood Analysis for each of the MAEs;
6. Completion of a '3C' (Cause – Consequence – Control Measure) risk analysis to identify the risks and outline control measures to manage and mitigate risks. This analysis is commonly referred to as the "Bow-Tie" model. A brief description of the model is provided in Sections 2.4 and 2.5 in **Appendix D2 Transport Risk Assessment**.

The likelihood of each MAE was estimated based on representative transport incident data and the individual risk was estimated for representative locations along the transport routes.

There are no published quantitative risk criteria in NSW for the assessment of transport risk. Therefore, the risk criteria considered for the TRA were based on the fatality risk criteria outlined in the NSW Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 4: *Risk Criteria for Land Use Safety Planning*.

9.4.2 Hazard Identification

The proposed Project is described in **Chapter 4 Project Description**. The routes that would be selected for the transportation of goods associated with the Project are described in **Chapter 15 Traffic and Transport**. A complete assessment of these routes and the hazards and risks associated with these routes is contained in **Appendix D2 Transport Risk Assessment**. This hazard identification process also identified sensitive land uses along the proposed routes and discussed the properties of each of the relevant dangerous goods.

Vehicle Analysis

The types of vehicle that would be used in the construction and operation of the Project are described in **Chapter 15 Traffic and Transport** and in **Appendix J Transport Impact Assessment**.

Ships used for the import of ammonia would comply with the standards and regulations of the International Maritime Organization (IMO) and the Australian Maritime Safety Authority (AMSA). In addition, the ship's operations would need to comply with the safety requirements of the Newcastle Port Authority Safety Management System. Ships would have storage compartments that are separated from the hull to reduce the likelihood of a hull breach event resulting in a loss of cargo containment.

B-double trucks would be used generally to transport hazardous goods to and from the Site. The number of B-double trucks transporting hazardous goods leaving the Site was identified. These numbers were augmented by the number of trucks transporting hazardous goods leaving the existing and proposed Orica site.

A full list of the control measures and risk management techniques that would be incorporated into the Project's transport operations is contained within **Appendix D2 Transport Risk Assessment**.

Route Analysis

The risk assessment for the movement of ships is limited to within the Port of Newcastle.

Road transport routes for TGAN and ANSOL have been assessed from the Site to IPL customers in the Hunter Valley and to the IPL facility at Warkworth. Routes have been planned to minimise travel near sensitive land uses.

Road transport routes for ammonia and sulphuric acid have been assessed in the surrounding area from the Site to the nearest major intersection at Industrial Drive.

Once the trucks make use of the Hunter Expressway, this would further reduce any residual risk associated with the transport of dangerous goods from the Site to the Hunter Valley. The routes that would be used by the Project are shown in **Appendix D2 Transport Risk Assessment**.

9.4.3 Register of Major Accident Events

Once the relevant information was gathered a number of accident scenarios were identified. These scenarios were discussed at a Transport Risk Workshop in September 2011. The outcomes of this workshop allowed the hazard identification process to be concluded and a number of accident scenarios or MAEs to be agreed. **Table 9-6** presents the MAEs that have been identified for the TRA.

Table 9-6 MAE Register for the Transport Risk Assessment

Number	Major Accident Event Description
1	Toxic emissions from a major fire on a ammonium nitrate truck
2	A fire leading to an explosion of ammonium nitrate on a truck
3	Large release of refrigerated ammonia into the harbour
4	Release of ammonia (gas) from road tanker relief valve
5	Small liquid release (13 mm hole size) of ammonia from road tanker (damage to nozzle or seal leak)
6	Medium liquid release (45 mm hole size) of ammonia from road tanker (damage following vehicle accident)
7	Large liquid release of ammonia (150 mm hole size) from road tanker (major damage following vehicle accident)
8	An external fire and / or contaminated ANSOL leading to an explosion of ANSOL on tanker

These MAEs are discussed in greater detail in Section 4.4 of **Appendix D2 Transport Risk Assessment**.

9.4.4 Consequence Analysis

The consequence analysis examined the MAEs and discussed the three main events:

- Toxic gas from a fire involving AN;
- AN Explosion (both from TGAN and ANSOL); and
- Release of ammonia.

Where appropriate the analysis considered the results of the PHA and completed additional modelling as required. **Section 9.3.5** of this chapter above discusses the consequence analysis for 'Toxic gas from a fire involving AN' and 'AN Explosion'. 'Release of ammonia' is discussed below.

Release of Ammonia

Ammonia would be delivered to the Site by ship and by road, as described in **Chapter 4 Project Description**. The consequences of an ammonia release from a ship within the Port of Newcastle harbour, or as a result of a road traffic accident or vehicle malfunction, would vary depending on the quantity and rate of the release and the meteorological conditions at the time of the accident. Four specific scenarios were considered for this event:

- Relief Valve Release;
- Small Liquid Release;
- Medium Liquid Release; and
- Large Liquid Release.

The consequences of such an accidental release and the measures that are taken to reduce both the likelihood and severity of a leak are examined in **Appendix D2 Transport Risk Assessment**.

9.4.5 Likelihood Analysis

The likelihood of MAEs occurring was also considered. The likelihood of these events occurring is dependent on:

- **Fabric failures -** Any fabric failure events (smaller releases of ammonia) are low frequency events. These are failures of equipment that can be as a result of material failures (e.g. operating outside safe operating conditions, corrosion, fatigue or wrong material used).
- **Ship incidents** – NPC has defined rules and requirements for all ship movements within Newcastle Harbour. In the event of a release of hazardous materials occurring, the Newcastle Port Authority has, in conjunction with the emergency services, processes in place to attend to and address such events to minimise the risk to its personnel and members of the public. A qualitative assessment of the effectiveness of the various controls was undertaken using a bow-tie methodology.
- **Road tanker accidents** - These are generally the events with the highest consequence outcomes. However, these are also the events where the likelihood can be managed to ensure that the risk can be reduced to an acceptable level. A semi-quantitative analysis of the likelihood and average fatality risk was undertaken for these events. A qualitative assessment of the effectiveness of the various controls was also undertaken using a bow-tie methodology.

Ships used in the construction and operation of the proposed Project would be piloted. Movement of ships in the Port of Newcastle harbour area would be controlled by the Port of Newcastle Pilot Station. The Pilot Station is manned 24/7 and controls all ship movements within the Port of Newcastle. All ship movements within the port would be controlled by a minimum of two tug boats.

The frequency and likelihood of an incident occurring during the road transport of dangerous goods to and from the proposed Project would be limited by the control measures employed by the transport contractor. Equally risk mitigation measures have been put into place to ensure that fabric failures are also managed to an acceptable level.

9.4.6 Risk Assessment

The qualitative risk assessment examined the causes and controls for each MAE using the bow-tie model. The adequacy of the identified risk controls were evaluated to assess their ability to prevent the MAE or mitigate the effects, should the event be realised. The following scenarios were assessed:

- Fire in an AN Truck Leading to Toxic Gas or an Explosion;
- Fire / Contamination in Road Tanker leading to ANSOL Explosion;
- Release of Ammonia from a Ship into the Harbour; and
- Anhydrous Ammonia Release from Road Tanker.

Details for each of the scenarios and qualitative 'bow tie' risk assessments are provided in Section 6 of **Appendix D2 Transport Risk Assessment**.

In addition to the qualitative risk assessment described above a semi-quantitative risk assessment was also completed for two road segments along Industrial Drive: one segment to the east of the intersection with Tourle St; and, another segment to the west of the same intersection. The maximum fatality risk for each material and each road segment is summarised in **Table 9-7** below.

Table 9-7 Maximum Individual Fatality Risk for Identified Road Segments

Road Segment	Maximum Individual Fatality Risk (p.a.)			
	AN	ANSOL	NH3	Total
1. Industrial Drive to East of Intersection with Tourle St	6.1E-08	-	-	6.1E-08
2. Industrial Drive to West of Intersection with Tourle St	2.8E-07	6.7E-08	1.7E-08	3.7E-07

The maximum total average fatality risk was estimated at 3.7×10^{-7} per year. Therefore, the proposed road transport of dangerous goods complies with the representative NSW DP&I criteria adopted for this assessment.

Themaximum fatality risk for a release of ammonia from a ship at the bulk liquids berth, or from a ship whilst moving to/from the berth, is summarised in the **Table 9-8** below. Note: The risk results shown in this table are for different worst-case receptor locations and should not be summed together.

Table 9-8 Maximum Individual Fatality Risk for Release of Ammonia from a Ship

Location	Maximum Individual Fatality Risk (p.a.)
1. Release of Ammonia at K2 Berth due to Striking by Passing Vessel or Allision with Berth	8E-09
2. Release of Ammonia Near Entry to Port due to Collision or Grounding	2E-08

The maximum fatality risk was estimated at 2×10^{-8} per year for collision / grounding near the entry to the Port. Therefore, the proposed marine transport of ammonia complies with the representative NSW DP&I criteria adopted for this assessment.

9.4.7 TRA Findings

The main findings of the risk assessment were that:

- the existing practices and risk controls, together with the proposed additional risk controls, are in line with good practice and would be sufficient to manage the risks associated with the transportation of dangerous substances; and
- based on a semi-quantitative analysis, the risk for populated areas along the transport routes is below comparable risk criteria applied for fixed facilities in NSW.

The assessment noted that the management of ships in the Newcastle Harbour have adequate risk controls in place. In addition, the shipment of AN in the Harbour will decrease as a result of the Project. This would reduce the risks associated with AN within the Newcastle Harbour.

The examination of road transport routes identified that adequate controls are in place for the management of the road transport fleet. The Hunter Expressway (currently under construction) should be considered as a potentially "lower risk" option.

The assessment also determined that the majority of the initiating causes of MAE for road transportation are adequately managed by multiple preventative controls. Some of the risk controls related to truck/road tanker transport are administrative in nature, and are not design or engineering based.

The assessment noted that certain causes of a MAE, such as training, are not sufficient alone, and that these measures need to be strengthened and supported by an independent risk control measures, e.g. through random inspections and testing.

Findings to strengthen the management of risks have been incorporated into the proposed management and mitigation measures in **Section 9.5**.

9.5 Conclusion

The Project complies with the relevant land use safety planning risk criteria for new industrial developments, as published in HIPAP No. 4 by the DP&I. Therefore, on the basis of the results of the PHA the Project is considered an acceptable land use at this location.

The results of the TRA indicate that the proposed controls for the Project are in line with good practice and that existing and proposed controls will reduce potential risks associated with the transportation of dangerous goods to levels that meet established criteria.

A number of controls and measures have been identified from both the PHA and TRA and these have been incorporated into the table of proposed management and mitigation measures shown in **Table 9-9** below.

The construction, commissioning and operation of the Project would be subject to rigorous scrutiny, safeguarding delivery and operation of the Project in a manner that minimises the risk to workers, contractors and the community.

The potential for incidents is well understood and the design of the plant and equipment would minimise the probability of an incident occurring as well as mitigating an incident if it did occur.

9.6 Proposed Management and Mitigation Measures

The construction, commissioning and operation of the proposed Project will be subject to rigorous scrutiny by IPL and TR, safeguarding delivery and operation of the Project in a manner that minimises the risk to workers, contractors and the community. The measures presented in **Table 9-9** below would help ensure that any risks associated with the Site and the Project are reduced as far as possible.

Table 9-9 Management and Mitigation Measures – Hazard and Risks

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
An inspection, testing and preventative maintenance program would be developed, implemented and maintained to ensure the reliability and availability of key safety critical equipment.	✓	✓	✓
Safety Integrity Level (SIL) allocation and verification studies would be undertaken in accordance with IEC 61508 / 61511 as part of final design stage to ensure the probability of failure on demand of the following key safety critical equipment is consistent with the data estimates used in the PHA: • The overfill protection systems for the bulk Ammonia storage tank and Ammonia road tankers. • The automatic water quench system on the ANSOL tank. • The overheating protection system on the AN pumps. • The water quench system and overheating protection system on the Neutraliser vessel. • Level control and feedwater systems for the Absorber. • The ammonia road tanker driveaway protection system. A safety requirement specification (SRS) would also be prepared for the safety instrumented systems.	✓		
The cryogenic (i.e. liquid) piping for ammonia would be designated as critical equipment and inspected / maintained accordingly.			✓
To ensure a low likelihood of small liquid ammonia leaks from flanged joints, spiral wound gaskets would be provided for all liquid ammonia pipework (cryogenic and pressurised).	✓	✓	✓
The final design would include physical protection measures to ensure the bulk ammonia storage tank is protected from impact by vehicles (including cranes, trucks, etc.). Also, the tank would be subjected to a hydrostatic test and full radiography for all welds of the lower five strakes during construction. Alternative non-destructive testing methods may be used in any locations where radiography is not practicable.	✓	✓	

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Measures (e.g. Fire detection and protection systems; storage limits per stack / pile; separation distances between stacks / piles; etc.) would be implemented to reduce the likelihood of an AN explosion due to fire, contamination or high energy impact. All of the listed engineering measures would be incorporated into the final facility design and the procedural control measures would be incorporated into the Site safety management system.	✓	✓	✓
The gas detection system would be designed to ensure isolation within 3 to 15 minutes of the incident. Assessment such performance would be evaluated as part of the assessment for the Final Hazard Analysis. Similarly, as this system relies on human intervention, human factors would be evaluated as part of the system design (e.g. warning systems in control room, etc.) and its ongoing operation (training, etc.).	✓		✓
For isolation of the marine loading arms at the berth, the automatic emergency release system would isolate a release within 25 seconds (15 seconds to detect; 5 seconds to send the signal to the isolation valve; and 5 seconds for the isolation valve to close). The final design of this pipework would ensure that a pressure surge cannot cause subsequent failure of the pipework due to this relatively short isolation time.	✓		✓
An emergency systems survivability analysis (ESSA) would be undertaken during the detailed design stage to ensure all emergency isolation systems would perform their designed function in the event of a potential explosion (on- or off-site).	✓		
A detailed structural analysis would be undertaken on the final design of the ammonia storage tank to determine the potential for leaks from the tank and associated pipework due to earthquake or strong wind events and these events would be included in the final hazard analysis (as relevant).	✓		
The owner/operator of the trucks or road tankers would implement and maintain a robust Safety Management System			✓
IPL would undertake formal audits of the vehicle owner's/operator's Safety Management System to verify it is adequate in managing the safety risks.			✓
The audits of the transport contractor's Safety Management System would incorporate how the system manages the risks and maintain the risk controls related to the Major Accident Events. These would include:			✓
• Random unannounced checks of the vehicles documentation to verify that the requirements for pre-use inspections are adhered to.			✓
• Scheduled audits of the maintenance program to verify it is adhered to and that it is effective.			✓
• Scheduled physical inspections of the vehicles to establish if they appear to be well maintained and licensed as a dangerous goods vehicle.			✓
• An evaluation of the driver induction and compliance (including route familiarity).			✓
• Evaluation of the driver competency and licence compliance, including product knowledge, emergency procedures, etc.			✓
• Adequate program for disciplinary action if drivers break the rules (e.g. speeding, drug and alcohol, etc.) and enforcement of this program.			✓
• Evaluation of the driver fatigue management program and its implementation.			✓
• Adequacy of, and adherence to, secure parking.			✓
• Inclusion of duress and GPS tracking systems in the vehicles			✓

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
• Planned maintenance schedule. If not already in place, the vehicle owner/operator would ensure that all vehicles have speed recording/limiting devices installed.			✓ ✓
IPL would undertake random checks of the quality of the product restraining systems (for bags of TGAN) and record this as part of their Safety Management System			✓
Adequate loading procedures would be implemented to ensure overloaded tankers are not allowed to leave the Site.			✓
IPL and the transport contractor would consider the Hunter Expressway, once operational (planned for 2013), as an alternate main route to the Hunter Region, instead of the existing route (New England Highway).			✓
A “Route Plan and Risk Assessment” similar to those existing for the current routes would be conducted by the transport contractor prior to commencing the regular use of the Hunter Expressway.			✓

10 Air Quality & Odour

10.1 Introduction

This chapter presents a summary of the air quality impact assessment (AQIA) undertaken to assess the potential air quality impacts during the construction and operation of the Project. The AQIA is provided in full in **Appendix E Air Quality**.

The DGRs for the Project require:

- *"an assessment of all air pollutants from all sources during construction and operation and from road, rail and sea transport, including any potential volatile organic compounds, particulates, odour, NO_x, N_2O and NH_3;*
- *details of all control measures including NO_x and N_2O abatement and start-up venting controls for NO_x and NH_3 for the Nitric Acid Plant; and*
- *cumulative impacts of the proposal in relation to existing and approved developments in the area,"*

To meet these requirements, an assessment of the potential air quality impacts of the Project has been completed. A qualitative assessment was completed for the construction phase and a quantitative assessment, in accordance with Approved methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005), was completed for the operational phase.

Based on a review of the proposed operations, emissive processes have been identified for consideration in the AQIA. These primarily included Nitric Acid (NA) manufacture, and Technical Grade Ammonium Nitrate (TGAN) manufacture. Key pollutants associated with these processes were identified as Oxides of Nitrogen (NO_x), Particulate Matter (as PM_{10}), and Ammonia.

It is noted that the DGRs requested the assessment of N_2O emissions. URS have not identified Australian Standards relevant to local ambient air quality[1] rather, N_2O emissions have been addressed in the greenhouse gas assessment for the Project (refer to **Chapter 14 Greenhouse Gas** and **Appendix I Greenhouse Gas Report**).

10.2 Legislation and Planning Policy

There are three main types of regulatory criteria relevant to air emissions associated with the Project. These are:

- **Emission Standards** – which specify maximum allowable in-stack pollutant concentrations specified for particular industrial activities and plant types;
- **Air Impact Assessment Criteria** – ambient criteria designed for use in air dispersion modelling and air quality impact assessments for new or modified emission sources; and
- **Ambient Air Quality Standards** – regional standards against which ambient air quality monitoring results may be assessed.

[1] URS notes that the Texas Commission on Environmental Quality has a 1 hour guideline value of 4,500 µg/m^3 (TCEQ, 2012). Given the magnitude of the emissions of N_2O it is extremely unlikely that this guideline will be exceeded. N_2O is expected to be released from the NA Plant at concentrations similar to NO_x (i.e. NO+NO_2), hence would be expected at a similar ratio in ambient air downwind of the NA Plant.

A combination of Emission Standards and Air Impact Assessment Criteria are typically used to evaluate the expected impact of air emissions on local air quality, and the effectiveness of plant design with any associated mitigation measures. The wider objective of these criteria is to ensure that the resulting local and regional ambient air quality meets the relevant Ambient Air Quality Standards.

10.3 Assessment Methodology

10.3.1 Assessment Scope

The AQIA for the Project included the following:

- a review of proposed activities and production processes;
- identification of emission sources and key pollutants;
- a review of regulatory criteria including emission limits and impact assessment criteria;
- benchmarking of proposed emission controls against Best Available Techniques (BAT), and a comparison of proposed emission limits against regulatory emission limits;
- a review of existing environment including climate, meteorology and existing air quality;
- preparation of an air emissions inventory for the Project;
- atmospheric dispersion modelling of Project emissions; and
- comparison of predicted impacts against relevant impact assessment criteria.

This section provides details of the methodologies employed to assess the potential impact during the construction and operation of the Project.

10.3.2 Assessment Criteria

Emission Standards

The *Protection of the Environment Operations (Clean Air) Regulation 2010* sets emission limits for air impurities from stationary plant and equipment. The current relevant standards are presented in **Table 10-1**. This table also presents the emission sources and key pollutants relevant to the Project.

It is noted that these limits do not apply during:

- A start-up period - that is, while the plant is being brought up to normal operation following a period of inactivity; and
- A shutdown period - that is, while the plant is being taken out of service from normal operation to inactivity.

The difference between start up/shutdown and steady state operation is discussed in **Chapter 4 Project Description**.

Table 10-1 Emission standards relevant to the Project

Activity or Plant	Applicable Source	Air Impurity	Group 6[1] Standard of Concentration[2]
Acid Production	NA Stack	NO_x as NO_2	350 mg/m^3
		Smoke	Ringelmann 1 or 20% opacity
Any crushing, grinding, separating or materials handling activity	AN Plant Scrubber, Bagging Scrubber	Solid Particles	20 mg/m^3
Any boiler operating on gas	Boiler	NO_x as NO_2	350 mg/m^3 (3%O_2)
Any Flare	Ammonia Flare	Visible Emissions	No visible emission other than for a period of no more than 5 minutes in any 2 hours.

Notes

1. An activity is designated to "Group 6"if it commenced to be carried on, or to operate, on or after 1 September 2005, as a result of an environment protection licence granted under the Protection of the Environment Operations Act 1997 pursuant to an application made on or after 1 September 2005.

2. Concentrations apply at reference conditions: dry, 273K, 101.3 kPa.

Air Impact Assessment Criteria

In August 2005, OEH (NSW EPA) released the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. This document specifies impact assessment criteria for a range of air pollutants. The impact assessment criteria for those pollutants associated with the Project are shown in **Table 10-2**.

Table 10-2 OEH Impact Assessment Criteria

Substance	Averaging Period	Impact Assessment Criteria	
		(ppmv)	(µg/m^3)
Nitrogen dioxide (NO_2)	1 hour	0.12	246
	Annual	0.03	62
Ammonia (NH_3) [1]	1 hour	0.46	330
Particulate Matter as PM_{10}	24 hour	-	50
	Annual	-	30

Notes:

[1] In the Approved Methods, where a compound has both toxic and odorous properties, the lower criterion has been adopted, e.g. if a compound is determined to be toxic at levels below which it is determined to be odorous (as is the case for Ammonia), the endorsed criterion is based on toxicity. Hence this criterion is considered protective against odour impacts associated with ammonia emissions from the Project.

Ambient Air Quality Criteria

Ambient air quality criteria are provided in the National Environmental Protection Measure (Ambient Air Quality) NEPC (1998). However, the guidelines contained in the NEPC (1998) are designed for use in assessing regional air quality and are not intended for use as site boundary or atmospheric dispersion modelling criteria; hence Project emissions have not been assessed directly against these guidelines. However, it should be noted that the maximum concentrations for NO_2 and PM_{10}, are identical to the DEC (2005) criteria.

10.3.3 Qualitative Assessment of Construction Impacts

Based on the review of Project activities, and the industrial nature of the Lot and immediate surroundings, the potential for adverse air quality impacts to arise during construction is considered to be low.

The key air emission issue during construction would be the generation of dust, with dust generation considered to be of moderate emissions potential, and manageable through the implementation of appropriate mitigation and management programs. Therefore the construction phase impacts have been assessed qualitatively.

10.3.4 Quantitative Assessment of Operational Impacts

Study Area, Receptor Locations and Dispersion Modelling

Quantitative air quality assessments are undertaken using computer based dispersion models. These models rely on the input of accurate meteorological, baseline air quality and emission source data to calculate the worst-case dispersion of a particular emission across a study area.

Three dispersion models are generally endorsed by OEH / EPA for use in air quality impact assessment. These are AUSPLUME, TAPM and Calpuff. The Calpuff dispersion model was selected for this assessment for the following reasons:

- The ability to address variations in meteorology with changing land use (water/land) including coastal fumigation[2]; and
- The ability to treat causality, and mixing of emissions from consecutive hours (of interest given that the plant startup sequence extends over several hours).

Dispersion modelling was performed on a 10 x 10 km grid to assess the impacts of the Project during operation. This area is considered inclusive of key receptor locations and of an adequate range to capture peak ground level impacts of the Project. **Figure 10-1** shows an aerial view of the study area showing the Site, nearby suburbs and 'gridded' and 'discrete' receptor locations.

For the purposes of the model the study area is overlain with a grid. The grid consists of 101 X 101 'gridded receptors' (i.e. the point where north/south and east/west lines cross), at 100 m resolution, equating to a total of 10,201 gridded receptors. In addition, two rows of 'discrete receptors' (34 in total) have been added: one along the Fern Bay to Stockton shoreline; and another along the residential/industrial boundary at Mayfield. Whilst it is noted that elevated impacts may originate beyond these lines, these receptors have been included for screening purposes.

Local meteorological data was also entered into the model. A range of meteorological data was sourced for the purposes of the dispersion modelling. A detailed discussion of this data is provided in **Appendix E Air Quality**.

In order to assess the potential significance of building downwash[3] on the dispersion of emissions within the model, a number of point sources and building structures associated with the Project were identified (refer to **Figure 10-2**). The following were identified as potentially significant with regard to building downwash:

- TGAN building (24 m high);
- AN Prill Tower (63 m high);

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[2] During onshore wind flows, as emissions from elevated sources (present above the boundary layer) travel inland, they can be consumed into a growing Thermal Internal Boundary Layer (TIBL), where the strong convective mixing can act to bring emissions to the ground.

[3] As air passes over building structures, aerodynamic wakes are produced. In these wakes strong turbulence, and downward mixing can occur. Emissions from point sources located near to these wakes can be drawn downward, and recirculated within the lee of the wake, producing locally elevated concentrations, and reducing the extent of plume rise at a distance downwind.

- Ammonia storage tank (42 m high); and
- NA plant (25 m high).

Bagging scrubber emissions were assumed to be completely wake effected, hence were represented as a ground level volume source.

Figure 10-1 Dispersion Model Study Area

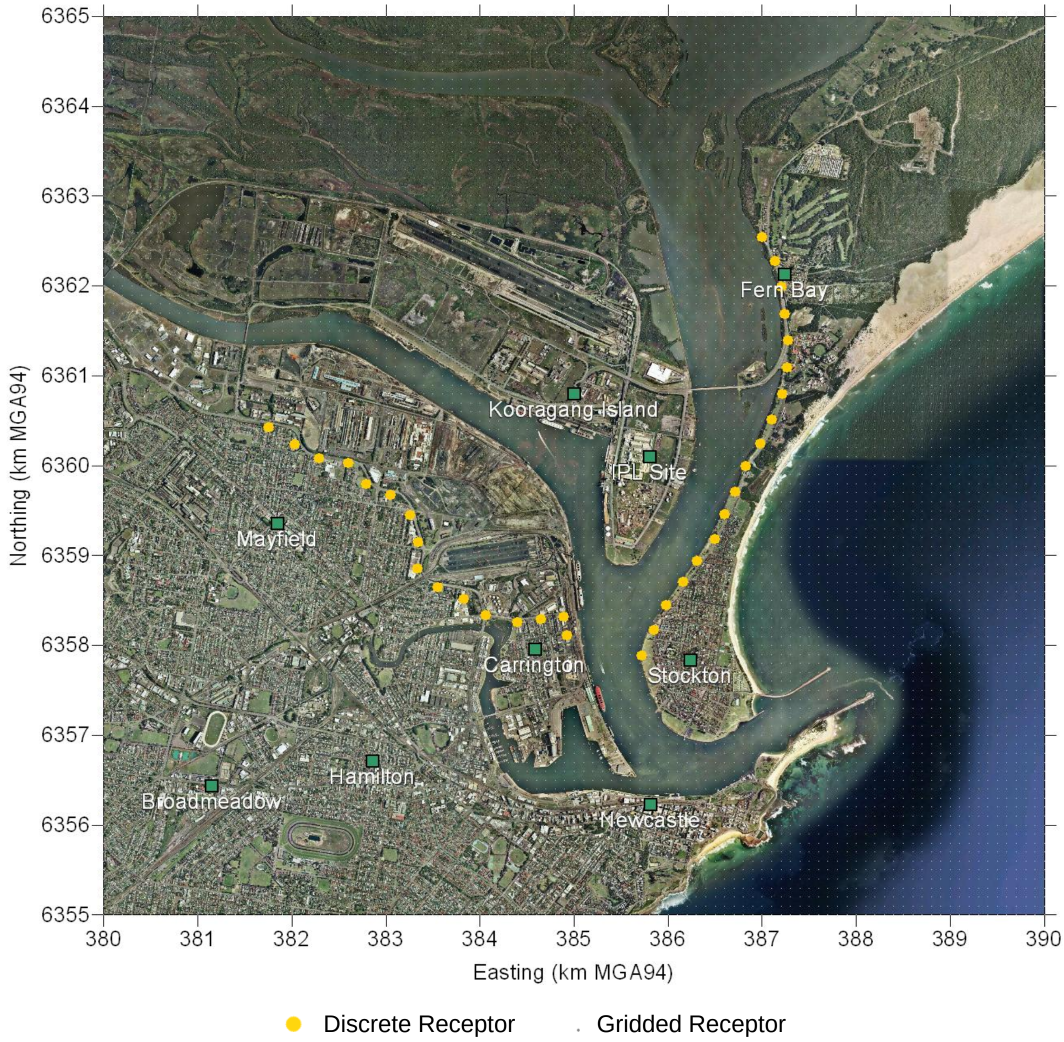
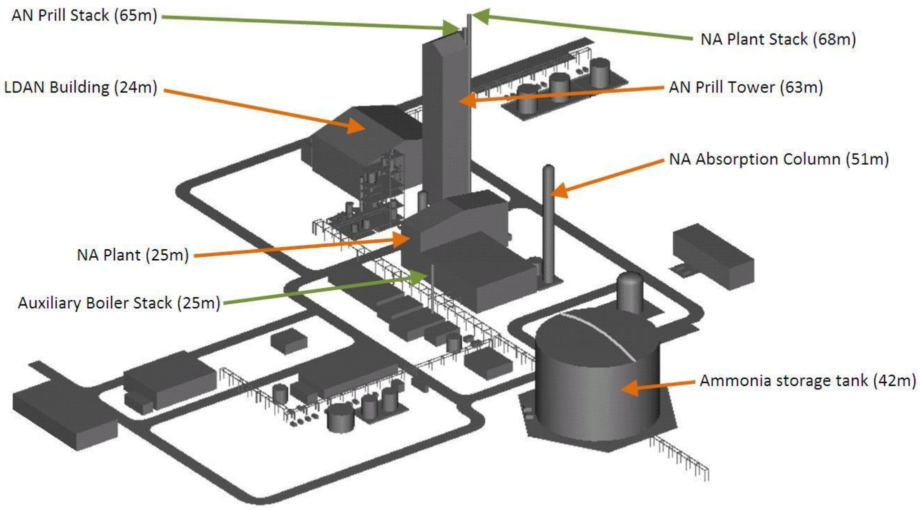


Figure 10-2 Plant Structures Showing Heights of Point Sources



Qualitative Assessment Parameters

Emission Sources

The Project involves a range of plant components that produce gaseous waste streams. **Table 10-3** lists the significant air emission points and describes the respective processes from which each effluent gas stream is generated.

Table 10-3 Emissions to Air

Emission Source	Generation Process
NA plant stack	Tail gas from aqueous absorption of NO_x gases.
NA storage tank vents	Displacement of NO_x gases from NA storage tank headspace.
AN plant scrubber	Moisture-laden exhaust stream from AN prilling and drying.
Auxiliary boiler	Exhaust stream from natural gas combustion.
Ammonia storage flare (standby)	Exhaust stream from natural gas combustion.
Ammonia storage flare (operation)	Exhaust stream from (natural gas-assisted) ammonia combustion.
AN bagging plant dust extraction	Exhaust stream from material handling operation.
Waste ANSOL concentrator	Moisture-laden exhaust stream from ANSOL concentration.

Key Pollutants

Key pollutants which would be produced during the operation of the Project are shown in **Table 10-4**.

Table 10-4 Pollutant Types by Emission Source

Emission Source	Pollutant		
	NO_x	Ammonia	Particulate Matter (as PM_{10})
NA plant	✓	✓	
NA storage tank vents	✓		
AN plant scrubber		✓	✓
Auxiliary boiler	✓		

Emission Source	Pollutant		
	NO_x	Ammonia	Particulate Matter (as PM_{10})
Ammonia storage flare	✓	✓	✓
AN bagging plant dust extraction			✓
Waste ANSOL concentrator		✓	✓
TGAN Bulk Load Out Facility			✓

PM_{10} is considered the most relevant particulate class of emissions from the Project. The use of wet scrubbers on key emission sources would capture the vast majority of particles greater than 10 microns in aerodynamic diameter. There are currently no state regulatory criteria for $PM_{2.5}$. Whilst the Ambient Air NEPM does provide an Advisory Standard of 25 µg/m3, further data collection and research is currently underway prior to a regulatory criteria being issued. Within this assessment, it has been assumed that all particulate matter from point sources will be emitted in the form of PM_{10}. In addition, particulate matter has been modelled as a tracer gas, which means that it has been assumed that particles will not deposit out of the atmosphere. This is considered to be a conservative approach for the estimation of PM_{10} levels.

It is also noted that Ammonia constitutes the key odorous pollutant associated with the Project. Ammonia has therefore been used as a surrogate for the assessment of potential odour impacts.

Emission Scenarios

Table 10-5 shows the duration and frequency Project Operations.

Table 10-5 Duration and Frequency of Routine and Infrequent Operations

Emission Source	Duration	Frequency
Routine Operations		
NA plant stack (operational conditions)	Continuous	>95% of the year
AN plant scrubber		
Auxiliary boiler (operational conditions)		
AN bagging plant dust extraction		
Ammonia storage flare (standby)		~100% of the year
TGAN load out	Intermittent	Throughout the year
Existing fertiliser load out		
Non-Routine Operations		
NA plant stack (startup conditions)	~30 minutes	~3 – 4 times per year
Auxiliary boiler (plant startup conditions)	~3 hours	~3 – 4 times per year
Waste ANSOL concentrator	~ 1 hour	~ Monthly
Ammonia storage flare (full operation)	~12 hours	< once in 10 years

The sources listed in **Table 10-5** have been collated into three emission scenarios. These are:

- plant startup;
- steady state operation; and
- ammonia flaring.

Table 10-6 identifies active emission sources of the Project by emissions scenario.

Table 10-6 Active Emission Sources by Emissions Scenario

Emission Source	Modelling Scenario		
	NA Plant Start-up	Plant Operation	Flaring
NA plant	✓	✓	
AN plant scrubber	✓	✓	
Auxiliary boiler	✓	✓	
Ammonia storage flare (standby)	✓	✓	
Ammonia storage flare (operation)			✓
AN bagging plant dust extraction	✓	✓	
Waste ANSOL concentrator		✓*	
Existing bulk load out		✓**	
TGAN bulk load out		✓**	

Notes: * Modelled each day at 12 pm for a single hour. ** Modelled continuously each day between the hours of 8am and 4pm.

NA Plant start-up is anticipated to occur approximately 3-4 times per year after plant commissioning. A start-up event consists of a sequence of operations, beginning with the priming of the boiler, then the initiation of NA plant flows and introduction of heat and reactant (ammonia). At this stage, the reaction parameters are transient, and NO_x emission levels are elevated. Within 30 minutes, the NO_x levels are expected to reduce to below 75 ppmv, and the plant ramps up to full operational flow. This scenario has been represented in the dispersion model through the use of a variable emissions file, allowing the effect of accumulation of emissions from the various processes to be investigated.

The steady state operational emissions scenario assumed that all sources in **Table 10-6** operate continuously through the year, with the exception of the bulk load out points which have been assumed to operate continuously each day between the hours of 8 am and 4 pm, and the waste ANSOL concentrator which has been modelled as operating each and every day at 12 pm for a single hour.

Full operation of the flare has been assumed to take place independently of other plant operations. This is due to flare vent requirements being driven by emergency venting of the ammonia tank when the duplicate refrigeration units are offline, and unable to accommodate this flow. IPL considers this to be a rare event.

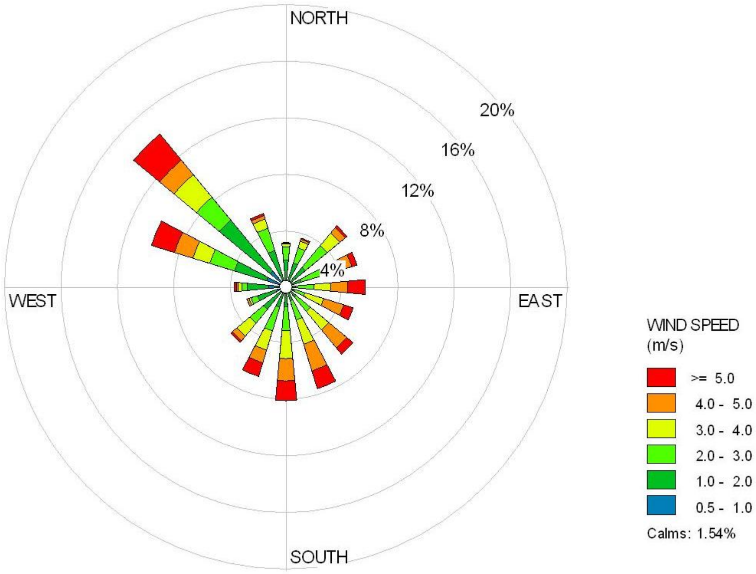
10.4 Existing Environment

10.4.1 Climate and Meteorology

Climate data was obtained from one of the closest Bureau of Meteorology (BoM) weather stations located at Williamtown RAAF air base, approximately 13 km north east of the Lot. This data showed that the mean daily maximum temperature is approximately 28 degrees C during summer and 18 degrees C during winter. Sub-zero temperatures have been recorded between May and August. The area receives moderate to high rainfall having a mean annual rainfall of 1126.6 mm over an average of 138.1 rain days per year.

A range of meteorological data was sourced for the purposes of dispersion modelling. **Figure 10-3** shows the wind rose for the Lot. Winds are typical of the region with dominant north westerly winds as influenced by the broader topography of the Hunter Valley (and large scale metrological trends for the region), as well as a high proportion of winds from the south eastern quadrant. A discussion of meteorological data used in this assessment is presented in **Appendix E Air Quality**.

Figure 10-3 Wind Rose for the Lot



10.4.2 Existing Air Quality

The existing air quality surrounding the Lot has been reviewed in order to establish general trends in pollutants and identify appropriate background values for use in the assessment. A review was undertaken of:

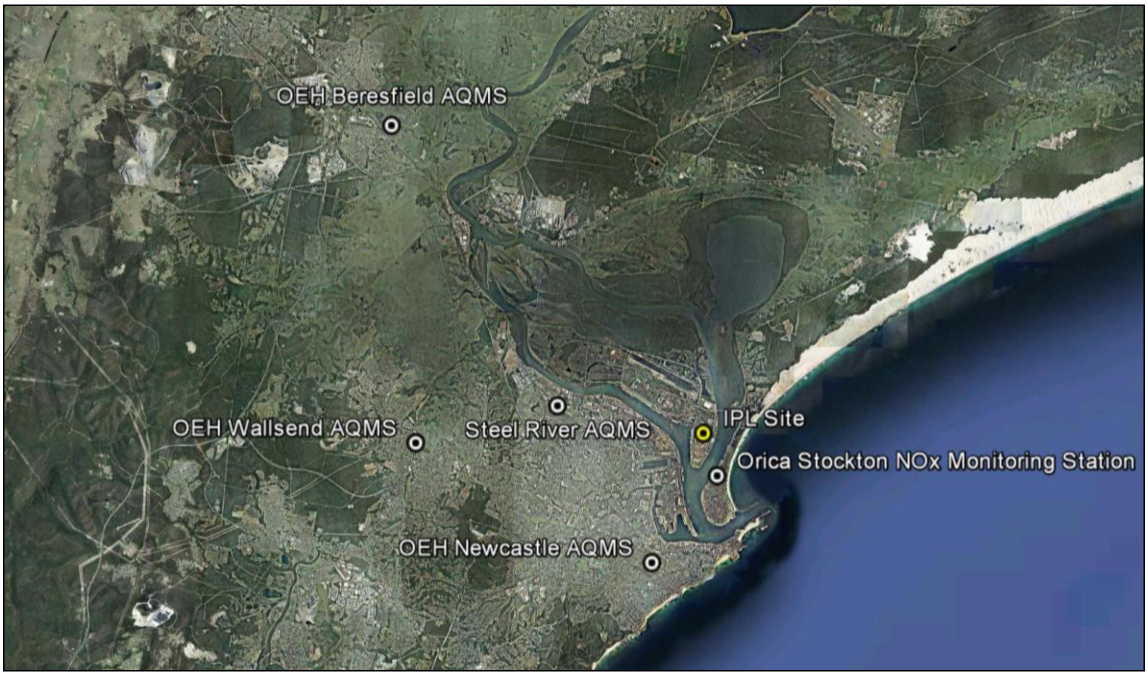
- available monitoring data; and
- NO_2 and PM_{10} levels and trends.

The following monitoring sites were identified for NO_2 and PM_{10}:

- OEH Beresfield (NO_2 and PM_{10});
- OEH Wallsend (NO_2 and PM_{10});
- OEH Newcastle (NO_2 and PM_{10})
- Steel River (NO_2); and
- Orica Stockton (NO_2).

Figure 10-4 shows and aerial view of Air Quality Monitoring Stations (AQMS) relative to the Lot.

Figure 10-4 Aerial View of Newcastle Showing NO_2 Monitoring Sites



(Image sourced from Google Earth Pro)

Data from the Steel River site was not used due to potential influences from sources within the immediate vicinity of the monitoring site[4].

The monitoring data from each of the sites listed above was reviewed and analysed to ensure that the dataset was robust and did not contain any anomalous results. A description of the monitoring data analysis is provided in **Appendix E Air Quality**. A summary showing the results of this analysis is provided in **Table 10-7**. This baseline air quality data was used within the dispersion modelling for the Project.

Table 10-7 Summary of Background Pollutant Concentrations

Substance	Averaging Period	Monitoring Source	Background Concentration µg/m³ (ppbv)	DECCW Criteria µg/m³ (ppbv)
NO_2	1 hour	Newcastle	84 (41)	246 (120)
	Annual	Beresfield	18.7 (9.1)	62 (30)
PM_{10}	24 hour	Beresfield	31.7	50
	Annual	Newcastle	21.7	30
Ammonia	1 hour	N/A	N/A	330 (460)

Notes: N/A - Not Applicable: The *Approved Methods* stipulate that the incremental impact be evaluated. Bracketed figures represent ppbv.

[4] The monitoring site is now located within 10 m of a small car park, and near to a main thoroughfare of the Steel River Industrial Park. Environ (2012) provides a summary of this monitoring which includes erratic data that was dismissed within the report.

10.5 Assessment of Impacts

10.5.1 Construction Impacts

During the construction phase the key source of potential air quality impacts would be through the creation of dust. Dust could potentially be generated as soils are disturbed on Site or if soils are handled or stored inappropriately. Dust is often transported around the Site and offsite by wind but can also be transported by construction vehicles. Dust has the potential to impact the local community and nearby workers by being an irritant and causing nuisance and can also impact environmental receptors, e.g. by covering the leaves of plants or reducing light penetration in watercourses.

Mitigation measures to manage dust generation are discussed in **Section 10.6**.

10.5.2 Operational Impacts

Comparison to Existing Newcastle LGA Emissions

For NO_x and PM_{10}, the proposed emissions from the Project were compared against emissions information for the whole of the Newcastle Local Government Area (LGA). Information for Newcastle LGA was sourced from the National Pollutant Inventory (NPI) database.

Table 10-8 provides a comparison of Project emissions with the NPI Newcastle LGA 2010/2011 data. As can be seen, NO_x emissions constitute approximately 1.5% of total reported emissions, and approximately 2.9% of total emissions excluding motor vehicles (the key non-industrial NOx source). In addition, PM_{10} emissions were estimated to be approximately 1.1% of total emissions for Newcastle LGA.

Table 10-8 Comparison of Project Emissions to NPI 2010/2011 Data for Newcastle LGA

Category	LGA Emissions (tpa)	Project Contribution (tpa)	Project Contribution (%)
NO_x			
All sources	5,531	84	1.5%
All sources (excl. Motor Vehicles)	2,931	84	2.9%
PM_{10}			
All sources	1,095	13	1.1%
All sources (excl. Motor Vehicles)	1,002	13	1.3%

Dispersion Modelling Results

This section provides the results of the dispersion modelling, and compares these results against OEH impact assessment criteria. Results have been presented in tabulated form. Select contour isopleths have been included below. The complete set of contour isopleths are provided in **Appendix E Air Quality**.

NO_2 results have been presented in accordance with the Approved Methods, which specify assessment against the peak (100th percentile) results, with addition to peak background concentrations. Whilst this may be sufficient to demonstrate compliance with assessment criteria, consideration should be given to model assumptions when considering reported pollutant levels outside of the assessment framework provided in the Approved Methods.

Nitrogen Dioxide (NO_2) Results for Plant Operation

Table 10-9 shows the results for the model predictions for NO_2 and compares these results against impact assessment criteria. The table also includes the background concentrations shown in **Table 10-7**. **Table 10-9** shows that peak model predictions are low relative to criteria. When the 'Incremental Impact' (i.e. the emissions from the Project alone) are added to existing background levels, the 'Cumulative Impact' peak model predictions remain within OEH impact assessment criteria for both the gridded receptor and the discrete receptor.

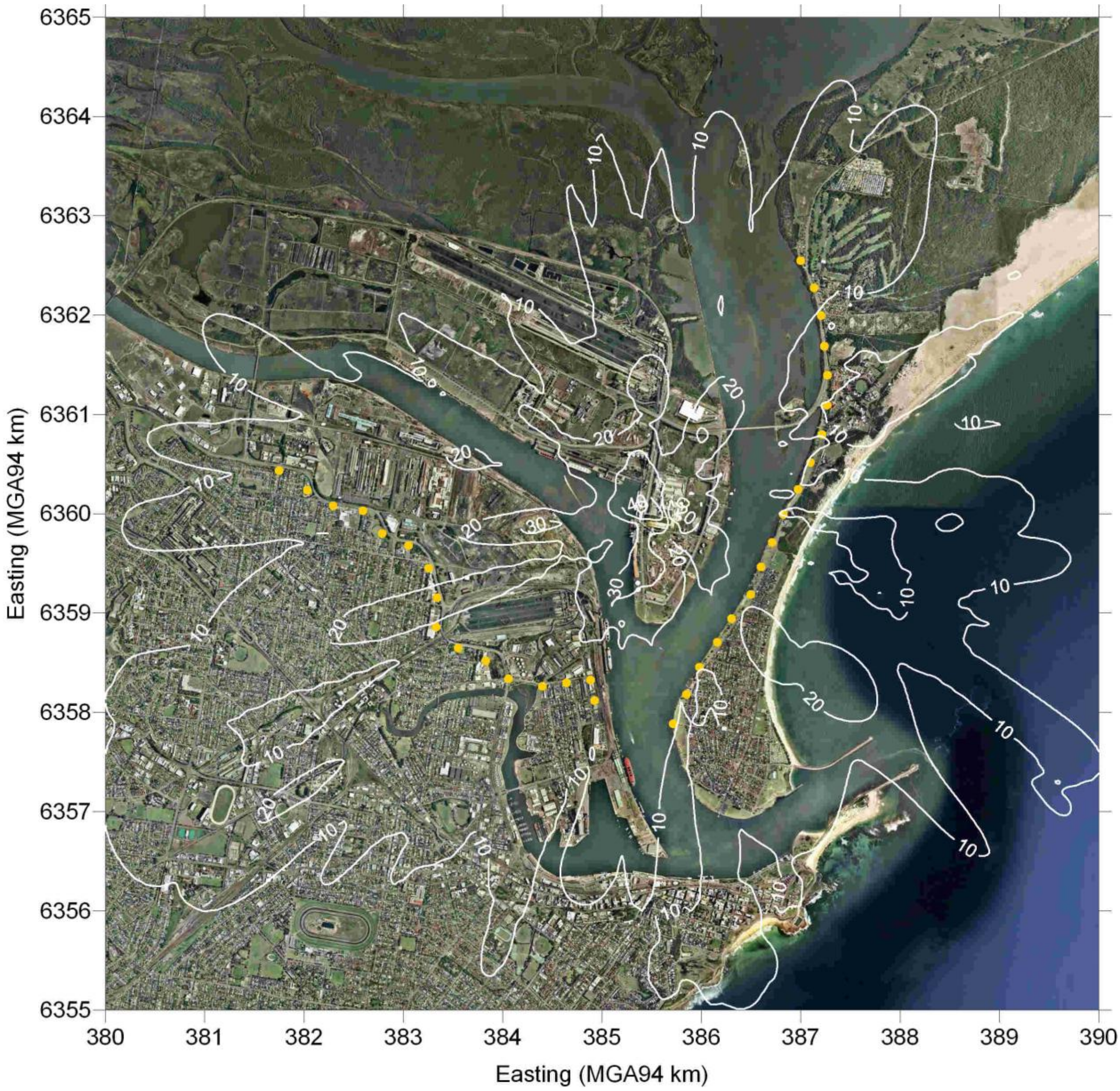
Table 10-9 Dispersion Model Results: NO_2 (All NO_x as NO_2) - Plant Operation (µg/m³)

Category	Receptor	1 hr Average	Annual Average
Incremental Impact	Max Discrete	25	0.4
	Max Gridded	53	1.5
Background	-	*84*	*18.7*
Cumulative Impact	Max Discrete	109	19.1
	Max Gridded	137	20.2
Criteria	-	*246*	*62*

Figure 10-5 shows the spatial variation of peak 1 hour average model predictions. A review of the 20 most affected gridded receptors identified peak areas as being confined to the (closest) 30µg/m³ contour area immediately to the south west and west of the Lot. Peak concentrations at these 20 grid points ranged between 34 µg/m³ and (the peak grid point) of 53 µg/m³, implying that outside of this area, peak maximum concentrations were all less than 34 µg/m³. Indeed, predicted peak 1 hour NO_2 impacts were less than 30µg/m³ at all non-industrial locations, with a maximum of 27.8 µg/m³ predicted at Stockton[5].

[5] As discussed in Section 7.2.1 of Appendix E Air Quality, discrete receptors have been included for screening purposes, and occasionally elevated levels may originate beyond these lines. URS has checked for where this occurs and in this case the levels at Stockton were predicted to be slightly higher at 27.8 µg/m³ than at the discrete receptors at 25 µg/m³ (refer to Table 10-9).

Figure 10-5 Maximum Incremental 1 Hour NO_2 (All NO_x as NO_2) – Plant Operation



(Image sourced from Google Earth Pro)

● Discrete Receptor

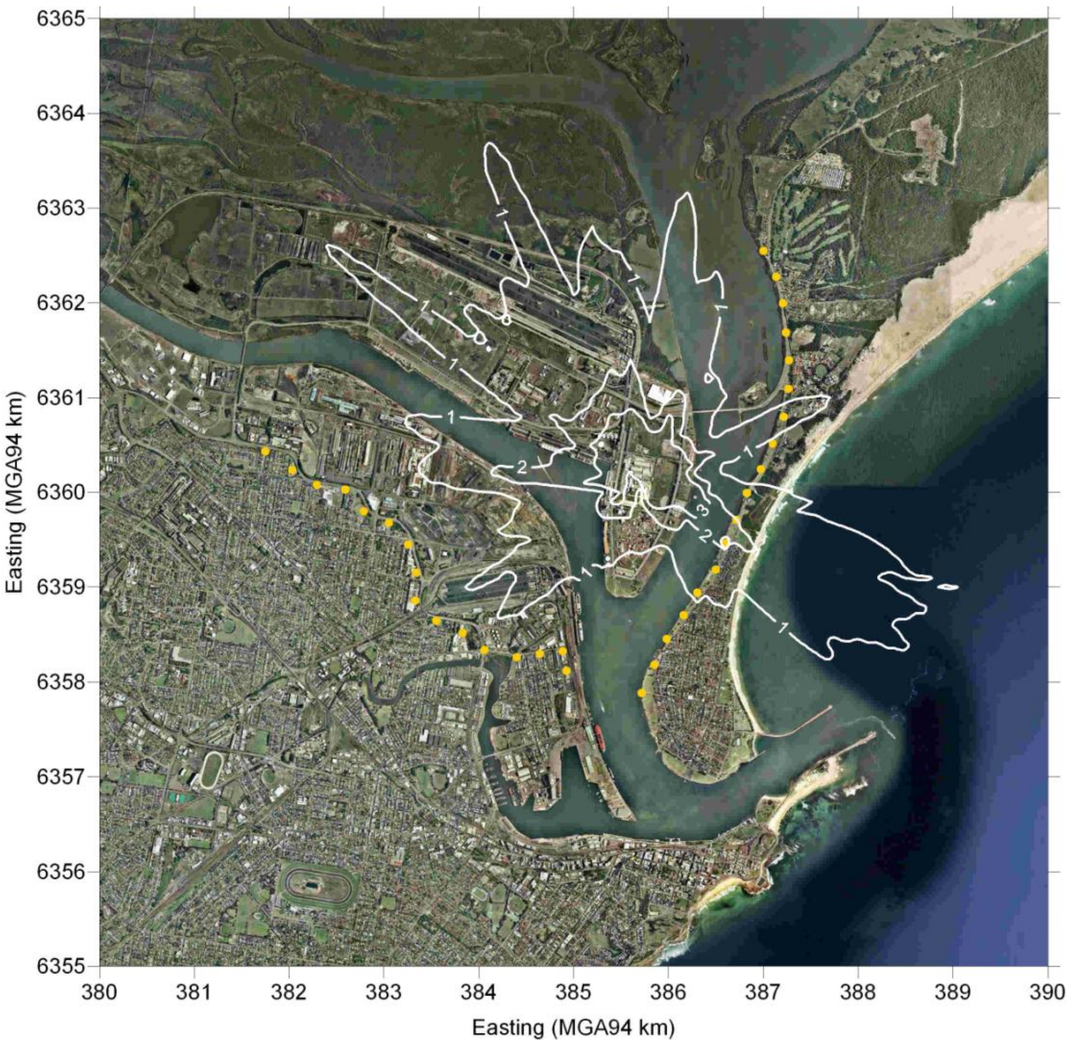
Particulate Matter (as PM_{10}) Results for Plant Operation

Table 10-10 shows the results of model predictions for PM_{10}. It shows that peak model predictions are low relative to criteria, both as an incremental impact, and when added to existing background levels as a cumulative impact. All levels are within OEH / EPA impact assessment criteria. **Figure 10-6** shows the peak incremental 24 hour PM_{10} predictions for the Project's operational scenario. Concentrations greater than 2 µg/m³ are primarily confined to areas directly around the Site.

Table 10-10 Dispersion Model Results: PM10 - Plant Operation (µg/m³)

Category	Receptor	24 hr Average	Annual Average
Incremental Impact	Max Discrete	2.0	0.2
	Max Gridded	11.9	0.9
Background	-	*31.7*	*21.7*
Cumulative Impact	Max Discrete	33.7	21.9
	Max Gridded	43.6	22.6
Criteria	-	*50*	*30*

Figure 10-6 Maximum Incremental 24 Hour PM_{10} Predictions – Plant Operation



(Image sourced from Google Earth Pro)

●Discrete Receptor

Ammonia Results for Plant Operation

Table 10-11 provides the results of the model predictions for Ammonia compared against OEH impact assessment criteria. As shown, peak model predictions are within the OEH impact assessment criteria. In accordance with the Approved Methods, this criterion is applied based on impacts of the pollutant source alone (i.e. emissions from the Project).

Table 10-11 Dispersion Model Results: Ammonia - Plant Operation (µg/m³)

Category	Receptor	1 hr Average
Predicted Impact	Max Discrete	1.2
	Max Gridded	2.5
Criterion	-	*330*

Non-Routine Emissions

This section provides the results of the dispersion modelling of non-routine operations, with comparison against OEH impact assessment criteria. Results have been presented in a tabulated form. Contour isopleths are provided in **Appendix E Air Quality**. Despite the infrequent nature of these events, 100^{th} percentile results have been presented. An awareness of the proposed frequency of these events should be made when reviewing these results. In addition, given the short duration and infrequent nature of these events, criteria with averaging periods greater than 1 hour have not been presented.

Nitrogen Dioxide Results for Non-Routine Emissions

Table 10-12 shows peak NO_2 predictions for the NA plant start up, and flaring scenarios. When added to existing background levels, peak model predictions are within OEH impact assessment criteria.

Table 10-12 Dispersion Model Results: NO_2 (All NO_x as NO_2) – Non-Routine Operations (µg/m³)

Category	Receptor	NA Startup	Flaring
Incremental Impact	Max Discrete	40	47
	Max Gridded	94	137
Background	-	*84*	*84*
Cumulative Impact	Max Discrete	124	131
	Max Gridded	178	221
Criteria	-	*246*	*246*

Ammonia Results for Non-Routine Emissions

Table 10-13 shows the predicted ammonia concentrations associated with a flaring event. This result is within the OEH impact assessment criterion. Given the rarity of flaring events (~1 in 10 years), the use of a 99.9^{th} percentile result in conjunction with the OEH / EPA criterion is considered highly conservative.

Table 10-13 Predicted 99.9^{th} Percentile 1 hour Ammonia – Flaring (µg/m³)

Category	Receptor	Flaring
Incremental Impact	Max Discrete	52
	Max Gridded	262
Criteria	-	*330*

Conclusion

The results of the dispersion modelling show that the key pollution sources for the Project do not exceed OEH / EPA criteria even when considered with the existing air quality in the Newcastle LGA. A review of the cumulative results for the discrete receptors (i.e. those receptors close to residential areas) in **Tables 10-9** to **10-12** show that adverse air quality impacts as a result of Project operation are unlikely. Based on the information reviewed and the assessment performed, the potential for the Project to result in adverse air quality impacts during operation is considered to be low.

10.5.3 Best Available Technology

Introduction

URS conducted a review of air emission levels from the Project against Best Available Technology (BAT) as defined in *Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for the Manufacture of Large Volume Inorganic Chemicals - Ammonia, Acids and Fertilisers* (IPPC, 2007). This document represents a comprehensive reference for production processes relating to AN manufacture, and provides specific recommendations with regard to BAT air emissions control for a range of industrial processes relating to inorganic chemical production.

Consistency with BAT for NA Production

With regard to BAT for NA production, IPPC (2007) provides the following recommendations:

"BAT is to reduce emissions of NO_X *and to achieve the emission levels given in..*(**Table 10-14**)*..by applying one or a combination of the following techniques:*

- *Optimisation of the absorption stage;*
- *Combined* NO_x *and* N_2O *abatement in tail gases;*
- *Selective Catalytic Reduction (SCR)*[6]*;*
- *Addition of* H_2O_2 *to the last absorption stage.*

BAT is to reduce emissions during startup and shutdown conditions."

The Project is consistent with the recommendations from IPPC (2007) in the use of BAT given the following:

- Optimised design of the absorption stage;
- Use of SCR;
- Use of a tail gas heater to maintain operation of the SCR through startup.

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[6] Selective catalytic reduction (SCR) is a means of converting nitrogen oxides (NO_x) with the aid of a catalyst into nitrogen and water. Commercial SCR systems have been shown to reduce NO_x by 70 – 95%.

As shown in **Table 10-14**, the Project is consistent with BAT NO_x emission levels as listed in IPPC (2007).

Table 10-14 Comparison of IPL Proposed NOx Emission Levels with IPPC (2007) BAT

Emission Source	NO_x Emission Level (ppmv)	
	IPPC (2007) BAT	IPL Proposed
New plants	5 - 75	30-40 (typical) 75 (licence limit)
Existing plants	5 - 90*	N/A
NH_3 slip from SCR	<5	<5

Note:

*can be up to 150 ppmv, where safety aspects due to deposits of AN restrict the effect of SCR or with addition of H_2O_2 instead of applying SCR.

N/A: Not Applicable.

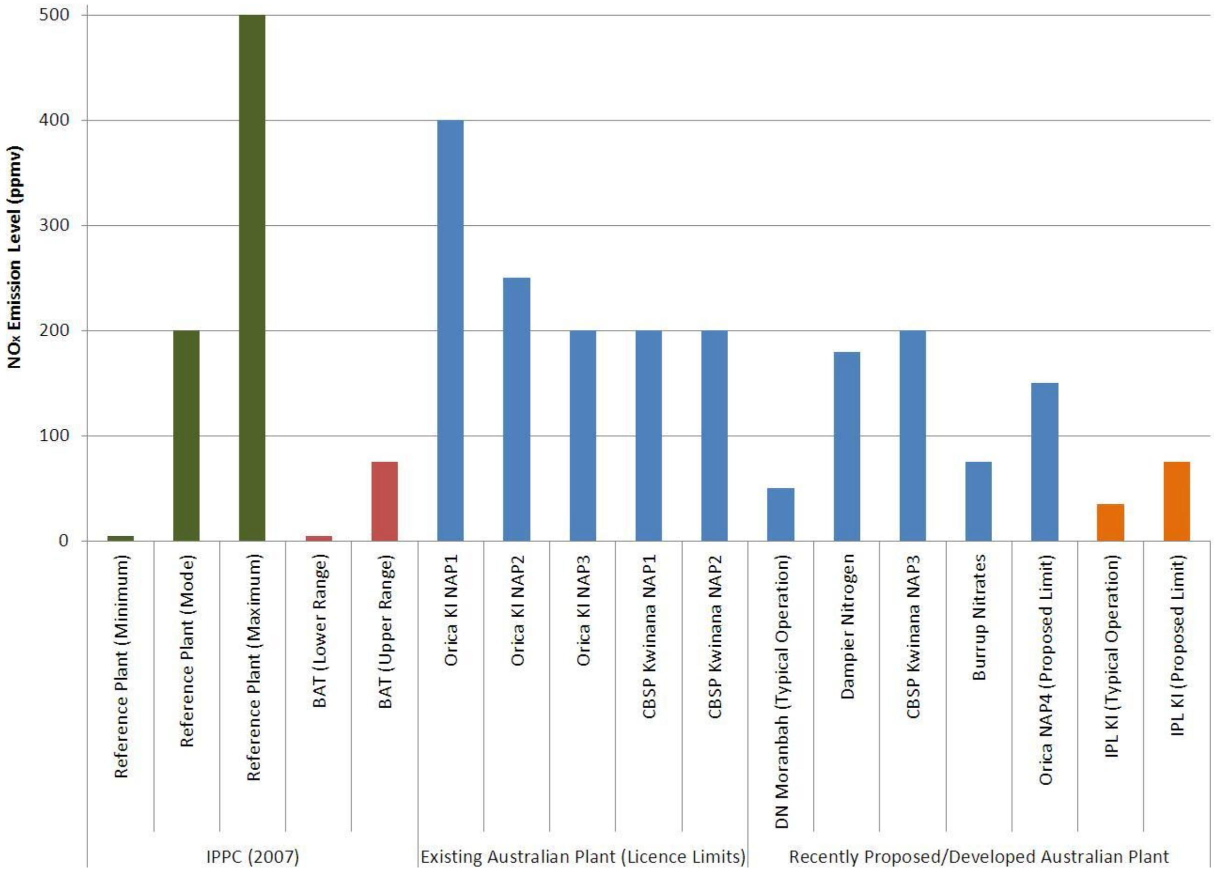
Review Against Existing and Proposed NA Plants within Australia

A review was conducted for emission levels within Australian NA plants (refer to **Appendix E Air Quality**). The review provided examples of emission levels from existing and proposed NA plants. **Table 10-15** provides a summary of these data. A range of emission levels from IPPC (2007) are also provided for context. **Figure 10-7** provides a visual representation of these data.

Table 10-15 Review Against IPPC References as well as Existing and Proposed Plants within Australia

Class	Plant	NO_x Emission Level (ppmv)	Source
IPPC Reference	Reference Plant - Minimum	5	IPPC (2007)
	Reference Plant - Mode	200	
	Reference Plant - Maximum	500	
	BAT - Lower Range	5	
	BAT - Upper Range	75	
Existing Australian Plant (Licence Limits)	Orica KI NAP1	400	ENSR (2009)
	Orica KI NAP2	250	
	Orica KI NAP3	200	
	CBSP Kwinana NAP1	200	Environ (2011)
	CBSP Kwinana NAP2	200	
Recently Proposed/Developed Australian Plant	Dyno Nobel Moranbah (Typical Operation)	50	GHD (2006)
	Dampier Nitrogen	180	GHD (2010)
	CBSP Kwinana NAP3	200	Environ (2011)
	Burrup Nitrates	75	ERM (2009)
	Orica NAP4 (Proposed Limit)	150	ENSR (2009)
	IPL KI (Typical Operation)	35	IPL
	IPL KI (Proposed Limit)	75	

Figure 10-7 Review of Project NOx Emission Levels Against IPPC References as well as Existing and Proposed NA Plants within Australia



AN Production

IPPC (2007) does not provide BAT recommendations with regard to AN production, stating: "*Because of an insufficient data basis, no conclusions could be drawn for emissions to air from neutralisation, evaporation, granulation, prilling, drying, cooling and conditioning.*"

It does however detail a summary of reference levels for ammonia and particulate matter emissions from ammonium nitrate prilling, drying and associated processes. These reference levels are from *Best Available Techniques for Pollution Prevention and Control in the European Fertilizer Industry Booklet No. 6 of 8: Production of Ammonium Nitrate and Calcium Ammonium Nitrate*, European Fertilizer Manufacturers' Association, 2000 (EFMA BAT).

Table 10-16 shows a comparison of proposed particulate matter and ammonia emission levels with BAT as defined in EFMA (2000).

Table 10-16 Comparison of IPL Proposed AN Emission Levels with EFMA (2000) BAT

Emission Source	EFMA (2000) BAT	IPL Proposed
Particulate Matter		
AN Prill Towers	15 mg/Nm^3	<20 mg/Nm^3
Other Individual Emission Points	30 mg/Nm^3	
Ammonia		
AN Prill Towers	10 mg/Nm^3 (13 ppmv)	<3.8 mg/Nm^3 (<5 ppmv)
Other Individual Emission Points	50 mg/Nm^3 (66 ppmv)	

As shown in **Table 10-16**, the Project is consistent with BAT as defined in EFMA (2000), with the upper limit of particulate emission levels within the range of BAT values provided, and ammonia levels well within the provided BAT values. It is noted that the AN scrubber stack handles air from the prill tower and other processes (i.e. drying/screening and cooling).

10.6 Mitigation Measures

Construction Mitigation

As noted above, the key construction stage impact would be from the generation of dust. To reduce dust generation and transportation, a Soils and Erosion Management Plan (SEMP) would form part of the CEMP. This plan would outline management measures for any soils that are excavated or stored on Site during the construction works. Specific measures to manage dust generation would include:

- Covering and/or wetting down on stockpiled soils to reduce windblown dust generation;
- Removal of soils, dirt and dust before vehicles leave the Site; and
- Rehabilitation of bare ground once the construction works are complete or as soon as is practicable.

Further soil management measures are discussed in **Chapter 12 Soil and Groundwater**.

Operational Mitigation

The following mitigation measures have been integrated into the design of the Project.

- During import and storage of the anhydrous liquid ammonia, refrigeration would be required to compensate for heat that is conducted through tank and pipe insulation, and thus minimise ammonia venting.
- Selective Catalytic Reduction (SCR) control would be maintained for the NA Plant tail gas to reduce NO_x levels that could have in impact on the local air quality.
- The NA Plant tail gas emission stack would be continuously monitored for levels of NO, N_2O and NO2
- A heater will be installed for SCR to minimise NO_x levels during NA Plant start-up.
- During NA storage, the NA tank vent would be fitted with a simple gravity fed water column scrubber. This would help reduce breathing emissions (due to minor changes in atmospheric and/or tank pressure), whilst also reducing NOx gases in the flow when tank headspace relief is required.

- During the prilling process, the warm air stream leaving the top of the Prill Tower would be scrubbed with weak acidic AN solution to remove entrained AN dust and any free ammonia. The scrubber would also cool the air stream allowing greater volumes of air to be recycled into the base of the Prill Tower, thereby further reducing the emissions. The balance of air from the scrubber would pass through a second stage of scrubbing, before being discharged via the vent stack. The second stage scrubber would consist of a primary venturi scrubbing and secondary packed column scrubbing to ensure maximum scrubbing efficiency. The two stages of scrubbing would eliminate the majority of pollutants in the discharged air. As a result of this treatment, exhaust gases would contain less than 20 mg/m^3 of particulate matter (273K, 1 Atm), with operational levels typically ranging between 4-7 mg/m^3.
- The Project would use a package boiler with a low NO_x burner, such that NO_x emissions are reduced below 75 ppmv (150 mg/m^3) at the reference conditions.
- The ammonia storage flare is an emission control device. It is used to control ammonia emissions in the event of a refrigeration failure. During standby, the flare would remain in a ready state by combusting approximately 20 kg of natural gas per hour, in conjunction with a minor quantity of inert gases that accumulate in the storage tank.
- During emergency flaring operation (a less than 1 in 10 year event), a peak design ammonia flow of 4 t/hr would be sent to the flare. The flare would provide an ammonia destruction efficiency in excess of 98% (Woods, 2012).
- Emissions from bagging operations would be managed through the capture and filtration of dust that is produced through the associated material transfer operations. Given the minor scale of this source, it is not envisaged that it would be licenced. In-stack concentrations have been estimated at less than 20mg/m^3 (273K, 1 Atm).

These measures have been incorporated into the Project design and as such have been considered in the Air Quality Impact Assessment provided in **Appendix E Air Quality**.

10.7 Cumulative Effects

For the purposes of the Cumulative Effect Assessment the emissions from the Project were assessed alongside emission sources from the proposed Orica expansion project. This assessment was performed in order to consider potential cumulative impacts from the proposed Orica expansion emission sources that have not been captured in ambient monitoring performed to date. This cumulative assessment has been limited to NO_2, on the basis that it is the key pollutant of interest with respect to potential cumulative impacts from proposed sources. **Table 10-17** shows the predicted cumulative NO_2 as a result of both the Project and the Orica expansion project.

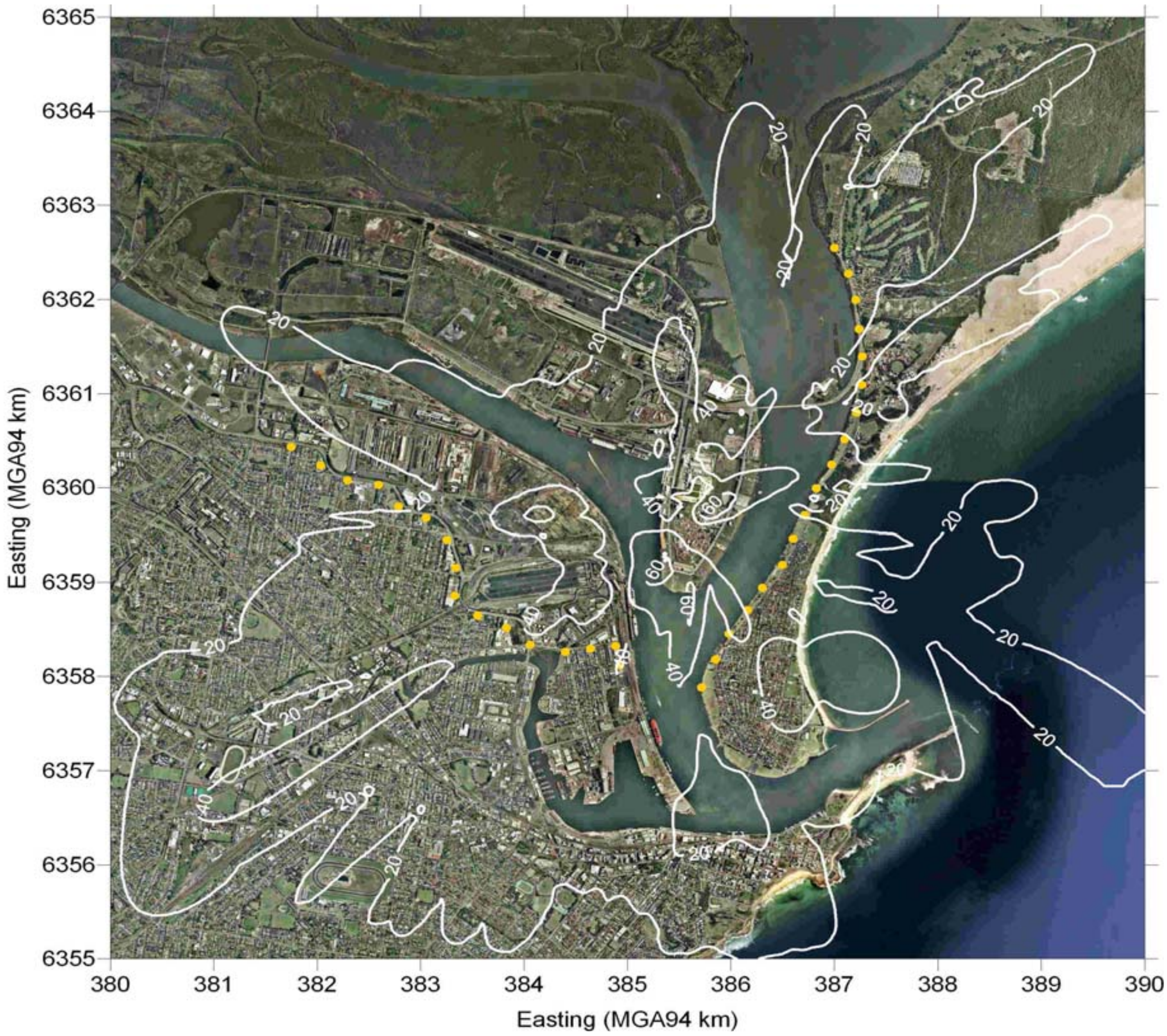
Table 10-17 Predicted Cumulative NO_2 –Orica and IPL KI (µg/m³)

Category	Receptor	NA Plant Startup	Plant Operation	
		1 hour Max	1 hour Max	Annual
Incremental Impact [1]	Max Discrete	41	41	0.7
	Max Gridded	108	71	3.0
Background	-	*84*	*84*	*18.7*
Cumulative Impact	Max Discrete	125	125	19
	Max Gridded	192	155	22
Criteria	-	*246*	*246*	*62*

Note: [1] In this instance, "incremental" refers to the incremental impact from the Project and Orica upgrade sources combined.

Figure 10-8 shows the predicted cumulative incremental NO_2 predictions for operation of the Orica expansion project and the Project. All sources have been modelled as all NOx as NO2, excluding the NOx emissions from gas combustion on the Orica site, which have assumed an ambient ratio of 30% NO_2/NO_x.

Figure 10-8 Predicted Maximum Incremental 1 hour NO_2 –Orica and IPL KI Operation (µg/m³)

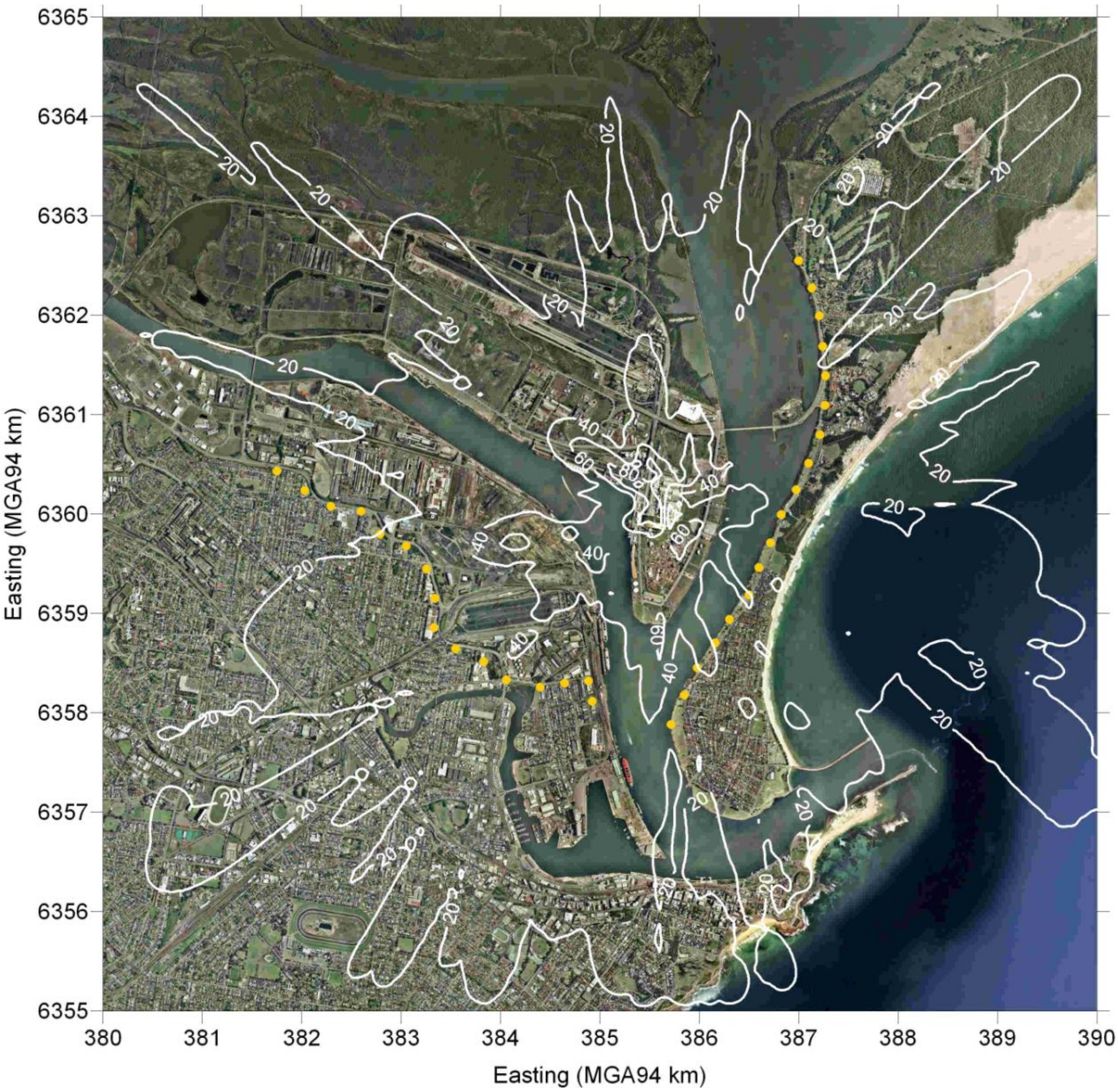


(Image sourced from Google Earth Pro)

Discrete Receptor

Figure 10-9 shows incremental NO_2 predictions for operation of the Orica expansion project and startup of the Project. All sources have been modelled as all NO_x as NO_2, excluding the NO_x emissions from gas combustion on the Orica site, which have assumed an ambient ratio of 30% NO_2/NO_x.

Figure 10-9 Predicted Maximum Incremental 1 hour NO_2 – Orica Operation and IPL KI Startup (µg/m³)



(Image sourced from Google Earth Pro)

Discrete Receptor

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Figure 10-10 shows annual average NO_2 predictions from operation of the Orica expansion project and the Project.

Figure 10-10 Predicted Incremental Annual Average NO_2 – Orica and IPL KI Operation (µg/m³)

(Image sourced from Google Earth Pro)

Discrete Receptor

The results presented in **Table 10-17** and shown in **Figures 10-8**, **10-9** and **10-10** indicated that the cumulative NO_2 emissions for the Project and the Orica expansion project would not exceed the OEH NO_2 criteria provided within the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (OEH, 2005) at the discrete receptor locations. Based on this assessment the potential for the Project to result in adverse cumulative air quality impacts is considered to be low.

10.8 Proposed Management and Mitigation Measures

The AQIA (refer to **Appendix E Air Quality**) determined that the mitigation measures that would be incorporated into the design of the Project would significantly reduce the likelihood of impacts on air quality. A number of mitigation measures have been suggested to ensure that impacts during the construction and operation of the Project are minimised as far as practically possible. These are summarised in **Table 10-17**.

Table 10-17 Management and Mitigation Measures – Air Quality and Odour

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Dust suppression would be used during Project construction		✓	
Ammonia would be refrigerated during import and storage to reduce the potential for external exposure to pollutant and odorous ammonia.			✓
In the event of refrigeration failure within the ammonia storage facility, excess ammonia would be flared.			✓
Catalytic control would be maintained throughout the operation to reduce the possible emissions of NO_x and N_2O.			✓
Bagging activities would be conducted within an enclosed area with sufficient filtering to remove suspended particles.			✓

11 Noise & Vibration

11.1 Introduction

This chapter presents a summary of the noise and vibration impact assessment undertaken to assess the potential noise and vibration impacts during the construction and operation of the Project.

The technical assessment is provided in **Appendix F Noise and Vibration**.

The DGRs for the Project ask for an assessment of *"construction, operational and on-site and off-site road, rail and sea transportation noise" '"*

The assessment of potential noise and vibration impacts of the construction and operation of the Project on surrounding noise sensitive receptor locations, has been carried out in accordance with relevant NSW noise guidelines, these are outlined below in **Section 11.3.1**.

11.2 Glossary of Technical Terms

A range of acoustic parameters and technical terms are used in the noise and vibration assessment. To assist in understanding the technical content, a brief description of the acoustic terms used within this chapter is provided below:

- dB (Decibel): A unit of sound level measurement that uses a logarithmic scale.
- "A" Frequency Weighting: The method of comparing an electrical signal with a noise measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. The symbol to show this parameter has been included in the measurement is "A" (e.g. L_{Aeq}).
- Background Noise: Background noise is the term used to describe the level of noise measured in the absence of the noise under investigation. It is measured statistically as the A-weighted noise level exceeded for ninety per cent of a sample period. This is represented as the L_{A90} noise level. The measurement sample time may be indicated in the form $L_{A90,t}$ where t is the measurement sample time e.g. $L_{A90,15\ min.}$
- Ambient Noise: The all-encompassing sound at a site comprising all sources such as industry, traffic, domestic, and natural noises. This is represented as the LA_{eq} noise level in environmental noise assessment.
- Rating Background Level (RBL): The overall background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). The rating background level is the level used for assessment purposes. Where the rating background level is found to be less than 30dB(A), then it is set to 30dB(A).
- L_{Aeq}: A-weighted equivalent continuous noise level that is used as the constant level of noise that would have the same energy content as the varying noise signal being measured. The letter "A" denotes that the A-weighting has been included and "eq" indicates that an equivalent level has been calculated. This is referred to as the ambient noise level. The measurement sample time may be indicated in the form $L_{Aeq,t}$ where t is the measurement sample time e.g. $L_{Aeq,15\ min.}$
- Perception of Sound: Audible sound ranges from the threshold of hearing at 0dB to the threshold of pain at 130dB and over. A change of 1dB or 2dB in the level of a sound is difficult for most people to detect, whilst a 3dB to 5dB change corresponds to small but noticeable change in volume. An increase of about 8 – 10dB is required before the sound subjectively appears to be significantly louder.

- Sound Pressure Level (SPL): Sound pressure is the measure of the level or loudness of sound. Like sound power level, it is measured in logarithmic units. The symbol used for sound pressure level is SPL, and it is generally specified in dB. 0dB is taken as the threshold of human hearing.

Table 11-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
120	Riveter; rock concert, close to speakers; ship's engine room	Intolerable
100 – 110	Grinding; sawing, Punch press and wood planers, at operator's position; pneumatic hammer or drilling (at 2 m)	Very noisy
70 – 80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
50 – 60	Office, department store, restaurant, conversational speech	Moderate
40 – 50	Private office; Quiet residential area	Quiet
30 – 40	Unoccupied theatre; quiet bedroom at night	
20 – 30	Unoccupied recording studio; Leaves rustling	Very quiet
0 – 10	Hearing threshold, excellent ears at frequency of maximum sensitivity	

11.3 Assessment Methodology

11.3.1 Scope and Guidance

The scope of this assessment was to:

- assess the existing acoustic environment and establish appropriate Project-Specific Noise Levels (PSNL);
- predict potential noise and vibration impacts by means of noise modeling and calculations;
- assess predicted construction and operational noise levels against the established noise criteria;
- provide a statement of potential noise and vibration impacts;
- provide recommendations for appropriate noise mitigation measures and noise management practices, where required; and
- report the findings of the assessment (refer to **Appendix F Noise and Vibration**).

Potential noise impacts associated with the proposed construction and operational activities have been assessed in accordance with the following guidelines:

- *NSW Industrial Noise Policy* (INP, EPA 1999) for the assessment of the operational noise;
- *NSW Road Noise Policy* (RNP, DECCW 2011) for the assessment of the off-site traffic noise on public roads;
- *NSW Interim Construction Noise Guidelines* (ICNG, DECC 2009) for the assessment of the noise from construction of the Project; and
- *Assessing Vibration: A Technical Guideline* (DEC, 2006) for the assessment of the vibration from construction of the proposed development.

The following documents have additionally been considered for this assessment:

- *Guidelines for Community Noise* (WHO,1999);
- AS 3671-1989: *Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*; and
- *A Simple Outdoor Criterion for Assessment of Low Frequency Noise Emission* (Acoustics Australia, Vol. 39), Dr N Broner, 2011.

Potential for sleep disturbance has also been assessed as the proposed facility would operate 24 hours per day.

11.3.2 Noise Monitoring

Noise measurements were undertaken at selected noise sensitive receptors and on-site locations. Noise monitoring locations were chosen after examination of satellite imagery and inspection of the Site and the surrounding area.

Consideration was also given to selecting monitoring locations representative of the potentially worst affected receptors with respect to the construction of the Project, additionally to quantify the level of industrial noise emissions from Kooragang Island.

Two locations, R1 and R2, (refer to **Figure 11-1**) were considered representative of the potentially worst affected receptors and were therefore selected for the long-term noise monitoring. Additionally two locations inside the eastern boundary of the Site, R3 and R4, were established to allow for assessment of the existing levels of noise emission on the Site boundary during the baseline study.

Short-term attended measurements were also undertaken during daytime, evening and night-time periods at the four identified locations to supplement and verify the long-term noise monitoring.

Noise and vibration levels on the Site are defined by the activities of the site immediately to the south of the Project, operated by Orica. A series of short-term (2 minute) measurements were conducted at several locations (O1 to O35) along the northern and eastern boundaries of the Orica site to determine the level of Orica noise emissions at the time of the assessment. It is understood that the Orica operated ammonia plant was not operating at full capacity during the baseline monitoring period.

All noise measurements were undertaken in general accordance with AS1055:1997 *Acoustics – Description and Measurement of Environmental Noise*.

Site visits undertaken on 23-24 February 2012 and 5-6 March 2012 in fine and dry conditions. The equipment used complied with *AS IEC 61672.1 – 2004 Electroacoustics – Sound level meters – Specifications* and *AS IEC 60942-2004: Electroacoustics - Sound Calibrators* as appropriate. Further details regarding the noise monitoring are provided in **Appendix F Noise and Vibration**.

11.3.3 Noise Assessment Criteria

Construction Noise

The noise criteria set out in the *Interim Construction Noise Guidelines* (ICNG) (DECC, July 2009) have been used to assess the potential construction noise impact of the Project. **Table 11-2** and **Table 11-3** summarise the construction noise criteria specified in the guideline.

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PROPOSED AMMONIUM NITRATE FACILITY

NOISE MONITORING LOCATIONS

URS

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Figure: 11-1

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Table 11-2 Construction Noise Criteria – Noise at Residences

Time of Day	Management Level $L_{Aeq, 15min}$	How to apply
Recommended standard hours: Monday to Friday: 7.00am to 6.00pm Saturday: 8.00am to 1.00pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: Where the predicted or measured $L_{Aeq, 15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Table 11-3 Construction Noise Criteria – Noise at Other Sensitive Land Uses

Land Use	Management Level, $L_{Aeq, 15min}$ (applies when properties are being used)
Classrooms at schools and other educational institutions	Internal noise level: 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level: 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level: 60 dB(A)
Commercial premises (offices, retail outlets, etc)	External noise level: 70 dB(A)
Industrial premises	External noise level: 75 dB(A)

Construction Vibration

An evaluation of the potential for construction vibration effects was made, based on the guideline *Assessing Vibration: A Technical Guideline* (2006) along with the aforementioned legislation and guidance. The effect of construction related vibration on structures and human comfort was assessed. A full description of the methods used is found **Appendix F Noise and Vibration**.

Off-Site Traffic Noise Criteria

Criteria for off-site road traffic noise are specified in the *NSW Road Noise Policy* (RNP). The applicable criteria for assessment of the Project are summarised in **Table 11-4**.

The identified limits do not apply to vehicle movements within the Site. For the purpose of assessment any noise generated by on-site vehicle movements while on the Site is considered as construction industrial noise and assessed in accordance with the Industrial Noise Policy (INP).

Table 11-4 RNP Criteria for Road Traffic Noise

Type of Development	Assessment Criteria – dB(A)	
	Daytime (07:00-22:00)	Night (22:00-07:00)
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15\ hour}$ 60 (external)	$L_{Aeq,9\ hour}$ 55 (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1\ hour}$ 55 (external)	$L_{Aeq,1\ hour}$ 50 (external)

The traffic route roads that have sensitive receivers located on them are all sub-arterial/arterial roads and therefore for the purpose of assessing likely future road traffic noise arising from the Project the 60dB(A) $L_{Aeq,15hour}$ (daytime) and 55dB(A) $L_{Aeq,9hour}$ (night-time) assessment goals have been considered. Additionally, in accordance with the provisions of the RNP any increase in the total traffic noise level should be limited to 2 dB above the corresponding road traffic noise levels, due to general traffic growth, that would have occurred if the Project had not proceeded. A 2 dB increase is not typically considered noticeable.

Operational Noise

The INP provides the framework for deriving operational noise limits. The policy sets out two criteria (intrusive criterion and amenity criterion) to assess potential operational noise impacts of industrial sources. The first criterion is used to control intrusive noise impacts in the short-term for residences, and the second criterion is used to maintain noise level amenity for particular land uses for residences and other land uses. **Table 11-5** provides a summary of the recommended noise levels for industrial noise sources from the INP.

Table 11-5 Recommended Noise Levels from Industrial Noise Sources

Type of Receptor	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable (ANL)	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial Premises	All	When in use	70	75

The INP requires that where noise levels from industrial sources already exceed the acceptable noise level for the area in question, the L_{Aeq} noise level from any new source should be at least 10 dB below the existing level if there is no reasonable expectation that existing levels will fall.

For the purpose of INP assessment, **Table 11-6** defines the boundaries of each part of the day.

Table 11-6 INP definitions for the Time of Day

Time of Day	Hours
Day	0700-1800 Monday to Saturday
	0800-1800 Sundays and public holidays
Evening	1800-2200, all days
Night	2200-0700 Monday to Saturday
	2200-0800 Sundays and public holidays

Sleep Disturbance Criteria

In addition to the criteria in **Table 11-5**, an assessment of sleep disturbance for the potentially affected noise sensitive receptors during the operation of the Project has been considered in this assessment.

The World Health Organisation (WHO) recommends that the noise level inside bedrooms should not exceed 30–35 dB L_{Aeq} and 45 dB L_{AFmax} to protect against sleep disturbance.

When considering internal noise levels occurring due to the presence of an external noise source, it is common practice to assume that windows are partially open to allow natural ventilation. The noise reduction through partially opened windows is estimated to be 10 dB(A), as specified in *AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*.

Section 2.2 of the INP states that meeting the Acceptable Noise Level (ANL) will to some extent protect against sleep disturbance, with a recommended acceptable external noise level for suburban areas of 40 dB(A) L_{Aeq} at night.

For the purpose of assessment, based on the recommendations of the WHO and the INP, the sleep disturbance criteria set out in **Table 11-7** has been adopted.

Table 11-7 Sleep Disturbance Criteria

External Noise Level Sleep Disturbance Criteria	
Recommended Limit (External)	45 dB L_{Aeq}
Maximum Limit (External)	55 dB L_{Amax}

11.3.4 Noise Modelling

A computer acoustics model was prepared to predict noise levels from construction and operational noise associated with the Project. The model used was SoundPLAN 7.1. SoundPLAN is specified by the INP as an approved computer program for noise predictions. The INP requires noise levels to be predicted under different meteorological conditions, representative of conditions that are likely to occur. This was done for this assessment by using the CONCAWE algorithm within the SoundPLAN model.

The CONCAWE algorithm was developed to predict noise from large industrial facilities such as petroleum and petrochemical facilities, and is commonly used in Australia for calculating noise emissions from all types of industrial facilities. Empirical factors are provided to account for refraction resulting from different atmospheric stability and wind conditions. In addition to meteorological effects, CONCAWE also corrects for air absorption, ground absorption, and screening from buildings and terrain.

The Sound Insulation Prediction model INSUL Version 6.4 was used to determine the levels of attenuation that would be expected to be achieved through the proposed on-site building envelopes.

11.4 Existing Environment

11.4.1 The Site and Surrounding Area

The acoustic environment on and around Kooragang Island is dominated by industrial, traffic and port related noise sources. Noise on the Site is dominated by industrial noise from the neighbouring Orica facility. This noise source dominated both the background and ambient noise sources. Other less influencing noise sources at this location were local fauna (birds and insects), distant road traffic, occasional traffic movements on Greenleaf Road and lower level industrial hum emanating from Port Waratah Coal Services (PWCS).

Existing operations on the Site are outlined in **Chapter 3 Project Location and Existing Environment**. Site visits undertaken by URS noise specialists, observed that the existing operations have limited material contribution to existing noise levels on and around the Site.

The nearest residential receptors to the Site are located at Stockton approximately; 800 m to the east of the Site. The key noise sources at this location include local road traffic (reducing at night), local fauna (birds and insects), surf and industrial sites located on Kooragang Island, particularly the neighbouring Orica operation, clearly audible at all times of day.

Other residential areas are located in Carrington to the south, Fern Bay to the north east and Mayfield to the west, approximately 1.5 km, 1.5 km and 2 km from the Site respectively.

The closest industrial receptor to the Project is the Orica facility adjacent to the south of the Site.

11.4.2 Noise Monitoring Results

The results of the long-term noise monitoring are shown in **Table 11-8.** This table presents a summary of overall ambient and background noise levels at each monitoring location.

Table 11-8 Summary of Long-Term Noise Monitoring

Location	Rating Background Level (RBL) L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
R1: 306 Fullerton St	46	46	45	64	61	58
R2: 324 Fullerton St	47	45	44	65	61	59
R3: Site eastern boundary	47	49	50	56	57	57
R4: Site eastern boundary	52	54	56	61	61	60

The results of the long term noise monitoring show consistent daily noise levels throughout each period at all the monitoring locations. The results at the residential monitoring locations (R1 and R2) show similar trend and background noise levels. Therefore the noise monitoring data was considered representative of the area's acoustic environment and suitable for the assessment.

The short term attended noise monitoring results along the Orica site boundary and R1-R4 are presented in **Appendix F Noise and Vibration**. Operational noise from the Orica plant was observed to be relatively steady state, with the main sources contributing to the industrial noise including compressors, fans and cooling towers. Individual sources could not be clearly identified and noise emissions were noted to be relatively broadband in nature, with no notable low frequency or tonal components.

11.4.3 Project-Specific Noise Levels (PSNL)

Construction Noise Criteria

In accordance with the ICNG, and following the results of the noise monitoring, **Table 11-9** presents the construction noise management levels applicable for the nearest residential receptors in Stockton and the nearest industrial receptor at the Orica site. A noise level of 46 dB (A) was measured as the daytime RBL for R1 in Stockton. In line with the ICNG, an additional 10 dB (A) is added to this number to provide the Noise Affected Level for Stockton residences. Construction activities on the Site would generally have to be below this noise level, although activities causing noise levels for Stockton residences of 75 dB (A) may be allowed in certain circumstances. Industrial receptors are provided a set Noise Affected Level of 75 dB (A) in all cases.

Table 11-9 Project-Specific Construction Noise Management Levels

Receptor Location	Rating Background Level L_{A90} dB(A)	Noise Affected Level $L_{Aeq,15min}$ dB(A)	Highly Noise Affected Level $L_{Aeq,15min}$ dB(A)
All Receptors (Stockton)	46	46 + 10 = **56**	**75**
Industrial Receptors (Orica)	-	75	**-**

Proposed Amenity Criteria

Observations on the Site confirmed that the existing Orica operation generates exceedances of the suburban night-time acceptable and maximum industrial noise levels in Stockton. The night-time acceptable noise level has been estimated to be exceeded by approximately 6-7 dB. Further, it is noted that as the Orica operation was not at full capacity at the time of assessment, potentially higher industrial noise levels than those identified are conceivable.

In this regard, it is noted that the Noise Impact Assessment prepared by Atkin's Acoustics and Associates Pty Ltd (Atkin's) on behalf of Orica for the proposed expansion of their existing Kooragang Island Ammonium Nitrate Production Facility (Report No: 39.6357.R1:GACD03 Rev 03) sets out noise prediction results for the existing Orica operation. This report identifies predicted noise levels in the 51-62 dB(A) L_{Aeq} range at a location close to R1 (approximately 200 m to the south at 284 Fullerton Street) for varying meteorological conditions.

Notwithstanding Orica's existing influence on industrial noise levels in Stockton, it is noted that Orica is required to reduce its noise emissions in the long term. The current Environment Protection Authority (EPA) Environmental Protection Licence (828) applying to Orica includes a Pollution Reduction Program (PRP) requiring the licensee to implement actions in order to reduce noise emissions from their Kooragang Island site.

Whilst the appropriate zoning in Stockton is recognised as suburban, considering the adjoining industrial zone it must be noted that a suburban/industrial interface exists. The INP does not provide recommended industrial noise levels for suburban/industrial interfaces and therefore it is considered appropriate to relax the recommended levels for suburban areas by 5 dB. On this basis, for the purpose of assessment, the nominated industrial noise levels in Stockton are shown in **Table 11-10**.

Table 11-10 Proposed Industrial Noise Levels in Stockton

Time of Day	Proposed L_{Aeq} Noise Level, dB(A)	
	Acceptable (ANL)	Recommended Maximum
Day	60	65
Evening	50	55
Night	45	

With consideration to the existing industrial noise influence in Stockton and the Orica noise reduction program, for the purpose of this assessment, a reasonable and feasible long term noise goal in Stockton would be to achieve the nominated suburban/industrial criteria and specifically the night-time acceptable amenity criterion of 45 dB(A) L_{Aeq}.

Given that IPL and Orica are the only two operators that could materially influence industrial noise levels at the identified locations R1 and R2, it is proposed that the adjacent sites assume an equal responsibility in achieving the nominated criteria. This would require that each operation contributes no more than the identified $L_{Aeq,Period}$ level less 3 dB, i.e. to achieve the controlling night-time criterion neither operation should contribute more than 42 dB(A) L_{Aeq} at the identified locations R1 and R2.

It would be proposed that for the purpose of compliance testing, monitoring locations in the proximity of the Lot boundary (i.e. locations R3 and R4) would be established and monitoring results extrapolated to the R1 and R2 locations.

Compliance with the nominated controlling limit in Stockton of 42 dB(A) L_{Aeq} would ensure that any industrial noise contribution from IPL would be at least 9 dB below the predicted existing contribution from Orica, as set out in the Atkin's report at all times and typically 16-17 dB below existing night-time ambient noise levels.

Table 11- 11 provides a summary of the noise levels proposed to protect the amenity of the residential receptors in Stockton and the nearby industrial receptors located on Kooragang Island due to the Project.

Table 11-11 Nominated L_{Aeq} Noise Levels from Industrial Noise Sources

Receptor	Indicative Noise Amenity Area	Time of Day	Nominated ANL L_{Aeq} Noise Level, dB(A)
R1 and R2	Suburban/Industrial Interface	Day	57
		Evening	47
		Night	42
Industrial Premises	All	When in use	70
Note:	Whilst the appropriate zoning in Stockton is recognised as suburban, considering the adjoining industrial zone it must be noted that a suburban/industrial interface exists. The INP does not provide recommended industrial noise levels for suburban/industrial interfaces and therefore it is considered appropriate to relax the recommended levels for suburban areas by 5 dB. The levels set out above are proposed for control of the IPL activity, on the provision that Orica assumes an equal responsibility in in achieving the nominated Suburban/Industrial criteria. It is noted that as the Project would operate for 24 hours per day, the nominated night-time criterion would represent the controlling limit for the Project. Compliance with the night-time criterion infers compliance at all other times. It would be proposed that for the purpose of compliance testing, monitoring locations in the proximity of the Site boundary (i.e. locations R3 and R4) would be established and monitoring results extrapolated to the R1 and R2 Stockton locations.		

Operational Noise Criteria

As discussed, the key noise source for the Site and for the residents at Stockton is the Orica facility on Kooragang Island. The noise monitoring undertaken showed that the Orica site typically generates noise levels of up to 46 dB(A) L_{Aeq} at R1 and 47 dB(A) L_{Aeq} at R2. These levels were estimated during observations made within the night-time and early morning periods of 23-24 February 2012 under very still conditions, during a brief period when other extraneous noise sources had limited influence on the monitored noise levels. It should also be noted that the Orica plant was not operating at full capacity and that other monitoring has suggested that the Orica operation generates higher level of noise in Stockton than noted in **Table 11-8**.

The PSNL reflected in **Table 11-12** present the most stringent noise level requirement to ensure that intrusive noise is limited and amenity protected. Further detail on this methodology is provided in **Appendix F Noise and Vibration**.

Table 11-12 Project-Specific Noise Levels

Receptor Location	Intrusive Criterion $L_{Aeq,15min}$ dB(A)			Amenity Criterion $L_{Aeq,period}$ dB(A)		
	Day	Evening	Night	Day	Evening	Night
R1 and R2	51	50	49	**57**	**47**	**42**
Industrial Premises	n/a	n/a	n/a	**70**	**70**	**70**
Note:	Shaded results represent the PSNL applicable to the assessment. Whilst it is noted that the RBLs presented in **Section 11.4.3** potentially understate the normal baseline, the Intrusive Criteria have been conservatively based on them. The lower of the RBLs calculated for locations R1 and R2 have been applied for all residential receptors in Stockton. It is noted that as the proposed IPL facility would operate for 24 hours per day, the nominated night-time amenity criterion would represent the controlling limit for the Project. Compliance with the night-time criterion infers compliance at all other times. It would be proposed that for the purpose of compliance testing, monitoring locations in the proximity of the IPL Site boundary (i.e. locations R3 and R4) would be established and monitoring results extrapolated to the R1 and R2 Stock ton locations.					

As the Project would operate 24 hours a day, the controlling criterion, as shown in **Table 11- 10** would be the nominated night-time amenity criterion. For the purpose of this assessment, compliance with the night-time criterion would ensure compliance at all other times.

The PSNL is the noise contribution from the operation of the Project only, i.e. excluding the contribution from the background noise level. Compliance monitoring locations on the Site are proposed for this reason.

In assessing noise levels at residential receptors, the noise level is to be assessed at the most affected point on or within the residential property boundary.

11.5 Impact Assessment

11.5.1 Construction Phase

Construction Noise

The construction phase would be split into four stages and each stage would require specific construction equipment (refer to **Chapter 5 Construction**). Sound Power Levels for construction equipment are presented in Section 6.31 of **Appendix F Noise and Vibration**. The sound power levels of these items have been extracted from Appendix D of AS 2436-1981: "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*" and library data.

The noise levels generated during each construction stage have been predicted at each receptor location. Noise emissions would vary as construction progresses. The assessment assumed a worst case scenario whereby all noise sources are operational simultaneously. This scenario would be unlikely to occur often and so noise levels at receivers would typically be lower than identified. The predicted construction noise levels are presented in **Table 11-13**.

Table 11-13 Predicted Construction Noise Levels

Construction Stage	Predicted Receiver Noise Level $L_{Aeq,15min}$ dB(A)			Residential Boundary Construction Noise Management Levels $L_{Aeq,15min}$ dB(A)	Industrial (Lot) Boundary Construction Noise Management Levels $L_{Aeq,15min}$ dB(A)
	R1	R2	Industrial (Lot) Boundary	Noise Affected Level / Highly Noise Affected Level	
Demolition	54	54	64	57 / 75	75
Site preparation & earthworks	54	54	64	57 / 75	75
Concrete foundation works	55	55	65	57 / 75	75
Building construction	51	51	61	57 / 75	75
Pipeline construction	53	53	63	57 / 75	75

The levels indicate full compliance with the identified construction noise limits and therefore the ICNG. Therefore no impacts at Stockton or Orica are expected as a result of construction noise.

Construction Vibration

Construction vibration was considered against the guideline for *Assessing Vibration: A Technical Guideline* (2006). Although the piling method is not finalised, piling provides the highest potential vibration source. As the nearest residential receptor is 900 m away and across a river, vibration risk is unlikely and has not been considered further. The nearest industrial neighbour (Orica) is 100-200 m from the Project. The ground between the Project and the Orica site is made up of loose sandy soils, so the transmission of vibration from piling would not be expected to cause annoyance or damage to structures.

Off-Site Construction Traffic Noise

Existing vehicular access to the Site is via Heron Road, however early in the construction phase a new vehicular access point would be established for the Site off Greenleaf Road. These roads connect to Cormorant Road, which, alongside Teal Street and Tourle Street, is the primary route connecting Kooragang Island with the wider Newcastle road network.

As Heron Road and Greenleaf Road are located in an industrialised area with no existing residences in close proximity, potential noise impacts associated with the Project have not been assessed.

All other route sections identified are classed as freeways/arterial/sub-arterial roads. As such, the relevant assessment time periods used for this assessment were daytime (15 hours, 07:00-22:00) and night-time (9 hours 22:00-07:00).

For the Project not to exceed acceptable noise limits for traffic, additional road traffic resulting from the Project should not increase the existing daytime/night-time traffic noise levels by more than 2dB(A).

The potential off-site traffic noise impact associated with the proposed construction of the Project has been assessed based on traffic volume predictions provided in **Chapter 15 Traffic & Transport** and shown in **Table 11-14**. Using the daily traffic profile from the Stockton Bridge count site, it was assumed that 89% of flow occurs during daytime hours with 11% at night-time for the area.

Table 11-14 Existing and Predicted AADT*s due to Construction

Road	2011	% HV	2014 background	% HV	2014 with construction	% HV
Tourle Street / Cormorant Road	29,588	10	31,930	10	32,250	10.2%
Industrial Drive	27,128	10	29,270	10	29,500	10.3%
Maitland Road / Old Pacific Highway	45,818	10	49,340	10	49,340	10.0%
New England Highway	48,818	10	52,570	10	52,570	10.0%
Golden Highway	3,997	10	4,300	10	4,300	10.0%
*AADT – Average Annual Daily Traffic						

As a result of these increases, noise levels for all vehicles, activities and timeframes are calculated to produce no more than a 2 dB increase and therefore comply.

11.5.2 Operational Phase

Operational Noise

Sound Pressure Levels (SPLs) and other data regarding the various noise sources for the Project were provided by IPL's engineering consultants, alongside information regarding potential attenuation measures, such as acoustic screening, and the coordinates for each noise source. This information was entered into the SoundPLAN model with the relevant metrological data and the results of the INSUL modelling, which examined the attenuation provided by various proposed on-site building envelopes. Maximum operating conditions were assumed with all sources operating constantly and simultaneously.

The predicted A-weighted noise levels are compared with the INP Evening/Night-time PSNL in **Table 11-10**, with results presented for the identified neutral and adverse meteorological conditions.

Table 11-15 Predicted Operational Noise Levels

Receptor Location	Predicted Noise Levels (L_{Aeq} dB(A))				Nominated Night-Time Criterion (L_{Aeq} dB(A))	Exceedance
	Neutral Met Conditions		Adverse Met Conditions			
	Day	Evening/Night	Day	Evening/Night		
R1	35	36	39	40	42	Nil
R2	37	37	41	41	42	Nil
R3	51	51	53	54	n/a	Nil
R4	52	52	55	55	n/a	Nil
Industrial (Lot) Boundary	54	54	57	57	70	Nil

The results of the modelling show that the operation of the Project would comply with the proposed noise criteria. This would be expected to be achieved under the identified neutral and adverse meteorological conditions based on the preliminary noise source definitions, proposed Site layout and identified building elements within the Site.

Assessment of Sleep Disturbance

The potential for sleep disturbance at Stockton would potentially be greatest during the early morning hours when background noise levels are at their lowest.

For the purpose of this assessment it has been assumed that the noise from the Project would be relatively steady and that the difference between L_{Aeq} and L_{max} (or L_{A1}) noise levels would not be greater than 10 dB. On this basis, the nominated sleep disturbance criteria of 40 dB L_{Aeq} and 55 dB L_{Amax} (or L_{A1}) (refer to **Table 11-7**) is not expected to be exceeded. Therefore, during operation, the Project is not predicted to give rise to sleep disturbance.

It is noted that the nominated PSNLs set out in **Table 11-10** are more onerous than the nominated L_{Aeq} sleep disturbance limit and therefore, where the PSNL is not exceeded at residential receptor locations, the L_{Aeq} sleep disturbance criterion would also be satisfied, and no additional noise control measures would be required.

Operation Traffic Noise

The potential off-site traffic noise impact associated with the operation of the Project has been assessed based on traffic volume predictions provided in **Chapter 15 Traffic & Transport** and shown in **Table 11-16**.

TGAN and ANSOL would be transported from the Site to the Hunter valley mines and the IPL facility at Warkworth via a number of roads as described in **Chapter 15 Traffic & Transport** and **Appendix J Transport Impact Assessment**.

Table 11-16 Existing and Predicted AADTs Due to Operation

Road	2015 background				2015 with operational activities			
	07:00-22:00	%HV	22:00-07:00	%HV	07:00-22:00	%HV	22:00-07:00	%HV
Tourle Street	29,121	10.00%	3,599	10.00%	29,351	10.49%	3,631	10.44%
Industrial Drive	26,700	10.00%	3,300	10.00%	26,930	10.53%	3,332	10.48%
Maitland Road / Old Pacific Highway	45,096	10.00%	5,574	10.00%	45,240	10.32%	5,590	10.29%
New England Highway	48,051	10.00%	5,939	10.00%	48,195	10.30%	5,955	10.27%
Golden Highway	3,934	10.00%	486	10.00%	4,078	13.53%	502	13.19%

Noise levels from heavy vehicles at night during operation have the potential to exceed a 2dB increase in noise levels if there numbers exceed 175 per night (22:00-07:00). The Project would not come close to exceeding this number of heavy vehicle movements during the night, therefore no significant adverse noise impacts are expected as a result of operational traffic noise.

11.6 Mitigation Measures

An assessment of the impacts related to the Project has indicated that no significant adverse noise impacts are expected as a result of either the construction phase or the operational phase. Consequently no specific mitigation measures are required for the Project.

In order to ensure a precautionary approach, a number of measures would be included as conditions of consent to manage any potential risks moving forward. Measures would include:

- Provision of a Noise Management Plan as part of the CEMP for the Project. This plan would outline:
  - the locations of noise sensitive receptors;
  - construction noise monitoring procedures; and
  - construction equipment maintenance to ensure good working order.
- Awareness training for staff and contractors in environmental noise issues including:
  - minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered;

  - avoiding any unnecessary noise when carrying out manual operations and when operating plant; and
  - switching off any equipment not in use for extended periods during construction work.
- Carrying out all noisy construction works during the standard daytime construction hours;
- Strategic siting of Project components to reduce noise emission to sensitive receptors, where practicable;
- Where noise level exceedances cannot be avoided, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents;
- Community consultation with local residents and building owners to assist in the alleviation of community concerns. Previous experience on similar projects has demonstrated that affected noise sensitive receptors may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels; and
- Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.

During operation periodic noise monitoring would be required to ensure that the EPL noise levels are being met.

11.7 Proposed Management and Mitigation Measures

The Project would operate 24 hours a day, therefore noise limits for operation would be particularly sensitive, especially during night time operation. In order to maintain a noise limit that would be acceptable to the surrounding sensitive acoustic receptors, the Project would adopt a noise limit of 42 dB (A) at R1 and R2. This PSNL is at least 9 dB below the predicted existing contribution from Orica, as set out in the Atkin’s report at all times and typically 16-17 dB below existing night-time ambient noise levels.

By operating at a level that is significantly under the current baseline, the Project is able to reduce the possibility of a cumulative impact as a result of the Project. Other mitigation measures to be implemented are summarised in **Table 11-17**.

Table 11-17 Management and Mitigation Measures – Noise

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Following detailed design, the Noise Model for the Project would be rerun to confirm the operational noise predictions for the Project and to ensure compliance with relevant limits.	✓		
The CEMP for the Project would include a Noise Management Plan (NMP). The NMP would outline: • The locations of noise sensitive receptors; • Construction noise monitoring procedures; and • Construction equipment maintenance to ensure good working order.		✓	

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Low-noise plant and equipment would be selected, where practicable, in order to minimise potential for noise and vibration. All equipment would be regularly checked to ensure that the mufflers and other noise reduction equipment are working correctly.		✓	
Equipment would be located to take advantage of the noise screening provided by existing site features and structures, such as embankments, storage sheds and/or boundary fences.		✓	
Community consultation with local residents would be undertaken to assist in the alleviation of community concerns. A complaints register would be maintained.		✓	
Any noise complaint(s) would be investigated immediately. Reasonable and feasible measures would need to be implemented to reduce noise impacts.		✓	
General construction activities would be confined to between 0700 - 1800 Monday to Friday and 0800 - 1300 Saturday. Construction work outside these hours would only take place if it was not audible at nearby residential receptors.		✓	
Construction work would be scheduled to minimise the multiple use of the noisiest equipment or plant items near noise sensitive receptors.	✓	✓	
Construction staff and contractors would undergo training in environmental noise issues including: • Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered; • Avoiding any unnecessary noise when carrying out manual operations and when operating plant; and • Switching off any equipment not in use for extended periods during construction work.		✓	
Should any unexpected construction activities occur which could potentially generate significant noise not described in this report, monitoring would be undertaken to ensure equipment noise emission levels do not deteriorate.		✓	
Where noise level exceedances cannot be avoided, consideration would be given to applying time restrictions and/or providing quiet periods for nearby residents.		✓	
Heavy vehicle movements at night (22:00 - 07:00) would be limited to 175 per night.		✓	✓
During operation a NMP would be produced as part of the OEMP for the Lot. This NMP would outline the monitoring programme for the Lot to ensure compliance with EPL limits.			✓

12 Soil and Ground Water

12.1 Introduction

This chapter assesses the potential for soil and groundwater impacts to occur during the construction and operation of the Project.

The DGRs required that the following be undertaken as part of the EIS:

- *"an assessment of the potential soil, groundwater and surface water impacts including impacts on Newcastle Harbour;*
- *an assessment of contaminated groundwater and soils, and acid sulphate soils, and proposed mitigation and management measures; and*
- *including groundwater dependant ecosystems, adjacent licenced water users, and basic landholder rights"*

To comply with the DGRs, JBS Environmental Pty Ltd (JBS) was engaged to undertake a Phase 2 Environmental Site Assessment (ESA) on areas within the Site most likely to be affected by the Project.

The ESA conducted by JBS included a soils and groundwater investigation. JBS were required to provide a description of the soils, geology and groundwater condition on the Site and draw conclusions regarding the suitability of the Site for the proposed commercial/industrial redevelopment.

The JBS assessment is provided in **Appendix G Environmental Site Assessment** and a summary is provided within this chapter. Other information has also been used to prepare this chapter including a Geotechnical Audit of the Site (Douglas Partners, 2012).

Surface water impacts are discussed in **Chapter 13 Surface Water and Wastewater.**

12.2 Assessment Methodology

The assessment of soils and groundwater involved the review and collation of available data sources pertaining to the ground conditions of the study area. This information was then used to complete the ESA. The ESA has in turn been reviewed in the context of the Project to evaluate the potential direct and indirect impacts associated with the proposed works.

A review was undertaken of historical documentation to identify potential areas of environmental concern and contaminants of potential concern (COPC) via:

- historical aerial photographs;
- EPA records;
- title details;
- Council records including planning certificates; and
- development applications and building approval records.

The ESA included the following:

- development of a sampling and analysis program;
- soil sampling and analysis;
- well installation;

- groundwater sampling and analysis; and
- a comparison of COPC concentrations in soils and groundwater to guidelines made or endorsed by the NSW OEH.

12.3 Existing Environment

12.3.1 Historic Land Use

The Site is located in an area that was originally an inter-tidal sandbar situated between a number of smaller islands in the Lower Hunter River. This sandbar and the surrounding islands were reclaimed from the harbour beginning in the late 1890s. This reclamation process involved the dredging of harbour sands onto the island, along with the deposition of industrial refuse. Although the reclamation process of the south-eastern corner of Kooragang Island began in the 1890s, the Site is located on a portion of Kooragang Island that was not reclaimed until the 1950s.

A review of historical information for the Lot identified the following potentially contaminating activities:

- the presence of widespread fill across the Site, several metres in depth, that is likely to comprise sediment dredged from the nearby Hunter River; and
- use of the Lot as part of a fertiliser manufacturing operation for several decades, which has included outdoor stockpiling of raw materials and manufactured products. This may have included chemical, fuel and/or liquid waste storage.

Further to this, an Orica owned chemical manufacturing facility is located to the south of the Lot. The Orica site has been declared by the NSW EPA as a remediation site under the Contaminated Land Management Act 1997 due to significant arsenic and nutrient contamination of groundwater. The contamination on the Orica site is currently being managed under an EPA Approved Voluntary Management Proposal.

A summary of the Lot history is provided in **Table 12-1.**

Table 12-1 Summary of Historical Lot Use Information

Period	Activity	Source
Pre 1954	Unknown.	-
1954	The Lot was owned by the Minister of Public affairs.	Title Documentation
1954	The Lot is vacant.	Aerial Photograph (1954)
1965	The Lot appears to have begun or in the process of construction of the current plant.	Aerial Photograph (1965)
1974	The Lot appeared to be used for industrial use.	Aerial Photograph (1974)
1983	The Lot appeared to be used for manufacturing.	Aerial Photograph (1983)
1986	The Lot was transferred by Australian Fertilizers.	Title Documentation
1990	The Lot appeared to be used for manufacturing.	Aerial Photograph (1990)
1991	The Lot was transferred by Greenleaf Pty Ltd.	Title Documentation
1992	The Lot was purchased by Incitec Limited , a subsidiary of ICI Australia Pty Ltd.	Title Documentation
2001	The Lot appeared to be used for manufacturing.	Aerial Photograph (2001)
2003	The site became part of the IPL Group in 2003 with the acquisition by IPL of Incitec Fertilizers Limited.	
2006	The Lot was transferred by TOP Australia Ltd, a wholly owned subsidiary of IPL.	Title Documentation

The Section 149 Certificate obtained from Newcastle City Council indicates that the Lot may be affected by land contamination.

12.3.2 Topography

A review of the Land and Property Management Authority topographic map indicated that the Site is situated at an elevation of less than 5 m above Australian Height Datum (AHD). The topography of the Site is generally even and level with the surrounding properties.

12.3.3 Geology

The Newcastle 1:250,000 Geological Series Sheet (SI 56-2) indicates that the geology of the area is predominantly comprised of Quaternary aged gravels, sands, silts and clays. These recent fluvial deposits extend to depths of up to 90 m, below which is Permian aged sandstone bedrock.

12.3.4 Soils and Acid Sulfate Soils

Soils on the Site comprise a combination of fill and sandy/clay materials. The topsoil contains imported dredged silty/sandy topsoil to approximately 4 m below ground surface (bgs). This material was brought to the Lot as fill material during the reclamation of Kooragang Island and consists of predominantly dredged alluvial sediment, typically comprising light brown silty sands and shell fragments. Underlying this fill material are clayey silts and sand sediments. The clayey silts (estuarine clays) occur in discrete bands below the fill material, between 2-4 m bgs. Below the clayey silts are sand sediments (alluvial) which generally become denser with depth. Phosphogypsum[1] was also found in isolated patches within the soil profile.

Sandstone/siltstone rock underlies these layers and varies from a depth of 13 m in the northern part of Kooragang Island to between 45 m and 90 m in the south.

Geotechnical investigations from 2006 concluded that the Site is suitable for continued use as an industrial site, provided any heavy loads or settlement sensitive structures are supported on piles founded in the dense sand below the clays and loose sand layers.

The Acid Sulfate Soil (ASS) Risk Map (NSW Natural Resource Atlas website, 2011) indicates that the Site is located within an area that has a "*…low probability of occurrence"* of acid sulfate soils. Investigations at the Site have found some limited ASS conditions (in 2 of 54 test pit locations) and acid soil conditions (in 3 of 54 test pit locations).

12.3.5 Groundwater

There are a number of groundwater monitoring bores present on the Lot. Records at these bores show groundwater is present between 1.2 and 2.7 m bgs across the Lot. The water table is slightly higher on the western part of the Lot.

As the Lot is located in close proximity to the Hunter River there is a likelihood of saline influence in the shallow aquifer underlying the Site. However, results from the ESA indicate that any such saline influence is limited.

Surface water sampling of the Hunter River completed as part of investigations in 2003 indicated that contamination on the Orica site was not significantly impacting on water quality or sediment in the River.

[1] Phosphogypsum refers to the gypsum formed as a by-product of processing phosphate ore into fertilizer (Source: Wikipedia http://en.wikipedia.org/wiki/Phosphogypsum. Accessed on 28 March 2012)

Geotechnical investigations from 2006 noted that the shallow aquifer in the sand layer on the Site was above any tidal influence; however this water table was influenced by rainfall. Another deeper semi confined water table exists in the sands beneath the clay layer and is partly influenced by tidal levels. The water in this lower aquifer is saline. The two aquifers are partially connected due to penetrations through the clay layer.

Based on the elevation of groundwater within each of the thirteen wells gauged, the direction of groundwater flow was inferred to be in two directions, to the south west and north east, with mounding occurring at the centre of the Lot.

The groundwater at the Site is classified as brackish and is considered unsuitable for human consumption due to previous and current industrial practices on Kooragang Island.

12.3.6 Contamination

A review of historical information for the Lot identified the following activities, dating from before IPL took control of the Lot, which may give rise to contamination:

- the presence of widespread fill across the Lot, several metres in depth, that is likely to comprise sediment dredged from the nearby Hunter River; and
- use of the Lot as part of a fertiliser manufacturing operation for several decades, which included outdoor stockpiling of raw materials and manufactured goods (i.e. chemicals such as phosphate ore, sulphur, phosphogypsum stockpiles, fuel and/or liquid waste storage).

The potential contaminants of concern identified for investigation included heavy metals, Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Organochlorine pesticides (OCPs), Polychlorinated biphenyls (PCBs), asbestos and nutrients. The following outlines the results from soil and groundwater testing within the Lot:

- there were no visible fragments of asbestos containing materials (ACM) observed on the ground surface or in the subsurface fill material;
- observations of potential chemical contamination (e.g. staining, odours) were observed in four test pits;
- the concentration of TPH C_{10} – C_{36} was reported above the adopted Health-based Investigation Levels for commercial/industrial land use (HIL-F) in one sample collected from the surface fill material. The concentrations of TPH C10 – C36 in all other samples analysed were below the Limit of Reporting (LOR) and therefore below the adopted commercial/industrial criteria;
- concentrations of remaining contaminants of potential concern (COPCs) in soil were below adopted commercial/industrial criteria (HIL-F) and as such potential contaminants in soil at the Site do not appear to represent potential human health risk during future commercial/industrial development at the Site; and
- ammonia (and associated nitrogen) concentrations in half of all groundwater samples analysed exceeded adopted guideline for protection of aquatic ecosystems. The reported ammonia concentrations indicate that, while elevated values are present in the centre of the Lot, the concentrations down gradient of the centre are low, generally below or close to the adopted assessment criteria. As such it is considered that the ammonia concentrations reported within the defined Lot boundaries do not pose an unacceptable risk to down gradient receptors, i.e. the Hunter River.

Based on the findings of the ESA, the Site is suitable for commercial/industrial use without remediation of either soils or groundwater (refer to **Appendix G Environmental Site Assessment)**.

12.4 Impact Assessment

This following section discusses the likely construction and operational soil and groundwater impacts associated with the Project.

12.4.1 Construction Impacts

Soils

Details of the Project and its proposed construction methodology are provided in **Chapter 4 Project Description** and **Chapter 5 Construction**. A number of actions during construction could affect the soils on the Site. These include excavation, piling, movement and stockpiling of soils, vehicle movements and use of chemicals. As described in **Section 12.3**, the ESA indicated that some contaminated soil would be encountered when undertaking intrusive works. Therefore the following impacts could be associated with construction phase:

- contaminated soil may be encountered on the Site during excavation activities and piling;
- odours may be generated during the disturbance of any potentially contaminated soils;
- stockpiles generated as a result of any excavation works have the potential to cause ground and surface water contamination;
- potential acid sulphate soils (PASS) and acid soils may be encountered during construction;
- dust may be generated during excavation activities and from stockpiles;
- contaminated soil materials may be used for backfilling and/or grading;
- any spills and leaks from construction equipment would have the potential to contaminate soil; and
- vehicle movements may results in contaminated materials being dispersed around the Site and potentially offsite.

Measures to avoid or mitigate these potential impacts and risks are outlined in **Section 12.5**. However, the ESA concludes that the limited contamination in the soils is unlikely to affect human health. Therefore the ESA concludes that no specific measures to protect construction workers during construction are required.

Groundwater

Construction activities with the potential to intersect groundwater involve excavation and piling associated with construction of footings. The potential adverse groundwater impacts from excavation and piling would include:

- the interception of potentially contaminated groundwater during excavation;
- generation of waste water requiring disposal and the treatment and disposal of contaminated groundwater; and
- contamination of existing groundwater aquifers through the mobilisation of *in situ* contamination or by associated construction work.

Dewatering may also be required to allow construction to proceed safely by limiting the potential for excavation instability (either through wall collapse or floor heave) and preventing waterlogged ground conditions. If dewatering is required, this action may result in the removal of contaminated groundwater. As identified within the ESA, the ammonia levels in the groundwater would be the main contaminant of concern. Contaminated groundwater that is not properly handled, stored or treated, could potentially cause pollution on other parts of the Lot or nearby environmental receptors (e.g. the Hunter River if it entered the stormwater system).

A number of proposed structures would be piled to a depth of between 16 m and 18 m. The method of piling proposed for the Project is either continuous flight auger (CFA) or percussive piling. The piling will pierce the shallow aquifer and is likely to pierce the lower aquifer beneath the clay layer. Existing penetrations through the clay layer mean that these two aquifers are already partially connected. Any additional piling activity during construction of the Project is unlikely to significantly impact the quality or flow of either aquifer.

The potential human receptors of contaminated groundwater from the trenching works include workers conducting sub-surface excavations at the Site who may come into direct contact with or ingest contaminated soil or groundwater, or inhale hydrocarbon vapours during earthworks. However, these health risks associated with exposure to contaminated groundwater during the dewatering of excavation works would be minimised through implementing appropriate health and safety training and instituting suitable handling protocols for minimising human contact.

The ESA raised the issue that '*the saturated subsurface soils with high hydraulic conductivities mean that if extraction of groundwater occurs on the Site, potentially contaminated groundwater underlying the south of the island (e.g. Orica) could be mobilised*'. This could potentially result in the contaminated (arsenic) plume from the Orica site being drawn from the south west corner of the Lot to the centre. This potential impact would depend on the:

- groundwater elevation in different parts of the Lot;
- groundwater flow across the Lot;
- amount of water being extracted during construction; and
- distance between the dewatering activity and the plume.

In 2008, Orica issued an Environmental Management Plan (EMP)[2] regarding an arsenic plume originating from its site. This EMP included mapping of the plume and noted that the groundwater monitoring that had been completed enabled the plume to be readily delineated. Figure 2 of the EMP shows the location of the groundwater plume and the affected areas where certain precautions should be taken during construction. It should be noted that the EMP also states that these considerations would generally only be required when excavating below the groundwater table.

However, no construction works are expected to impact directly on the soil or groundwater that contains the Orica arsenic plume. A new pipe would connect the Ammonia unloading arm at the NPC berths with the proposed ammonia tank for the Project. The proposed location of this pipe runs over the area affected by the plume. However, it is intended that the pipeline would utilise the existing gantry foundations along the south of the Site. Therefore, no works that would involve ground excavation or impacts to the groundwater are expected to take place in the plume-affected area.

[2] Located on the World Wide Web at: http://www.oricaki.com.au/files/EMP_Final_Rev1_200308_.pdf

Nevertheless, care would be taken during the pipe construction works above the affected groundwater area to ensure that these activities do not indirectly increase the mobility of the Orica arsenic plume. The EMP notes that actions that could impact either groundwater pH or groundwater redox potential should be minimised or avoided. As noted above, measures to regularly check construction equipment for hydrocarbon and other leaks would be employed. This measure would help ensure that any impact on groundwater redox potential is minimised. Equally, to ensure that the arsenic plume is not affected during construction, no liquids or soils would be stored overnight within 100 m of arsenic plume affected areas (as delineated by Figure 2 in the Orica EMP (2008)).

With regards to dewatering activities related to construction potentially moving the Orica arsenic plume, it is considered that provided certain measures are implemented, the low risk of the plume being moved can be successfully managed. Key amongst these measures would be to monitor the groundwater during construction. Monitoring wells are already present in a number of locations to the south of the Lot between the plume and where dewatering may take place during construction. These wells would be fitted with data loggers to monitor any change in the direction or chemistry of the groundwater as construction progressed.

The proposed structures would either be piled and would sit on a concrete slab or require small footings or foundations. It is likely that some excavation would be required; however certain structures would require no dewatering, whereas others would require only minor dewatering. The Orica EMP notes that '*if large scale of prolonged dewatering is to be undertaken, consideration should be given to the effect on the mitigation of contaminated groundwater*'. Large scale and prolonged dewatering activities are not expected as part of the construction works. Nevertheless, where minor dewatering works are required, any potential change in groundwater gradient would be managed by locally recharging the aquifer with appropriate dewatered groundwater. As discussed below, dewatered groundwater would be tested, and would only be re-injected if its quality was the same or better than the existing groundwater. Locally recharging the aquifer would maintain a localised cone of depression in the groundwater sufficient to complete any foundation works, without affecting the overall groundwater gradients which might result in plume movement.

Recommendations

Section 12.5 outlines the proposed management measures to limit the potential impact of construction activities upon soil and groundwater quality on the Site. These measures would be incorporated into a CEMP. The CEMP would consider safety and construction requirements appropriate for the soil and groundwater conditions at the Site, including ASS/PASS.

12.4.2 Operational Impacts

During operation of the proposed Project two factors could potentially affect soil and groundwater. The first would involve a loss of containment from part of the Project. The second would involve mismanagement and pollution of stormwater run-off. A loss of containment could involve a burst pipe, leaking valve or a spill of some kind. Mismanagement of stormwater run-off could lead to contaminated stormwater entering parts of the Lot that are considered clean and infiltrating the soil and contaminating the groundwater. Measures to mitigate and avoid these impacts are discussed in **Section 12.5**.

12.5 Mitigation Measures

12.5.1 Construction Phase

In order to mitigate any adverse impacts or contamination risks the following mitigation measures would be implemented.

Soil Management

- A Contamination Management Plan would form part of the Construction Environmental Management Plan (CEMP) for the Project. This plan would outline measures for testing, handling, storing and managing contaminated soils and contaminated groundwater.
- A Soils and Erosion Management Plan would form part of the CEMP for the Project. This plan would outline management measures for any soils that are excavated or stored onsite during the construction works. It would identify:
  - the areas where soil disturbance is likely;
  - soil testing procedures;
  - soil handling procedures;
  - locations where soil would be stockpiled onsite for either removal, treatment or reuse;
  - procedures to reduce erosion and the spread of dust; and
  - the rehabilitation of bare soil following completion of the construction works.
- All materials would be stockpiled in accordance with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004). Principal controls would include the following:
  - silt fences would be installed around stockpiles to reduce erosion as necessary;
  - stockpiles would be covered and wetted down in order to reduce dust creation; and
  - stockpiles would not be located in close proximity to any stormwater drainage systems.
- Soils would be tested for both for contaminants and odour using standard practices (e.g. soil vapour and soil, leachate and water sampling).
- Clean materials would be separated from contaminated materials for reuse as backfill where required.
- Suspected contaminated materials would then be classified in accordance with *NSW (2009) Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and either stored on the Site or disposed of in a timely manner.
- The method of disposal would be in line with the materials' classification in accordance with specifications set out in a Waste Management Plan (WMP). This would include disposal of any contaminated materials to appropriately licensed facilities in accordance with the above classification guidance and the *Contaminated Land Management Act 1997.* Disposal of any contaminated soils would be in accordance with *NSW DECCW's Waste Classification Guidelines.*

Acid Sulphate Soils (ASS)

An ASS Management Plan would be prepared in accordance with the ASS Manual (ASS Management Advisory Committee 1998) if ASSs were encountered during the construction phase of the Project. This ASS management plan would include developing management and disposal options for acid sulphate soils and, if necessary, monitoring any surface water discharges to the Hunter River from the Site to ensure any stormwater discharge has not been affected.

Prevention of impacts to groundwater

It is likely that groundwater would be encountered during construction due to the presence of a shallow aquifer across the Site. As discussed in **Section 12.4.1,** dewatering activities are likely to be required. Therefore the following management strategies would be employed:

- A Groundwater Management Plan (GWMP) would be developed and included within the CEMP. This plan would outline the measures that would be used to manage the discovery, testing, dewatering, storage, movement and treatment of any groundwater during the construction phase.
- The GWMP would recommend measures to prevent the infiltration of contaminated run off to groundwater due to construction activities. Measures would include:
  - the use of appropriate drip trays and interception techniques for any liquids stored on the Site;
  - regular inspection of construction equipment to ensure any hydrocarbon or other leaks are minimised and rectified;
  - management of vehicles leaving the Site to reduce soil on roads, production of dust and the introduction of contamination to the groundwater and/or stormwater system;
  - appropriate and timely disposal of any contaminated soil, water or waste generated during construction;
  - regular inspection of erosion control structures and bunded areas; and
  - regular inspection and testing of containment areas, drainage lines and process pipe work.
- Dewatering works, where required, would be licensed in line with the requirements of the Water Act 1912and carried out by suitably trained personnel.
- Groundwater removed by dewatering, and any runoff that may accumulate in excavations, would be periodically tested for elevated levels of contamination. Groundwater that is found to have elevated levels of contaminants, and cannot be either recharged into the groundwater or discharged via the stormwater system without impacting agreed EPA limits, would be stored and classified onsite before being transported offsite by a licenced contractor for appropriate treatment and disposal. Groundwater that is used for aquifer recharge would have to be the same or better than the quality of the existing groundwater in that part of the Site.
- Disposal of any contaminated groundwater would be in accordance with NSW OEH's *Waste Classification Guidelines* (DECCW, 2009).

12.5.2 Operational Phase

Two potential issues were identified that could result in impacts on soils and/or groundwater during operations on the Site. The measures that would be implemented to mitigate or avoid these impacts are outlined below.

Loss of Containment

To avoid a loss of containment, all of the Project components would be closely monitored and subjected to:

- regular inspection and maintenance of equipment, pipes, tanks and protective bunding to minimise the risk of leaks; and
- expedited repair or replacement of any Project components that are found to be faulty to ensure public safety, EPA licence compliance and to maintain high levels of system reliability.

In addition, chemical storages and processing areas have secondary containment measure such as sealed concrete bunds. These areas also follow guidelines in *Environmental Compliance Report Liquid Chemical Storage, Handling and Spill Management, Part B - Review of Best Practice and Regulation* (DEC 2005)

This work would fall within the inspection, assessment, maintenance and repair programmes that would be implemented as part of the operation of the Project. These safeguards would also be incorporated into an Operational Environmental Management Plan (OEMP), which would be developed for the operational phase of the Project. The Project would be appropriately licenced under the *Protection of the Environment Operations Act 1997* and would be managed within EPA licence limits.

Management of Stormwater

A number of measures have been incorporated into the design of the Project to ensure that contaminated stormwater does not enter parts of the Lot considered to be ‘clean’. The Project has been designed so that the stormwater on the Site can be collected into three systems.

1. Contaminated Stormwater - New plant areas which could make significant contribution to stormwater pollutant levels if not controlled (e.g. process areas, product loading areas, areas vulnerable to spills and floors of some plant and chemical storage areas) would be completely contained and designed to hold at least a one in 10 year rainfall event. All stormwater in these areas would be either recycled or managed in the effluent system. These areas would be roofed where possible.
2. First Flush Stormwater - Stormwater run-off from new plant areas where process materials could be present and moderate surface contamination is possible (i.e. such as roadways near bulk AN loadout) would be diverted to a first flush collection system. A first flush retention pond would capture the first 10 mm of rainfall from the potentially contaminated external paved areas. The water collected within the first flush pond would be tested and, if contaminated, would be pumped to the wastewater tanks for treatment and discharge through the plant wastewater system. If the water in the pond were clean, it would be pumped into the cooling water tower basin or stormwater drainage system.
3. Clean Stormwater - New plant areas which are considered to be ‘clean’ and unlikely to be contaminated with process materials include back roads, roofed areas, certain hard stand areas and grassed areas. These areas would be physically separated from potentially contaminated areas by bunding up to a height of 150-200mm, interception drains, grading etc. Runoff from these areas would be collected in a new stormwater drainage system which would flow to the east before discharging into existing stormwater outfalls into the Hunter River North Arm.

Provided the stormwater run-off is managed in line with the approach outlined above, and the stormwater system is well maintained, it is considered unlikely that the Project would cause any further adverse impacts on soils or groundwater. Further information regarding stormwater management is provided in **Chapter 13 Surface Water and Wastewater**.

12.6 Proposed Management and Mitigation Measures

Provided the mitigation measures listed above are implemented during construction and operation the likelihood of the Project resulting in a significant adverse impact on soil and groundwater conditions is unlikely. Provided the mitigation measures within this EA are followed no residual effects are expected.

Adherence to mitigation measures outlined in **Section 12.5** and **Table 12-2** would ensure that no significant impacts on soil and groundwater conditions are likely as a result of the Project. These measures would be included within the CEMP or OEMP for the Project.

Table 12-2 outlines the measures that would be put in place to ensure no adverse impact.

Table 12-2 Management and Mitigation Measures – Soil and Groundwater

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Soils and Erosion Management Plan would be developed as part of the CEMP to manage the excavation, testing, stockpiling, reuse and rehabilitation of soils. This plan would outline: • the areas where soil disturbance is likely; • soil testing procedures; • soil handling procedures; • locations where soil would be stockpiled onsite for either removal, treatment or reuse; • procedures to reduce erosion and the spread of dust; and • the rehabilitation of bare soil following completion of the construction works.		✓	
All materials would be stockpiled in accordance with 'The Blue Book' Managing Urban Stormwater – Soils and Construction Volume 1 and 2 (Landcom, 2004). Principal controls would include the following: • silt fences would be installed around stockpiles to reduce erosion as necessary; • stockpiles would be covered and wetted down in order to reduce dust creation; and • stockpiles would not be located in close proximity to any stormwater drainage systems.		✓	
Excavated soils would be tested for both for contaminants and odour using standard practices (e.g. soil vapour and soil, leachate and water sampling etc.)		✓	
Clean materials would be separated from contaminated materials for reuse as backfill where required.		✓	
A Contamination Management Plan would form part of the CEMP for the Project. This plan would outline measures for testing, handling, storing and managing contaminated soils and contaminated groundwater.		✓	
Suspected contaminated materials would be classified in accordance with NSW (2009) *Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and disposed by a licenced contractor.		✓	
Disposal of any contaminated soils or groundwater would be in accordance with NSW DECCW's *Waste Classification Guidelines* and the Contamination Management Plan (CMP) for the Project. Contaminated materials would be sent to appropriately licensed facilities in accordance with the *Contaminated Land Management Act 1997*.		✓	
If Acid Sulfate Soils (ASS) are encountered during construction, an ASS Management Plan would be prepared in accordance with the ASS Manual (ASS Management Advisory Committee 1998).		✓	

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Groundwater Management Plan (GWMP) would be developed and included within the CEMP. This plan would outline the measures that would be used to manage the discovery, testing, dewatering, storage, movement and treatment of any groundwater during the construction phase. Measures would include: • the use of appropriate drip trays and interception techniques for any liquids stored on the Site; • regular inspection of construction equipment to ensure any hydrocarbon or other leaks are minimised and rectified; • management of vehicles leaving the Site to reduce soil on roads, production of dust and the introduction of contamination to the groundwater and/or stormwater system; • appropriate and timely disposal of any contaminated spoil, water or waste generated during construction; • regular inspection of erosion control structures and bunded areas; and • regular inspection and testing of containment areas and drainage lines.		✓	
Aquifer interference approval under the 1912 Water Act would be sought prior to construction starting.	✓		
Dewatering works would be appropriately licensed, and carried out by suitably trained personnel.		✓	
Groundwater removed by dewatering, and any runoff that may accumulate in excavations, would be periodically tested for elevated levels of contamination.		✓	
Groundwater that is found to have elevated levels of contaminants, and cannot be either recharged into the groundwater or discharged via the stormwater system without impacting agreed EPA limits, would be treated on-site or stored and classified onsite before being transported offsite by a licenced contractor for appropriate treatment and disposal. Groundwater that is used for aquifer recharge would have to be the same or better than the quality of the existing groundwater in that part of the Site.		✓	
No liquids or soils would be stored overnight within 100 m of arsenic plume affected area (as delineated by Figure 2 in the Orica EMP (2008)).		✓	
Relevant monitoring wells would be fitted with data loggers to monitor any change in the direction or chemistry of the groundwater as construction progressed. This monitoring would be focused on the Orica arsenic plume.		✓	
Where minor dewatering works are required, any potential change in groundwater gradient would be managed by locally recharging the aquifer with appropriate dewatered groundwater.		✓	
Construction workers would be instructed in appropriate health and safety and handling protocols for minimising human contact with contaminated soils and groundwater.		✓	
Stormwater runoff would be separated into wastewater, first flush and clean streams during operation to minimise contamination of soils, groundwater and surface water receptors. Stormwater considered to be contaminated would be retained and treated as required.	✓		✓
Appropriate inspection, assessment, maintenance and repair programmes would be presented within the Operational Environmental Management Plan (OEMP) to reduce the likelihood for leaks or a loss of containment from the Project.			✓

13 Surface Water & Wastewater

13.1 Introduction

The DGRs request that the surface water and waste water assessment include the following:

- *"an assessment of the potential soil, groundwater and surface water impacts including impacts on Newcastle Harbour;*
- *water supply including options for reuse of process water;*
- *proposed erosion and sediment controls (during construction);*
- *proposed stormwater management system (during operation);*
- *potential impacts of flooding, with consideration of climate change and projected sea level rises;"*

Soil and ground water impacts are discussed in **Chapter 12 Soil and Groundwater.**

This chapter considers those issues and discusses the findings of a number of technical studies including:

- A review of current and future flooding potential of the Site based on recent hydraulic modelling and floodplain management studies completed on behalf of the City of Newcastle by BMT WBM (City of Newcastle, 2009). Details of this study and additional work to assess the impacts of flooding on the Site have been assessed by URS.
- A review of the existing stormwater system and runoff quantity and quality on the Site, including the required storage capacity to ensure no significant change in peak stormwater runoff rates as a result of the Project. This report was completed by URS.
- A review of water supply and waste water for the Project completed by URS.
- A review of the potential issues associated with the discharge of Project wastewater to the Hunter River on the existing water quality in that receiving environment and the selection of an appropriate discharge location. The assessment is based on a technical study by Water Research Laboratory (WRL) from the University of NSW, which built on more detailed hydrodynamic modelling and data collation for the area.

Each of these studies is compiled into a single volume and presented as **Appendix H Water Management Report**.

13.2 Assessment Methodology

This chapter and the assessments within **Appendix H Water Management Report** have been based on a number of data sources. These included:

- publicly available Catchment Management Authority (CMA) and NSW Government information;
- water quality data for the Hunter Estuary, primarily from Sanderson and Redden (2001);
- topographical information for the Site;
- local rainfall Intensity Frequency Duration (IFD) data from the Australian Bureau of Meteorology;
- Stormwater Audit and Conceptual Site Model Report for the Site (JBS, 2005);
- current stormwater management plan and stormwater runoff monitoring records for the Site;

- public works drainage plans for Kooragang Island;
- aerial and satellite imagery;
- project specific design information supplied by Técnicas Reunidas; and
- flood risk information from NCC.

A Principal Hydrologist from URS conducted a walkover of the Site on 10 February 2012. The Site walkover was conducted on a cloudy day following a period of heavy rain. This helped URS to understand the effectiveness of the existing stormwater systems and the permeability of the Site.

This primary and secondary information was used to understand and characterise the existing surface water, flooding and waste water baseline for the Site. This included identifying the surface water catchments, drainage systems, rainfall levels, flood risk areas and the characteristics and sensitivities of surface water receptors (i.e. the Hunter River and Newcastle Harbour).

Certain baseline information along with Project specific data (e.g. impermeable areas, wastewater quantity and quality, stormwater design etc.) was modelled using computer software. This modelling was completed to enable the Proponent to:

- estimate the capacity of the drainage network on the Site. The model DRAINS was used to perform design and analysis calculations for the local urban stormwater drainage systems; and
- understand the potential impacts that the discharge from the Project would have on the Hunter River and Newcastle Harbour. This work was completed by WRL and involved the use of in-house models specific to the lower Hunter estuary alongside other models including VISJET and JETLAG.

To assess the impacts of the Project, the following legislation, guidance and standards were used:

- the statutory planning framework and appropriate legislative context (refer to **Chapter 6 Legislation and Planning Policy**);
- flood modelling standards outlined in Australian Rainfall and Runoff (IEAust, 1997);
- stormwater guidelines for NSW and the City of Newcastle (refer to **Appendix H Water Management Report**);
- the National Water Quality Management Standards and Guidelines including the requirement to maintain or improve the water quality of the Hunter River; and
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, ANZECC 2000.

The design has been developed to fall within accepted water quality and stormwater standards.

Additional water quality sampling and hydrodynamic modelling is currently being completed to validate the Sanderson and Redden (2001) dataset and to confirm the modelling results. This work is ongoing and will be reported whist responding to submissions following the exhibition period.

13.3 Existing Environment

13.3.1 The Local Catchment

The Site is located on generally flat reclaimed land formed from a combination of fill and sandy/clay materials. Whilst mainly flat, the Site topography exhibits a low central ridge running north to south which directs water in either an easterly or westerly direction. The western part of the Site is more developed and contains an existing storage and bagging operation. The western part of the Site contains large areas of roofed structures and impermeable surfaces (e.g. roads). The eastern part of the Site is largely undeveloped and the soils are permeable. No substantive water catchment contributes to runoff on the Site and there are no defined waterways. An existing stormwater management system manages stormwater runoff on the developed part of the Site, whereas the rain falling on permeable surfaces is likely to infiltrate rather than run off.

13.3.2 Existing Stormwater Systems

Stormwater runoff is generated during rainfall events from roofs, paved areas and unpaved areas. Newcastle has an annual average rainfall of approximately 1200 mm and annual evapotranspiration of approximately 800 mm, with the majority of rainfall occurring during the summer and autumn months (January – May) (JBS, 2005).

Effectively, all of the rainfall that falls on the built and paved parts of the Site is directed to the existing stormwater management system. This stormwater is directed to one of three subsurface pipes known as Points 1, 2 and 7 (JBS, 2005) which represent the north, south and central drains. These all exit the Site at the western boundary. These pipes are 600 mm in diameter as they pass under the Site boundary and link with the stormwater drains that service Heron Road and the NPC managed land. These stormwater drains are between 600 mm and 750 mm in diameter and discharge into the south arm of the Hunter River.

The only collected surface water which does not exit the Site via one of these three drains is that which is collected from near the existing weighbridges to the east of Shed 3 (refer to **Figure 3-1**). It is understood that this water is diverted to infiltration pits to the south east of the weighbridge.

The existing stormwater management system on the Site reflects the design standards of the 1960s. It does not provide for reuse, detention storage, first flush or other systems.

The permeability of the sandy soils across the Site means that rain that falls on unpaved parts area infiltrates into the subsurface. Occasionally areas of standing water do form, but only for very short periods of time. Any runoff to the west that did not infiltrate would be captured by the existing stormwater system on the western part of the Site. Any run off to the undeveloped eastern part of the Site would either pond and infiltrate near an embankment running parallel to Greenleaf Road, or be diverted to Greenleaf Road in the northeast and southeast. Greenleaf Road and the NPC managed land to the east of the Site is serviced by a number of stormwater drains between 450 mm and 1,200 mm in diameter. These drains discharge into the north arm of the Hunter River at various locations.

The topography of the Site and knowledge of the existing stormwater systems allowed the Site to be divided into a number of catchments. **Figure 13-1** below shows the location of these catchments (labelled A – G). The main Project components occupy an area that falls mainly inside catchments B, D, E and F.

Areas adjacent to the Site (e.g. Heron Road and Greenleaf Road) that also contribute runoff to the local stormwater system were also considered (labelled A_{DS} – D_{DS}). The permeable and impermeable parts of each catchment were identified to understand the amount of land that contributed to stormwater runoff.

Concept level hydraulic modelling was completed for the existing drainage system to assess current design capacities. The modelling results suggested that the drainage off areas B, D, E and F readily carries stormwater flows associated with a 10 - 20 year Average Recurrence Intervals (ARI) flood. However, areas A and C were found to only have a 5 year ARI design flow capacity. Anecdotal evidence from the Site suggests that the drainage appears to operate more effectively than a 5 year ARI standard suggesting that more water infiltrated than modelled and a more detailed survey of the drains is required prior to detailed design.

Further modelling looked at the effect of potential sea level rise on the operability of the stormwater system. The conclusions of this work indicated that the outfall drains for all catchments will reduce to less than 1 year ARI level of service by 2100 due to climate change induced sea level rise. The implications of this sea level rise will ultimately require the whole of the Kooragang Island drainage network to be redesigned.

Figure 13-1 Estimated Existing Site Stormwater Catchments

13.3.3 Stormwater Generation and Quality

Runoff is generated from a range of land uses on the Site. Areas A and C are existing plant and material handling areas that can potentially generate increased levels of particulate matter and nutrients (e.g. sand, AN and fertiliser, etc.) from material handling, wind drift, spills, and vehicle tracking); or other contaminants (e.g. acid spills, oils or fuel spills and vehicle washdown). Bunding is in place to capture spills and washdown. The stormwater outfalls from the Site are fitted with isolation valves.

Part of Area E has been used for phosphate storage and has been remediated. Areas B, D and F are largely grassed areas where significant infiltration occurs due to sandy soils. These areas are also thought to be a potential source of wind-blown particulates across the Site.

The EPL for the Site requires that grab samples of stormwater are taken from the three existing western stormwater outfalls (i.e. 1, 2 and 7) following a rainfall event. As the samples collected are grab samples within the first 10mm of any storm-event, the measured quality is effectively more representative of the first flush storm water quality (designated as the first 10mm of a storm-event), rather than of the overall stormwater load. The monitoring data for the stormwater currently discharging from the existing site, for the period May 2009 until December 2011, is summarised in **Table 13-1**.

Table 13-1 Summary of Stormwater Quality Monitoring

	Concentrations								
	EPL 1			EPL 2			EPL 7		
Parameter	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
Total Nitrogen (as N) (mg/L)	488	8.8	97	383	2.3	55	746	5.2	99
Phosphate (mg/L)	760	7.4	145	488	8.3	100	342	14.0	104
pH (pH units)	7.8	5.9	6.44	7.3	2.9	5.81	8.8	2.6	6.10
Zinc (mg/L)	3.69	0.12	0.85	3.0	0.071	0.64	2.94	0.22	0.96
Total Suspended Solids (mg/L)	680	14	136	1126	7	176	498	14	122

Stormwater quality from the existing Site is in the process of being improved under a Pollution Reduction Plan to reduce the runoff of nutrients and suspended solids. Some of the improvements at the Site include removal of stockpiles no longer in use, cleaning of drains, more regular street sweeping, improved work practices including management of spills, and further isolation of significant contamination sources. A recent audit of drains indicated significant sediment build-up probably reflecting work practices on the Site over a long period. The current quality of the stormwater is likely to be adversely impacted by the sedimentation from historical operations therefore existing data is unlikely to be wholly representative of first-flush runoff from current operations.

13.3.4 Existing Flood Risks

The Newcastle Flood Planning Stage 1 Study (NCC, 2009) completed hydraulic modelling of tidal, riverine and surface water/flash flooding of the NCC local government area (LGA) including Kooragang Island. This study adopted the criteria shown in **Table 13-2** in order to understand how different land is affected by flooding. This approach is consistent with the Floodplain Development Manual (DIPNR, 2005) and NCC's Flood Policy and Development Control Plan.

Table 13-2 Flood Impact Categories and Definitions (NCC, 2009)

Flood Impact Category	DECC Criteria	Definition
Floodway	Velocity*Depth >1.0 m^2/s	Areas and flow paths where a significant proportion of flood waters are conveyed.
Flood Storage	Velocity*Depth <1.0 m^2/s Depth > 1.0m	Areas where floodwaters accumulate before being conveyed downstream. These areas are important for detention and attenuation of flood peaks.
Flood Fringe	Velocity*Depth <1.0 m^2/s Depth <1.0m	Areas that are low velocity backwaters within flood plain. Filling of these areas generally has little consequence to overall flood behaviour.

NCC has classified the majority of the Site as flood fringe.

DIPNR (2005) notes: "*Development within the flood fringe would not have any significant impact on the pattern of flood flows, and/or flood levels*". The western edge of the Site adjacent to berths at the Port is already developed and is the only area that has been classified as flood storage.

NCC (2009) also used the hydraulic modelling outputs to define a set of hazard categories associated with risks to life and/or infrastructure. The ticks and crosses within **Table 13-3** provide a broad assessment of the risk of flooding and therefore the suitability or otherwise of land use on the Site under the worst conceivable flooding. As sufficient time is available to remove people from flood risk regardless of flood type, Kooragang Island has been assigned an L1 rating - low risk to life.

Table 13-3 Extreme Flood Risk and Land Suitability (NCC, 2009)

Hazard Category	Indicative Risks and Suitability of Use	Type of Flooding	Areas on West of Site	Areas on East of Site
L1	Low Risk to Life	• All types	✓	✓
H1	During flooding the Site is hydraulically suitable for parked or moving cars.	• Hunter River Probable Maximum Flood (PMF)	✗	✗
		• Ocean/Tidal	✗	✗
H2	During flooding the Site is hydraulically suitable for parked or moving heavy vehicles, and for wading by able-bodied adults.	• Hunter River PMF	✗	✗
		• Ocean/Tidal	✗	✗
H3	Site is hydraulically suitable for light construction (e.g. timber frame and brick veneer).	• Hunter River PMF	✗	✗
		• Ocean/Tidal	✗	✗
H4	Site is hydraulically suitable for heavy construction (e.g. steel frame and reinforced concrete) only.	• Hunter River PMF	✗	✓
		• Ocean/Tidal	✓	✓
H5	Site is generally unsuitable for any construction type.	• Hunter River PMF	✗	✗
		• Ocean/Tidal	✗	✗

Notes:
Hunter River PMF refers to the Probable Maximum Flood (PMF) in the Hunter River.
Ocean/Tidal refers to a flood caused by a king tide in conjunction with sea level rise.

A Flood Information Certificate issued for the Site by NCC provides more detail regarding flood risk at the Site. The key conclusions are summarised below:

- No part of the Site is affected by a floodway or flood storage area.
- The estimated 100 year ARI flood level is 2.05 m AHD (riverine) or 2.3 m AHD (ocean/tidal).
- The highest property hazard category is P1 (riverine) and P2 (ocean/tidal).
- The estimated PMF level is 3.95 m AHD (riverine) or 3.4 m AHD (ocean/tidal).
- The highest life hazard category is L1 (H4) under river flooding and L1 (H3) under ocean/tidal flooding.
- Ocean/tidal flood levels include a 90 cm rise in sea levels relative to 1990 by the year 2100.
- The minimum floor level for occupiable rooms in a new development on this Site is 2.55 m AHD.
- No on-site flood refuge is required.

13.3.5 Future Flood Risks

NCC (2009) adopted a design sea level of 3.4m AHD to represent the Probable Maximum Flood (PMF) including an allowance for climate change. The 100 year ARI sea level condition of 2.3m AHD is approximated as the current peak recorded level within Newcastle Harbour (RL 1.4m AHD), plus a sea level rise projection of 0.9m (i.e. the recommended allowance for climate change to 2100). The PMF and 100 year flood levels were mapped onto a digital elevation model created from contours from the existing site survey.

The results of this analysis indicate that along the northern and southern boundaries of the site there may be some low lying areas that may experience flood depths of up to 1 m during the PMF event. There will not be any flooding due to sea level in the 100 year ARI event (2.3m AHD) except that expected due to localised flooding caused by stormwater runoff. The analysis also showed that there are a number of elevated areas that would not be inundated even under PMF conditions. These locations generally coincide with the proposed Bulk Storage and Load-out facility and Containers area (refer to **Figure 4-1** in **Chapter 4 Project Description**). A minimum pavement height of 3.5 m AHD has been adopted throughout the Project in order to reduce the likelihood of inundation.

13.3.6 Hunter River Water Quality in Proximity to the Site

The best currently available water quality data set for the Hunter River around Kooragang Island is that compiled by Sanderson and Redden (2001). The data consists of a variety of samples from estuarine and freshwater areas that are classified into zones as shown in **Figure 13-3**.

The south arm of the Hunter River (Zone B) is classified as a highly disturbed ecosystem, or a Condition 3 Ecosystem as defined in ANZECC (2000). The trigger values detailed in the ANZECC (2000) guidelines only apply to an undisturbed ecosystem, or a Condition 1 Ecosystem. Consequently, a reference condition must be set for this system based on available water quality data. The ANZECC guidelines recommend using an 80th percentile to improve water quality or 90th percentile value to maintain water quality.

Water quality statistics appropriate for the maintenance of current water quality are listed in **Table 13-4** for each relevant zone in the estuary as identified by Sanderson and Redden (2001).

The information from Sanderson and Redden (2001) represents the best available dataset and has therefore been selected as a starting point for the Project assessment. IPL are in the process of conducting sampling in the Hunter Estuary to validate this dataset. The results of this work are ongoing and will be reported whist responding to submissions following the exhibition period.

Figure 13-2 Water Quality Zones in the Hunter Estuary (Sanderson & Redden, 2001)

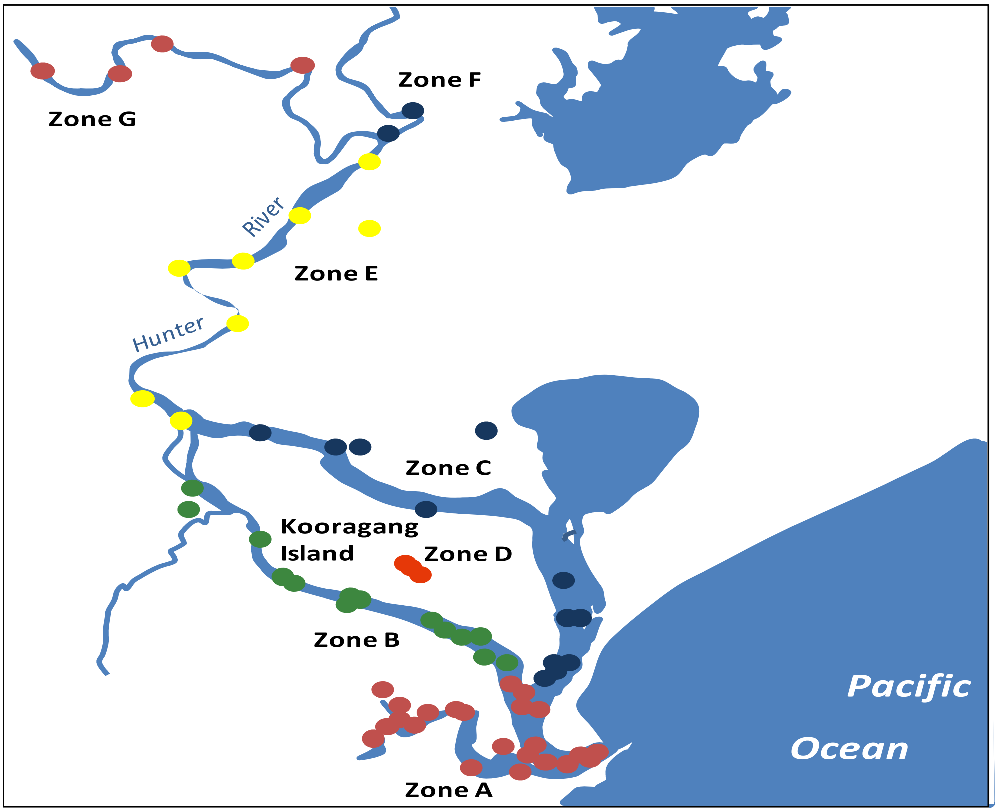


Table 13-4 90th Percentile Water Quality for Nutrients and Non-Filterable Residue (Sanderson & Redden, 2001)

Parameter	Units	90th Percentile Water Quality			
		ZONE A (Lower Estuary)	ZONE B (South Arm)	P.D.L.*	ZONE C (North Arm)
Total Phosphorus	mg/L	0.53	0.15	0.64	0.27
Non Filterable Residual	mg/L	190.00	76.00	39.03	104.00
Nitrate	mg/L	0.63	0.39	1.96	0.33
Nitrite	mg/L	0.03	0.07	0.07	0.04
Total Kjeldahl Nitrogen	mg/L	14.50	7.00	9.42	10.30
Total Nitrogen**	mg/L	15.16	7.46	11.45	10.67

Notes:
* P.D.L. refers to the preferred discharge location adjacent to IPL's plant. Data shown reflects the 90th percentile water quality from four sample locations close to this location.
** Total Nitrogen was calculated as the sum of the other observed forms of nitrogen.

Two key parameters for this Project are Nitrogen and Phosphorous. These two parameters are discharged into the Hunter River from a wide range of sources within the overall Hunter River Catchment. A review of available data from the National Pollution Inventory was undertaken to broadly understand the total Nitrogen and Phosphorous contributions to the Hunter River from both diffuse and point sources. It was estimated that approximately 5,214 t of Nitrogen and 573 t of Phosphorous are currently discharged into the Hunter River. Whilst the final total figures were probably an under-representation of the overall

Nitrogen contributions, they still provided a useful order of magnitude context, whereby the significance of individual source contributions can be considered.

13.4 Impact Assessment

13.4.1 Construction Phase

The key receptor for surface water quality impacts are the Hunter River and Newcastle Harbour.

Without proper controls in place, increased sedimentation, soil erosion and/or pollution during construction could, depending on the location, extent and magnitude of the impact, result in an adverse impact on the water quality of the Hunter River and the associated aquatic ecosystems.

Water runoff from the Site during construction could also potentially cause erosion of disturbed soils if adequate controls are not implemented. Since the Site is flat and there are no natural channels much of the suspended sediment could be expected to deposit locally. The existing drainage network would be the main vector for transport of material off site and could be potentially carry soils to either the north arm or the south arm of the Hunter River as suspended solids. This could result in increased turbidity in the river (i.e. a reduction in water clarity) and possibly a minor change in sedimentation patterns. Increased sedimentation in the existing stormwater drains could also occur. Any contamination in the soils could also be transported into the river. There would also be potential for minor levels of contamination from dewatered groundwater, or from small quantities of diesel or oil contamination from heavy machinery.

Any water required for construction purposes would be supplied from the Hunter Water Corporation (HWC) mains water supply. Potable quality water, generally meeting the requirements of the Australian Drinking Water Guidelines 2011, is currently supplied to the battery limit of the Site. The HWC water supply is generally a high quality, low Total Dissolved Solids (TDS) potable water. TDS is generally less than 200 mg/L. No additional water take is needed and consequently no licence for the abstraction of water from the Hunter River or any other water body will be required. The current and proposed water supply demands are examined in **Chapter 20 Resource Implications**.

As noted above, the risks discussed above are only potential risks if adequate measures are not implemented by the proponent as part of the Project. However, the proponent has developed measures to avoid or mitigate the potential impacts and risks discussed above are outlined in **Section 13.5**.

Due to the nature of the Site as a reclaimed island with no established natural waterways and existing drainage infrastructure, no significant erosion impacts are expected during construction provided the mitigation measures are adopted.

13.4.2 Operational Impacts

Stormwater Management

Stormwater Quality

A key principle of the proposed stormwater drainage design is to reinforce the current separation of drainage into areas that flow to the east and west. The east side of 12th Street forms the divide between the areas that would be drained to the east and the west. This effectively maintains drainage of the existing infrastructure to the south arm of the Hunter River whereas the proposed Project structures largely drain to the east.

The existing stormwater management system for the western half of the Site would be maintained as no significant change in roofed or paved areas is planned. Existing buildings would be replaced with buildings with effectively the same footprint.

On the eastern side of the Site, the majority of the Project buildings and plant are proposed with paved parking and loading areas as well as new roads. Stormwater falling on the Project area would be managed through three systems (refer to **Figure 4-5** in **Chapter 4 Project Description**) depending on the level of potential contamination risk:

- Contaminated Areas - Project areas which could make significant contribution to stormwater pollutant levels if not controlled, i.e. process areas, product loading areas, areas vulnerable to spills and floors of some plant and chemical storage areas, would be roofed or completely contained and hold at least a 10 year ARI rainfall event. All stormwater in these areas would be either recycled or managed in the Waste Water System. Each bunded area would self-drain into individual sumps to enable pump out to the Waste Water System for treatment and disposal.
- First Flush Areas - Stormwater run-off from new plant areas where process materials could be present and moderate surface contamination is possible would be diverted to a first flush collection system. A first flush retention pond would capture the first 10 mm of rainfall from the potentially contaminated external paved areas. The water collected within the first flush pond would be tested and, if found to be contaminated, would be pumped to the Waste Water System. If the water in the pond was found to be clean (i.e. if it met EPL limits), it would be pumped into the stormwater drainage system. Dependent on composition, stormwater may also be pumped from the first flush system to the Cooling Water System as make-up water. The first flush system and containment within plant areas would also be designed to capture typical firewater runoff for the Project.
- Clean Areas - New plant areas which are considered to be 'clean' and unlikely to be contaminated with process materials include light vehicle roads, roofed areas, certain hard stand areas and grassed areas. These areas would be physically separated from potentially contaminated areas by kerbing, interception drains, grading etc. Runoff from these areas would be collected in a new stormwater drainage system. Runoff from the new plant areas and the new storage and loading areas east of 12th Street (refer to **Figure 4-5**) would be collected and consolidated into a single stormwater pit in the east of the Site. This pit would be separated from the contaminated water pond. An isolation valve on the pit outlet would allow contaminated water to overflow from this pit into the contaminated water pond. The valve would close to isolate flow in the event of out of specification (pH or conductivity) water or on pressing of the emergency button. The pit would then lead to a new pipe that would carry the uncontaminated stormwater to an existing stormwater drain on Greenleaf Road. This drain discharges into the north arm of the Hunter River. Clean area runoff would be passed directly to the stormwater system only if it not economic to be captured and recycled. The stormwater quality from these areas would be cleaner than the existing stormwater runoff from the Site and would meet agreed EPL limits.

Separation of the three stormwater systems minimises the risk of poor water quality releases to the Hunter River. No increase in nutrient or suspended sediment concentrations in stormwater runoff is expected during operation of the Project. Runoff would be of a higher quality than that from the existing Site as a result of the inclusion of first flush and contaminant separation areas into the Project design. Therefore during operation it is unlikely that stormwater runoff from the Project would have a significant adverse impact on the water quality of the river.

A stormwater emergency shut-off valve is also proposed to ensure the majority of the drainage from the Site to the east can be isolated from the Hunter River. This would allow capture of spills and testing of water quality prior to discharge if required.

Stormwater Drainage

The new stormwater drainage system is to be designed for a 20 year ARI level of service. Preliminary hydraulic modelling of pipe capacities post development suggests similar or improved performance under peak flows compared to existing conditions (refer to **Appendix H Water Management Report**). However, results for Catchments C and E (refer to **Figure 13-1**) are sensitive to small changes in peak flows arising from modest changes to catchment area and percent of impervious surface. The final detailed design of the stormwater system would ensure the system operates within the nominated design standard and specifications.

Annual stormwater runoff is estimated to be reduced by up to 7% compared with current conditions due to the increase in bunded areas.

Mitigation for Stormwater Drainage is discussed in **Section 13.5**.

Fire Water Management

Fire water for the Site would be sourced from the mains supply. The Project has been designed to isolate and manage contaminated water resulting from fire or loss of containment. In the unlikely event of such an emergency occurring on Site it is likely to be centred on the bunded areas. Under these conditions, contaminated fire water would be captured within the bund and sump system for the contaminated stormwater. From here it would be pumped to the Wastewater System for treatment and disposal.

Fire water spills outside the bunded areas would be captured in a specifically designed contaminated water storage pond which would be designed as part of the clean stormwater drainage system. This contaminated water storage would be located immediately upstream of the stormwater emergency shut-off valve. A conservative volume of $250m^3$ has been proposed for the firewater storage based on the maximum amount of water required to extinguish a truck fire or to contain an ammonia leak until isolation is achieved.

The proposed storage would capture contaminated water flow resulting from a fire or ammonia release incident. The storage would include a stop valve preventing discharge to the Hunter River. Discharge would only occur if the stored water was within agreed EPL limits. If not within these limits, the contaminated water would be pumped out of the contaminated water storage pond and disposed of offsite or within the Wastewater System.

These design measures would ensure that no significant environmental impacts are expected as a result of contaminated water in the unexpected event of an incident on the site requiring firewater response.

Water Supply

Water supply for the Site is sourced from the Hunter Water Corporation (HWC) mains water. No additional water take is needed and consequently no licence for the abstraction of water from the Hunter River or any other water body will be required for the Project. The current and proposed water supply demands are examined in **Chapter 20 Resource Implications**. Harvested roof runoff and stormwater could be available to augment the HWC supply, if practicable.

Domestic Water Demand

Domestic water demands for the Project would be for the ancillary facilities described in **Chapter 4 Project Description**.

Industrial Water Demands

Industrial water demands would comprise the significant majority of the water demand for the Project. The main use would be for make-up water to the Project cooling towers, with feed water to demineralised water supply systems a notable secondary use. The main industrial water demands are summarised in **Table 13-5**.

Table 13-5 Summary of Industrial Water Demands

Water Demand	Specific Uses	Quantity	Comment
Cooling Towers Make-up	• Recirculated evaporative cooling water system.	170 kL/hr continuous (~1460 ML/yr). 160 kL/hr would be provided by HWC water and the balance by recycled water.	Corresponds to about ~91% of the total Project Site water demand. About 83% of this water would be lost by evaporation, based on Cooling Tower operation at 6 cycles of concentration.
Demineralised Water Plant Feed	• NA Plant Absorption Tower injection. • Process Gas Compressor Inlet Pipe injection. • NA Plant Steam System make-up. • Auxiliary Boiler make-up. • Chilled water circuit make-up and at filling lines. • Closed (secondary) cooling water circuit make-up and at filling lines.	Demineralised Water Plant capacity up to 20 kL/hr.	
Other	• Pumps gland water. • Laboratory water supply. • Utility water. • Fire water.		

The cooling water would be recirculated around the Project Site for process cooling applications (via heat exchangers, etc.). The water would be cooled in forced draft evaporative cooling towers. A portion of the water would be lost from the towers to atmosphere by evaporation and drift. Waste water would also be removed from the cooling towers as a bleed, referred to as blow-down. This wastewater would be removed to control the build-up of dissolved solids from the water supply in the cooling water. Make-up water would be required to maintain the system volume lost to evaporation, drift and blow-down.

The demineralised water plant produces high (HP) and low (LP) pressure demineralised water supplies, which are then used for a range of specific process demands including boiler feed water, chilled water system and closed cooling water system make-up, and in the NA plant absorption tower. The demineralised water plant removes total dissolved solids (TDS) from the feed water utilising a mixed bed ion-exchange process. The dissolved solids in the water are adsorbed onto the ion-exchange resins and the product water would be effectively “mineral” free. This prevents scaling (deposition) in steam system (boiler) applications and product quality impacts in the NA plant.

These processes would result in two considerations:

1. Water demand on the Hunter Water supply; and
2. The production and management of wastewater.

These issues are both discussed further below.

Wastewater Generation and Management

The main wastewater sources from the Project arise from industrial sources, primarily the blow-down from the cooling water system. Wastewater arising from ablution facilities and other domestic type uses would be discharged to existing and new septic systems. Sludge would be periodically collected and removed offsite by tanker. No surface water quality impacts are expected from the production of domestic wastewater.

The main process related wastewater streams produced by the plant are summarised in **Table 13-6.**

Table 13-6 Summary of Industrial Wastewater Streams

Wastewater Source	Specific Source	Destination	Characteristics
Cooling Towers	Blowdown from recirculated cooling water system – bleed to control water quality.	Waste Water System.	~28.3 kL/hr continuous discharge (based on ~6 cycles of concentration in the cooling towers). Main wastewater stream arising from the Project Site. Source of nitrate (typically ~30 mg/L, as NO_3),) and phosphate (~10 mg/L, as PO_4).
	Cooling tower filter backwash.	Waste Water System.	Intermittent. Minor Elevated total suspended solids (TSS).
Demineralised Water Systems Regeneration	Ion-exchange beds (mixed) regeneration wastewater.	Waste Water System.	Intermittent. Average flow ~0.1 kL/hr. Requires pH adjustment (neutralisation) prior to discharge to the Waste Water System. Elevated TDS.
Process Condensate	AN Liquor Plant (Pumps 5A/B).	Recycled as cooling tower make-up.	Continuous. Approximately 8.6 kL/hr. AN traces.
	AN Liquor Plant (Pumps 6A/B).	Reused in TGAN Prill Plant and NA Plant.	Continuous. Approximately 15.6 kL/hr. AN traces.
	TGAN Prill Plant Chiller.	Recycled as cooling tower make-up.	Intermittent. Approximately 1.9 kL/hr.
Ammonia Strippers	NA Plant.	Collected in IBC or tank for offsite disposal by licensed waste contractor.	Intermittent. Minor. May contain traces of oil and ammonia. Average of 10 L/hr.
	AN Liquor Plant.	Collected in IBC or tank for offsite disposal by licensed waste contractor.	Intermittent. Minor May contain traces of oil and ammonia. Average of 5 L/hr.
Boiler Blowdown	NA Plant Steam Drum.	Recycled as cooling tower make-up.	Continuous discharge of approximately 1 kL/hr. Source of phosphate (~10 mg/L, as PO_4).

Wastewater Source	Specific Source	Destination	Characteristics
	Auxiliary Boiler	Recycled as cooling tower make-up.	Continuous discharge of approximately 0.2 kL/hr. Source of phosphate (~10 mg/L, as PO_4).
Instrument Air and Plant Air systems condensate		Water condensate from intercooler/ aftercooler recycled to cooling tower.	Minor volume ~10 L/hr.
Laboratory Effluent		Waste Water System	Minor.
Process Area Bund Sumps	Sumps with potentially concentrated wastewater.	Collected in sump or tank for recovery (waste ANSOL handling) or for offsite disposal by licensed waste contractor. May be discharged to Waste Water System after confirmation of suitable quality.	Intermittent.
	Oily or potentially oily areas.	Waste Water system, via local oil water separators	Intermittent.
	Potential for moderate nitrogen impacts in wastewater.	Waste Water system.	Intermittent.
	Normally 'clean' areas.	Stormwater system after confirmation of quality.	Intermittent.
First flush stormwater	Stormwater runoff form areas with potential for moderate nitrogen quality impacts (refer to Chapter 2 of **Appendix H Water Management Report**	If quality is suitable first preference would be to utilise first flush water for cooling tower make-up. Alternative destinations based on quality, would be the Waste Water System, and potentially to stormwater if water quality meets specification.	Intermittent. Minor Average load of 260 L/d.

Liquid wastewater from various sources listed in **Table 13-6** would be collected in tanks as part of the Wastewater System. The typical total daily wastewater volume would be about 750 kL/d, (~270 ML/yr), about 680 kL/d (90%) would derive from the cooling water system blowdown.

Wastewater discharge streams represent approximately 17% of the water that would be supplied to the Site from HWC mains. Although some water is created during the Project process, the balance is lost primarily to the atmosphere as water vapour evaporated from the cooling tower system.

The Wastewater System would take process waste streams that cannot be concentrated or recycled and treat these wastes. The Waste Water System would pass the wastewater through an oil separator to remove any oils. Oil would be removed, collected in drums and disposed offsite. The wastewater would then be pH neutralised by adding either an acid or an alkali.

At this point the treated wastewater would be tested. If the wastewater meets the EPL limits, it would then be discharged to the south arm of the Hunter River. If not, the effluent would be stored on Site before being disposed of offsite by a suitably licenced third party contractor at an authorised offsite disposal facility (refer to **Chapter 16 Waste Management**).

Waste Water Quality and Discharge

The quality of wastewater to be discharged from the Project to the Hunter River is expected to typically have the characteristics presented in **Table 13-7**. The normal volume of wastewater would be 750 kL per day with intermittent peaks up to 1,500 kL per day from rainfall events.

Table 13-7 Indicative Wastewater Quality

Parameter	Unit	Indicative Quality	Worst Case Quality
Temperature	deg C	28	35
pH	pH units	7.0 – 8.5	6.5 – 8.5
Total Nitrogen (as N)	mg/L	<75	150
Ammonia (as N)	mg/L	<37.5	75
Nitrate (as N)	mg/L	<37.5	75
Total Phosphate (as PO_4)	mg/L	<10	25
Total Suspended Solids	mg/L	<15	30
Oil & Grease	mg/L	<5	10
Salinity	MicroSiemens/cm	1,750	2,600

Wastewater quality would be largely dictated by the cooling tower blowdown quality as this comprises in excess of 90% of the load. The quality of the water in the cooling tower blowdown would be dependent on the following factors:

- concentration effect of evaporation (variable depending on climatic conditions and selected operating cycles of concentration);
- primary feed water quality (HWC mains water);
- cooling water treatment additives (corrosion and scale inhibitors, biocide);
- quality of the wastewater streams (boiler blowdown and process condensates) recycled as cooling tower make-up;
- entrained solids; and
- absorbed nitrogen (from the air around the plant).

The concentration of total nitrogen from the cooling tower blowdown would be typically around 10-15 mg/L (as N), but potentially up to 35 mg/L associated with nitrogen absorption and entrainment via the cooling tower inlet air. An additional nitrogen load allowance has been assumed to account for expected variable contributions from first flush stormwater and process area sumps wastewater.

The cooling tower blowdown would also be the main source of phosphate in wastewater. The concentration would be typically predicted to be around 10 mg/L (as ortho-phosphate), which would be diluted slightly in final discharge by other wastewater streams.

Oily water streams would be treated by local oil water separation with an additional overall oil water separator in the wastewater treatment plant. The oil water separators to be employed would rely on gravity separation. Emulsification behaviour of oil would not be expected as emulsifiers would not typically be used.

The high salinity of the Hunter River estuary would ensure that a high proportion of Hydrogen ions (H^+) are available and reaction of bicarbonate atoms (HCO_3) in the wastewater stream with the estuary water would be almost instantaneous. Consequently pH would be unlikely to cause any significant impacts.

Hunter River water quality data (Sanderson and Redden, 2001), flow data and ecological values were assessed alongside the characteristics of the wastewater stream to decide the location and depth of the proposed discharge (refer to **Appendix H Water Management Report**). Dispersion modelling from Water Research Laboratory (WRL) was used to help complete this assessment.

In addition to these factors, the Environmental Values for the Hunter River Estuary, as identified by the NSW government in 2006, were also considered. These values include:

- Aquatic ecosystems protection (fauna and flora);
- Primary recreation;
- Secondary recreation;
- Visual amenity; and
- Aquatic foods to be cooked before eating.

The primary goal for each environmental value is to maintain or improve water quality where possible.

Discussions with the EPA in February 2012 indicated suggested that the south arm of the Hunter River and the lower estuary (Zones B and A respectively on **Figure 13-2**), should both be considered condition 3 (highly disturbed) ecosystems as defined in the National Water Quality Management Guidelines (ANZECC, 2000). The appropriate water quality objective for a condition 3 ecosystem is to maintain or improve (i.e. not worsen) existing water quality. It is therefore appropriate to compare the impacts of the proposed discharge with local water quality data (i.e. **Table 13-4**) rather than default ANZECC Guideline values.

In contrast the north arm of the Hunter River (Zone C) contains areas of SEPP 14 wetlands, and the Hunter Estuary Ramsar site is situated on the north side of Stockton Bridge. Ecological investigations have shown the presence of other wetland habitats in the area. Currently large ship movements into the north arm are limited. On the whole, the condition of the north arm of the Hunter River is less affected by anthropogenic impacts than the south arm.

Whilst flows in the north arm are greater than in the south arm and rapid mixing of wastewater and river water would be likely to occur, discharges to the east of the site into the north arm were not considered initially to be preferred given the location of potentially sensitive receptors. Therefore it was decided that the waste water discharge should be in the south arm of the Hunter River.

Due to a number of a number of operational constraints, mainly involving the future use of land and dredging constraints, a wastewater discharge location close to the Site was chosen. Dispersion modelling of the proposed discharge recommended that the outfall should be at a depth of approximately 11 m to ensure dilution of the wastewater stream in the receiving waters. Preliminary modelling of near surface wastewater discharges showed that the freshness of the wastewater compared with the estuarine environment meant that the wastewater stream effectively floated on top of the estuarine waters. In comparison, discharge at depth was found to provide the greatest dilution potential for the wastewater stream. To ensure mixing of the wastewater stream occurs in the receiving waters of the south arm, a diffuser would also be installed.

The modelling also showed that velocities in the south arm of the Hunter River are relatively low due, in part, to the depth and extent of the dredging. This low velocity means that the south arm of the Hunter River has less flushing and nutrients could potentially accumulate in extended dry periods[1].

However the overall increase in nutrient addition to the Hunter River Estuary arising from the proposed development would be, in the context of the overall inputs to the system on an annual basis, modest.

In terms of the nitrogen load from the wastewater stream alone, during operation the Project is expected to contribute 18.5 tpa to the Hunter River. This equates to 0.35% of the total Hunter River catchment inputs. In terms of the nitrogen load arising from the Site as a whole during Project operation (i.e. from atmospheric, groundwater, wastewater and surface sources) the proposed development is expected to contribute 32.4 tpa, which is approximately 0.62% of the identified catchment inputs.

The hydrodynamics of the north and south arm of the Hunter River are currently being further investigated by IPL, in consultation with the EPA, to confirm the results of the initial round of modelling. This work is ongoing and will be reported whist responding to submissions following the exhibition period.

Riverine and Ocean/Tidal Flooding

Based on an approximate analysis using spot survey data and flood information from NCC (2011) it has been shown that the Site is at risk of flooding during both the 100 year ARI and extreme flood events from both tidal and fluvial flooding.

However, this analysis has concluded that the parts of the Site to be developed are suitable for this type of development and, as sufficient time is available to remove people from flood risk regardless of flood type, the flooding at the Site presents a low risk to life.

It has also been shown that there are areas on the eastern side of the Site that are likely to remain relatively dry during flood events. The adopted design criterion of 3.5 m AHD for the Project provides at least 300 mm freeboard above the 100 year ARI flood level allowing for climate change, and 100 mm freeboard above PMF.

The Project does not involve any significant earthworks and therefore no significant impacts on riverine or ocean/tidal flooding levels are expected from the Project.

Due to the level of flood protection that exists and the relative volumes of material carried by flood waters compared with any inputs from the Project, no significant water quality or infrastructure impacts are expected from flood inundation.

13.5 Mitigation Measures

13.5.1 Construction Phase

Appropriate construction phase procedures would be used to minimise soil erosion, sedimentation and contamination of nearby surface waters. A number of interrelated measures to help avoid or manage impacts on soils and groundwater have been detailed in **Chapter 12 Soil and Groundwater**. These measures would also help manage potential impacts on surface water receptors. Key amongst these would be to complete all construction works in line with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004).

[1] The hydrodynamics of the north and south arm of the Hunter River are currently being further investigated by IPL, in consultation with the EPA, to confirm the results of the initial round of modelling. The results of this work are ongoing and will be reported whist responding to submissions following the exhibition period.

Measures to manage potential impacts on surface water receptors would be detailed within the CEMP for the Project. The CEMP would include a Surface Water Management Plan (SWMP) which would include the following measures:

- All materials would be would be stockpiled in accordance with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004). Principal controls would include the following:

  a) silt fences would be installed around stockpiles to reduce erosion and the movement of suspended solids as necessary; and

  b) stockpiles would not be located in close proximity to any stormwater drainage systems.

- Clean materials would be separated from contaminated materials.

- Suspected contaminated materials would then be classified in accordance with *NSW (2009) Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and either stored on the Site or disposed of in a timely manner.

- Measures to prevent the movement of contaminated run off to the Hunter River due to construction activities. Measures would include:

a) the use of appropriate drip trays and interception techniques for any liquids stored on Project Site;

b) regular inspection of construction equipment to ensure any hydrocarbon or other leaks are minimised and rectified;

c) managing vehicles leaving the Project Site to reduce soil on roads, production of dust and the introduction of contamination to stormwater drainage systems;

d) appropriate and timely disposal of any contaminated soil, water or waste generated during construction;

e) regular inspection of erosion control structures and bunded areas; and

f) regular inspection of containment areas, drainage lines and interception measures.

13.5.2 Operational Phase

Water Usage Efficiency Measures

IPL has recognised that the water demand for the Project would be significant. As a result, methods of minimising water consumption throughout the process have been considered. Measures that are proposed to be implemented include:

- recovery of steam condensate for return to the boilers as feedwater;
- process effluent streams would be recycled into the process or as cooling water system make-up; and
- closed circuit cooling water systems would be used for some applications.

The recycled water streams would provide approximately six percent of the make-up to the cooling towers. The current cooling water demand assumes six cycles of concentrations (the ratio of make-up to blow-down). Further reductions in water consumption would be made possible by operating the cooling towers at higher cycles of concentration.

Stormwater Drainage

As part of the Project, stormwater will be managed in a number of ways that ensure that an appropriate level of service is maintained. Certain areas would be bunded, a first flush system would be put in place, some areas where clean water runoff is expected are proposed to be sent to an infiltration device (e.g. Catchments B and D), and roof water capture and reuse is being considered as part of final design.

The impact of increased stormwater runoff due to the increased roof and paved areas would be mitigated through design that allows for the capture and reuse of clean water where practicable.

Waste Water Discharge

Wastewater discharge will be continuously monitored with an automatic sampler and on-line for pH, temperature, volume and electrical conductivity.

13.6 Proposed Management and Mitigation Measures

The proposed stormwater and wastewater management provisions have been designed to ensure a high degree of compliance with existing standards. This has included the appropriate selection of design elements and clear design decisions during concept development. Conservative estimates of impacts have been made where possible to provide a high level of confidence in the Project.

Table 13-8 outlines the measures that would be put in place to ensure no adverse impact on local surface water quality.

Table 13-8 Management and Mitigation Measures – Surface Water and Wastewater

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Surface Water Management Plan (SWMP) would be developed as part of the CEMP to manage stormwater runoff during construction. This plan would be completed in line with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004). The plan would outline: • Measures to manage soils in line with the Soil and Erosion Management Plan; and • Measures to prevent the movement of contaminated run off to the Hunter River due to construction activities.		✓	
A survey of the local drainage network relevant for the Project would be completed prior to detailed design.	✓		
The quality of stormwater discharges would be monitored throughout the construction and operation of the Project to ensure that water quality levels are maintained within the limits of the EPL.		✓	✓
Three stormwater management systems would be installed as part of the Project to manage stormwater quality. These systems include a contaminated water system, a first flush system and a 'clean' stormwater system.		✓	✓
In order to minimise demands on the water supply, water would be reused and recycled within the Project process.	✓		✓
Stormwater would be managed to ensure that there is no reduction in stormwater quality and that the current infrastructure is not operated over capacity			✓

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Fire water management would ensure that, in the event of a fire or ammonia leak on the Project Site, there is no loss of containment off the project Site of potentially contaminated water.			✓
Areas with a likelihood of containing potential contaminants would be appropriately bunded.	✓	✓	✓
Soil stockpiles would be managed so as to reduce the impact from sediment during Project construction.		✓	
Wastewater discharge will be continuously monitored with an automatic sampler and on-line for pH, temperature, volume and electrical conductivity.			✓

14 Greenhouse Gas

14.1 Introduction

The DGRs require the EIS to include *'a quantitative analysis of Scope 1 and 2 greenhouse gas emissions of the Project and a qualitative analysis of the impacts of these emissions; [and] details of measures to improve energy efficiency'*.

To address that requirement a Greenhouse Gas Assessment has been completed by URS. This full assessment can be found in **Appendix I Greenhouse Gas Assessment**. This chapter summarises the findings of that assessment.

14.2 Legislation and Policy

Relevant legislation and policy is briefly outlined below. A complete account is contained within **Appendix I Greenhouse Gas Assessment**.

14.2.1 International Policy

Policy relating to the assessment of greenhouse gases (GHGs) within Australia is based on international approaches and guidance as described in the Kyoto Protocol. The Kyoto Protocol was ratified by Australia in December 2007.

14.2.2 Commonwealth Legislation and Policy

The Project would need to operate in accordance with the following Commonwealth policies and legislation:

- Clean Energy Future (CEF) initiative;
- Energy Efficiency Opportunities (EEO) initiative;
- *National Greenhouse and Energy Reporting (NGER) Act 2007;* and
- *Clean Energy Legislation Amendment Act (CELA) 2012.*

The CEF and EEO are initiatives promoted by the Commonwealth government. CEF promotes the adoption of polices and measures that will work towards a clean energy future for Australia, while EEO promotes opportunities to improve energy efficiency.

The NGER Act establishes a national framework for Australian corporations to report Scope 1 and Scope 2 GHG emissions, reductions, removals and offsets, and energy consumption and production, from 1 July 2008.

The CELA Act was passed in June 2012. The CELA Act makes amendments to the Clean Energy Act 2011 and related legislation establishing the Government's carbon pricing mechanism. Companies operating large emitting facilities will be liable (i.e. over 25,000 tonnes of CO_{2-e} emissions each year).

With more than 50 sites around Australia, IPL is classified as a large emitter under the NGER Act. IPL is therefore required to annually report on carbon dioxide equivalent (CO_{2-e}) emissions.

14.2.3 NSW State Policy

NSW Greenhouse and Climate Change Action Plan

This Action Plan was released in November 2005 and provides a strategic approach to combating climate change in NSW from 2005 to 2008 and beyond. The plan sets out actions to reduce GHG emission from the NSW Government. It also sets out measures to work with stakeholders in order to reduce GHG emissions from their activities.

Recently the NSW2021 plan set the Government's agenda for change in NSW.

NSW Greenhouse Gas Reduction Scheme (GGAS)

The NSW Greenhouse Gas Reduction Scheme (GGAS) is a mandatory greenhouse gas emissions trading scheme aiming to reduce GHG emissions associated with the production and use of electricity. It was created in 2002 through amendments to the *Electricity Supply Act 1995* and the *Electricity Supply Regulation 2001*, and commenced on 1 January 2003. On 5 April 2012, the Minister for Resources and Energy announced the closure of GGAS, effective 1 July, due to the commencement of the Commonwealth carbon pricing mechanism.

NSW 2021 – A Plan to Make NSW Number One

The NSW 2021 plan sets the Government's agenda for change in NSW. It sets out key targets in relation to GHGs and climate change. Such actions include:

- Completion of fine-scale climate change projections for NSW, making them available to local councils and the public by 2014; and
- Work with government agencies and universities to deliver improved climate projections for NSW and ACT.

NSW 2021 also sets goals and targets that support practical action to tackle climate change including:

- Introducing a target for 20% renewable energy by 2020; and
- Assistance for businesses and households to realise annual energy savings of 16,000 gigawatt-hours by 2020 compared with 'business as usual' trends.

14.3 Assessment Methodology

This assessment has only considered emissions that relate to the construction and operation of the Project. To ensure that the assessment was conducted thoroughly, an inventory of the greenhouse gas emissions relating to the Project was compiled.

14.3.1 Emission Scopes

As required by the DGRs, this GHG assessment has considered Scope 1 and Scope 2 emissions.

Scope 1 emissions are often referred to as direct emissions as they are a direct result of the activities undertaken on-site. Typically Scope 1 emissions are directly controlled by the Proponent and therefore operating regimes or controls employed by the Proponent can directly affect GHG emissions from these sources.

The Scope 1 emissions for the construction phase would comprise:

- Combustion of liquid fuels (i.e. diesel) within transport and construction vehicles.

The Scope 1 emissions for the operational phase would comprise:

- Production of Nitrous Oxide (N_2O) within the nitric acid plant with subsequent release to atmosphere (post abatement[1]);
- Combustion of liquid fuels (i.e. diesel) in on-site vehicles and employee vehicles; and
- Combustion of gaseous fuels (i.e. natural gas) within steam boiler and flare at the Site.

IPL would not own or have direct control of import and export vehicles and vessels; hence these emissions have been excluded from the inventory.

Scope 2 emissions are often referred to as indirect emissions and cover greenhouse gas emissions from the generation of purchased electricity, steam, heating and cooling consumed by the facility. These utilities are defined as being brought into the organisation boundary, i.e. purchasing electricity from the grid or other external source.

14.3.2 Carbon Dioxide Equivalence

Each of the six GHGs recognised in Australia has a different Global Warming Potential (GWP). GWP is a measure of the amount of infrared radiation captured by a gas in comparison to an equivalent mass of CO_2. Therefore the GWP of a gas is expressed as carbon dioxide equivalent (CO_{2-e}). The carbon dioxide equivalence of the greenhouse gases used within the construction and operation of the Project are shown in **Table 14-1.**

Table 14-1 Summary of Adopted Emission Factors

Activity	Emission Factor
Scope 1 Emissions	
Nitrous oxide emissions	310 t CO_2-e /t
Diesel combustion	2.7 t CO_2-e /kL
Fuel oil combustion	2.9 t CO_2-e /kL
Natural gas combustion	51.3 kg CO_2-e /GJ
Scope 2 Emissions	
Electricity consumption	0.89 kg CO_2-e /kWh

Therefore **Table 14-1** shows that, for example, nitrous oxide (N_2O) has a CO_{2-e} rating of 310. This means that 1 t of N_2O is equivalent to 310 t CO_2.

14.4 Scoping Inventory

Greenhouse gas emissions from the Project are anticipated during both the construction and operation phases. In order to establish a quantitative analysis of the Scope 1 and 2 emissions, an inventory of Project emission sources has been compiled. These identified sources are summarised in **Table 14-2 GHG Scoping Inventory.**

[1] Abatement refers to lowering or reducing something, in this case Nitrous Oxide.

Table 14-2 GHG Scoping Inventory

Construction Stage	Operation Stage
Scope 1 Emissions	
Liquid fuel combustion Natural gas combustion	N_2O from NA production Liquid fuel combustion Natural gas combustion
Scope 2 Emissions	
Electricity consumption	Electricity consumption

During construction, Scope 1 emissions are anticipated from the liquid fuel that is burned as a result of vehicular movements associated with the Project, and also from the natural gas and liquid fuels that would be burned during the construction and commissioning processes in welding, heating and testing of the Project.

Scope 2 sources would be limited to electricity purchased from the grid and used for power during the construction process.

During Project start-up, natural gas would be burned to heat the facility to the operational temperature.

In line with the findings of the Intergovernmental Panel on Climate Change (IPCC), 2007, GHG production is only considered *significant,* if more than 5% of the total produced gasses are GHG. During the operational phase of the Project, two processes would be taking place, namely the production of NA from ammonia and the production of AN from NA. These are described in **Chapter 4 Project Description**. Of these processes, only the production of NA from ammonia would produce a significant amount of N_2O.

The Project would involve the combustion of liquid and gaseous fuels that would result in the generation of GHG. Additionally the ammonia flare would be required to be maintained in a standby state (i.e. pilot flame active) to allow for emergency flaring. Natural gas would be constantly combusted for this purpose.

14.5 Project Emissions

Construction Phase

As indicated above, Scope 1 emissions during construction would be caused by liquid fuel and natural gas combustion. Scope 2 emissions would be caused by electricity usage from the grid. During the construction phase of the Project, greenhouse gas emissions have been estimated at approximately 11 kt CO2-e. Of the construction emissions, approximately 6 kt CO2-e would be attributable to combustion of diesel in construction vehicles, not directly controlled by IPL. The remaining 5 kt CO2-e would be attributable to the purchase of electricity from the grid for the first plant start-up. The construction emissions would occur over a three year period. **Figure 14-1** below indicates the estimated emissions for the whole of the construction phase as compared against a typical year of Project operation.

Operational Phase

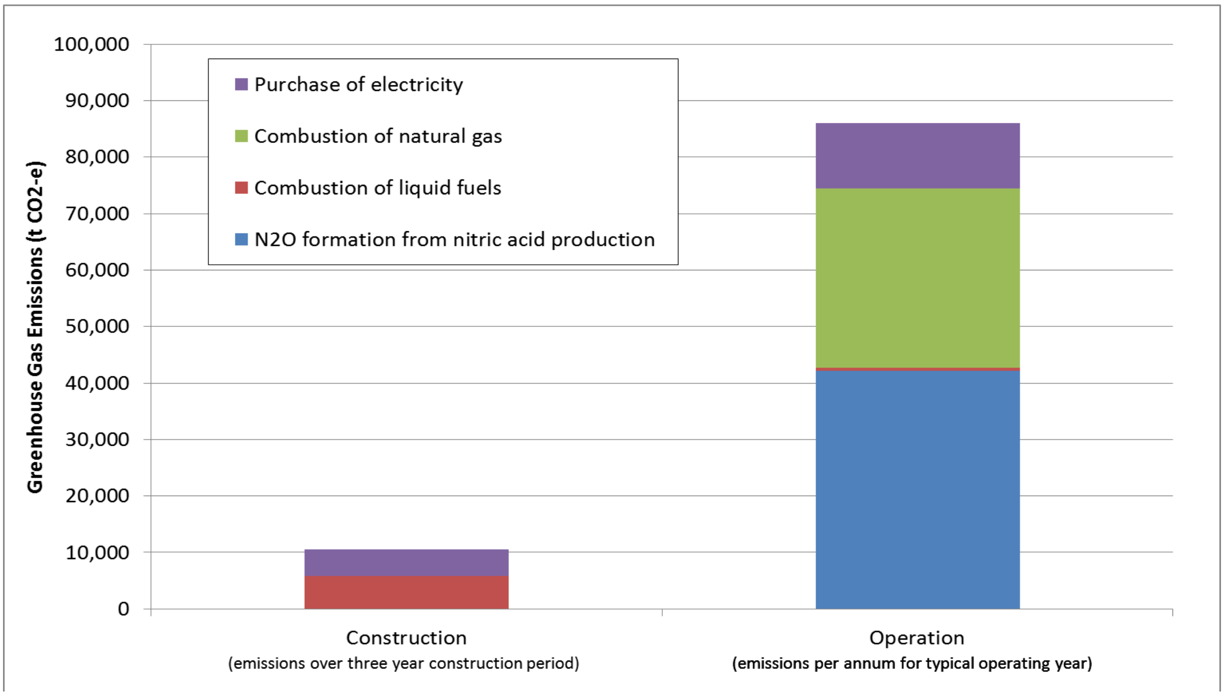
GHG emissions during the operational phase of the Project would be dominated by the post-abatement N_2O emissions from the production of NA. Emissions from natural gas combustion during start-up and operations, plus liquid fuel combustion resulting from vehicle movements, would also form part of the operational emissions profile. In order to calculate the level of emissions from each source, a number of estimates have been made regarding start up duration and steady state operating hours, plus engineering design data on flow rates through certain Project components, combustion rates during start up and steady state, liquid fuel (diesel) consumption and electricity consumption. The calculations of emission levels are outlined in full in **Section 4.3** of **Appendix I Greenhouse Gas Assessment**.

Table 14-3 presents a summary of the predicted GHG emissions for the operation of the Project. **Figure 14-1** shows the predicted GHG emissions during a typical year of operation for the Project.

Table 14-3 Summary of Projected Emissions during Operation

Activity	Quantity (kt $CO_{2\text{-}e}$)	Proportion of Total
Scope 1 Emissions		
N_2O from NA production	42.2	49.0 %
Natural gas combustion	31.7	36.9 %
Liquid fuel combustion	0.5	0.6 %
Scope 2 Emissions		
Electricity consumption	11.6	13.5 %
TOTAL	**86**	**100 %**

Figure 14-1 Summary of Scope 1 and 2 GHG Emissions



Emissions Comparison

The GHG emissions from the construction and operation of the Project have been compared to the National and State inventories for GHG emissions that are regularly published by the Department of Climate Change and Energy Efficiency. The GHG assessment has estimated that annualised GHG emissions from the Project would contribute approximately 0.06% of the NSW GHG registry and 0.02% to the Australian GHG inventory.

14.6 Mitigation Measures

The majority of the GHG emissions resulting from the Project are caused during operation of the Project. Mitigation measures in the form of nitrous oxide abatement are inherent in the process design of the Project.

US EPA (2010) classifies nitrous oxide abatement into three categories, as defined below:

- **Primary** - reduces the amount of N_2O formed in the ammonia oxidation step. This can be done by modifying the catalyst used in the oxidation process and/or modifying the operating conditions of this process;
- **Secondary** – reduces the N_2O immediately after it is formed in the ammonia oxidation step by installing a catalyst bed in the ammonia oxidation reactor; and
- **Tertiary** – reduces the N_2O by installing a catalytic reactor either upstream or downstream of the tail gas expansion unit following ammonia oxidation.

The Project would employ both primary and secondary mitigation measures and therefore has not required any tertiary measures. It is estimated that these technologies would reduce the N_2O emissions by up to 93% below those for an uncontrolled plant. As mitigation measures have already been incorporated into the design of the facility, no additional mitigation measures have been identified.

14.6.1 Energy Efficiency Opportunities

Energy loss has been minimised through efficient design of a range of energy recovery mechanisms within the Project. The heat generated from the exothermic reactions of the operational phase of the Project would allow the facility to produce steam to drive the NA Plant compressor, provide heat recovery and generate electricity. With additional steam from the Auxiliary Boiler, it is expected that approximately 7.5 MW of electricity would be produced. This would equate to approximately 51,660 t CO_2-e should this electricity be purchased from the grid. This represents a substantial quantity of the CO_2 emissions from the Project, upwards of approximately 50% of the direct (Scope 1) emissions associated with typical Project operation. Further detail regarding the energy recovery mechanisms for the Project is outlined in **Chapter 4 Project Description** and **Appendix I Greenhouse Gas Assessment**.

14.7 Benchmarking

The Project was compared to a number of other similar facilities around the world in order to get a better understanding of the impact of the GHGs produced by the Project. GHG emissions intensity (i.e. the quantity of GHG per unit of product), is the key benchmarking parameter for consideration.

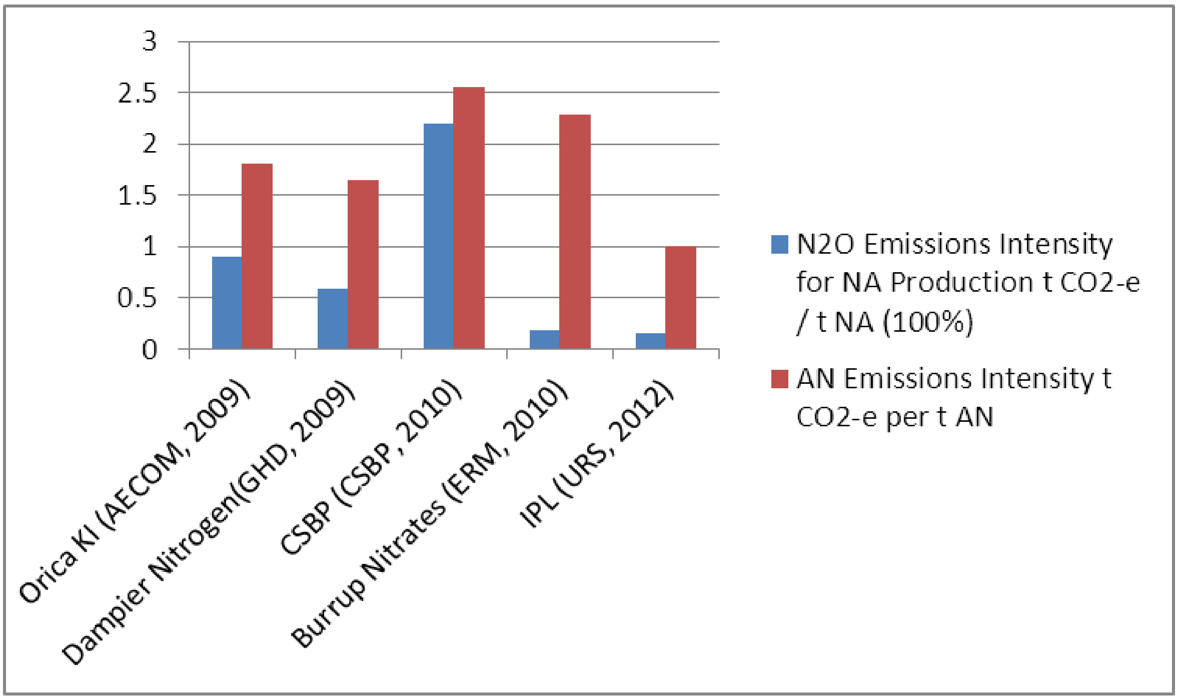
A full comparison of the GHG intensity of the operation of the Project during the production of NA and AN is available in **Section 6** of **Appendix I Greenhouse Gas Assessment**. **Table 14-4** and **Figure 14-2** summarise the findings of the benchmarking exercise. They show a comparison of the relative emission intensity from the Project when compared to the data set by other similar plants from across Australia.

Table 14-4 Emission Intensity Benchmarks

Plant	N_2O Emissions Intensity for NA Production t CO_2-e / t NA (100%)	AN Emissions Intensity t $CO_{2\text{-}e}$ per t AN
Orica KI (AECOM, 2009)	0.90	1.81
Dampier Nitrogen(GHD, 2009)	0.59	1.65
CSBP (CSBP, 2010)	2.02/2.14*	2.55
Burrup Nitrates (ERM, 2010)	0.19	2.28
IPL (URS, 2012) (the Project)	**0.15**	**1.0****

* Two NA plants are present on the CSBP site, therefore two intensities are recorded.
** In order to make a direct comparison between the Project and other sites where ammonia is manufactured rather than imported, the Project's emissions have been augmented to include emissions associated with the upstream manufacture and delivery of ammonia.

Figure 14-2 Emission Summary Benchmarks



The figures presented in **Table 14-4** and **Figure 14-2** show that through the use of modern technology and efficient design, the Project is able to maintain a GHG emission intensity that is lower than other existing plants in Australia. **Section 6** of **Appendix I Greenhouse Gas Assessment** compares the Project to GHG emissions intensity data from across the world. As evidenced by these data, on a global scale the Project performs well.

14.8 Conclusion

The greenhouse gas inventory developed for the Project estimates that total Scope 1 and Scope 2 emissions would equate to 86,041 t CO_2-e per annum during operation. Of the annual GHG emissions, 49% were estimated to be from N_2O emissions associated with nitric acid production, 36.9% of emissions were estimated to originate from the combustion of natural gas for the production of process heat and electricity, whilst 0.6% would be associated with the combustion of liquid fuels. The remainder (13.5%) is estimated to be associated with the consumption of electricity from the grid (Scope 2).

The plant design has incorporated a number of greenhouse reduction mechanisms, through N_2O abatement and energy saving opportunities. Most notably the facility would produce steam from the heat generated from exothermic reactions, and would be capable of generating approximately 7.5 MW of electricity. This would equate to approximately 51,660 t CO_2-e should this electricity be purchased from the grid, or upwards of 50% of the total Scope 1 emissions estimated for the Project.

Being a modern facility, the greenhouse gas intensities, in terms of emissions per tonne of NA (100%) and AN, performed well when compared against literature values for plants within Australia and around the world.

Overall the Project GHG emissions were found to be minor when compared to current NSW and National inventories. The Project would contribute approximately 0.02% of the National Greenhouse Gas Inventory and approximately 0.06 % of the NSW Greenhouse Gas Inventory.

15 Traffic and Transport

15.1 Introduction

This Chapter addresses the traffic related impacts associated with the construction and operation of the Project. The DGRs for the Project require that the EIS includes '*details of all transport types and impacts on the safety and capacity of the local road network and shipping channel if applicable; details of the site access, internal roads and car parking'*. These issues have been considered and, as appropriate, assessed within a Transport Impact Assessment (TIA). This TIA is provided in **Appendix J Transport Impact Assessment**. This chapter summarises the TIA.

15.2 Assessment Methodology

The preparation of the TIA involved a detailed desktop analysis. Aerial photography and information from the NSW Roads and Maritime Service (RMS) website were used to understand the local transport networks. Consultation was conducted with RMS, NCC and NPC with regards to the assessment and for information on the local transport network. As recommended by RMS the TIA has been completed in line with the guidance *Guide to Traffic Generating Developments* (RTA, 2002).

A site visit was conducted on 23 November 2011 by a URS transport planner. The purpose of the visit was to verify the initial findings of the TIA and to understand any key traffic and transport considerations specific to the local area.

Traffic count data for relevant locations along classified roads was obtained from the RMS database. Traffic generation during the construction and operational phases of the Project was estimated based on construction vehicle volumes and operational activities provided by the Proponent. These traffic generation estimates were applied to existing traffic volumes to determine the proportional increase arising as a result of the Project.

The capacity of the road network was determined by using information about the capacity of the intersections. Level of Service (LOS) is a performance measure used to describe the performance of an intersection or midblock location. LOS ranges are defined as falling between A, which indicates good intersection performance, to F, which indicates saturated conditions with long queues and delays. These definitions are explained in full in **Appendix J Traffic Impact Assessment**.

15.3 Existing Environment

15.3.1 Existing Road Network

The Site is located on the south eastern end of Kooragang Island, north of Walsh Point, within the City of Newcastle. Kooragang Island is accessed from the south by State Highway 121, a main arterial road that runs north, up Tourle Street, from Industrial Drive. Tourle Street crosses the south arm of the Hunter River at the Tourle Street Bridge. Tourle Street becomes Cormorant Road when it turns east. Cormorant Road runs east along the southern shore of Kooragang Island before meeting Teal Street at a roundabout. Teal Street heads north before turning east and crossing the north arm of the Hunter River over the Stockton Bridge. State Highway 121 then continues north towards Fern Bay and Port Stephens LGA.

Heron Road leaves Cormorant Road to the east of the Cormorant Road / Teal Street roundabout and heads south, passing along the western edge of the Lot, before running to Walsh Point where it turns into Greenleaf Road. Greenleaf road runs north, bordering the eastern edge of the Site, to join Teal Street. Heron Road and Greenleaf Road are owned and managed by NPC.

Existing access to the Site by road is via a security gate located on Heron Road. A location plan, including details of the surrounding road and transport network, is presented in **Figure 15-1.**

15.3.2 Existing Traffic Volumes

The traffic between Tourle Street Bridge and Stockton Bridge consists mainly of light vehicles going to and from Stockton and Fern Bay and light and heavy vehicles related to the industries and activities on Kooragang Island. This section of State Highway 121 provides the main vehicular access between the communities of Stockton, Fern Bay and Port Stephens LGA with the rest of Newcastle.

The RMS has an automatic count station located on Stockton Bridge to the north of the Site. This count station is closest to the Site and has therefore been used to measure traffic volumes in the area. The most recent Annual Average Daily Traffic (AADT) volume data at the count station was for 2010. The count station provides historic data as well as daily and weekly variation in traffic flows. Historic AADT volumes at this location are presented in **Table 15-1**.

Table 15-1 Historic AADT Growth from RMS Count Station on Stockton Bridge

Year	2004	2005	2006	2007	2010
Two-way Volume	18,966	19,581	19,691	20,233	21,732
Compound Annual Growth Rate from 2004 Base	-	3.2%	1.9%	2.2%	2.3%

For purposes of this assessment, a background traffic growth rate of 2.5% per annum has been adopted to account for unaccounted development in the area over and above that reflected in historic growth and to ensure robustness of the assessment.

In order to establish a robust baseline of road usage in the area, traffic count data for relevant locations along the classified roads was obtained from the RMS database. **Table 15-2** provides an outline of the 2010 and estimated 2011 AADT volumes and LOS for the traffic count stations relevant to this assessment.

Table 15-2 2010 AADT and Estimated 2011 AADT Flows on the Existing Road Network

Road	Traffic Count Location	2010 AADT (two-way)	2011 Estimated AADT (two-way)[1]	2011 Existing LOS
Tourle Street/ Cormorant Road	North of Tourle Street Bridge	28,923	29,588	**F**
Industrial Drive	East of Tourle Street	26,518	27,128	**B**
Maitland Road/ Old Pacific Highway	East Maitland	44,788	45,818	**D**
New England Highway	Black Creek Bridge	47,720	48,818	**E**
Golden Highway	East of Broke Road	3,907	3,997	**A**

Notes:

1. Based on compound annual growth rates of 2.5 % calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data.

Source: Aerial Imagery - Google Earth Pro
Road and Train Network - © Mapinfo Australia Pty Ltd and PSMA Australia Ltd

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INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

KEY ROAD NETWORK

URS

Figure: **15-1**

File No: 43177771.067.mxd Drawn: STB Approved: WM Date: 31/08/2012 Rev. A A4

15.3.3 Intersection Performance

In 2011 the Tourle Street/Industrial Drive intersection had been identified as operating close to capacity. The problematic lanes appear to have been the through movement on Industrial Drive (west), the right turn movement from Industrial Drive (east) into Tourle Street and the right turn movement from Tourle Street into Industrial Drive (west). **Table 15-3** presents the intersection performance of the Tourle Street/Industrial Drive intersection during existing conditions.

Table 15-3 2011 Existing Conditions at Industrial Drive / Tourle Street Intersection

Year	Time of Day	Degree of Saturation	Average Intersection LOS	Worst Performing Movement
2011	AM	0.88	B	Industrial Drive West Through
2011	PM	0.91	C	Industrial Drive West Through

15.3.4 Existing Parking Provision

A site visit undertaken in November 2011 confirmed that there is sufficient visitor and employee car parking for the existing operations currently provided on the Site. There are approximately 160 spaces provided in the main car park.

15.3.5 Public Transport

Port Stephens coaches operates a service between Newcastle and Port Stephens that includes MR 108 (Cormorant Road). There are no bus stops located along Cormorant Road. The closest bus stop to the Site is located on Teal Street at its intersection with Sandpiper Court approximately 1.3 km from the Site. Route 118 connects Newcastle to Stockton via Tourle Street, Cormorant Road and Teal Street.

The Stockton to Newcastle ferry operates three services per hour during peak periods and two services per hour at other times between Mitchell Street Wharf, Stockton and Queen's Wharf, Newcastle.

15.3.6 Rail Freight

The Kooragang Island mainline runs along the length of Kooragang Island (refer to **Figure 15-1**). The mainline is currently used for the transportation of coal from various sources in the Hunter Valley to the existing coal loader facilities. It also connects to the NSW rail network and inter State freight network, providing rail transport links to Sydney, Brisbane and beyond. A number of rail spurs, some of which are disused, service different parts of Kooragang Island.

15.3.7 Port of Newcastle

In addition to the road network, Kooragang Island can also be accessed through a number of NPC Berths. The Port of Newcastle currently accommodates approximately 1,860 ship movements per year across a number of wharfs. Kooragang No. 2 Berth (K2) operated by P&O is used for the shipment of bulk cargo, bulk liquids, general cargo and containers. The existing facilities at K2 berth include:

- Two ship unloaders;
- 18 tonne gantry grab;
- Design throughput (combined) 650 tonnes per hour; and
- One ship loader.

There is storage adjacent to the berth. K2 currently handles approximately 145 ships per year.

Kooragang No. 3 Berth (K3) operated by Kooragang Bulk Facilities (KBF) is used for the shipment of bulk cargo, general cargo and containers. The existing facilities at K3 include two pneumatic loaders. K3 currently handles approximately 75 ships per year.

15.4 Assessment of Impacts

15.4.1 Construction Phase Impacts

Construction Activities

The construction stage of the Project would involve the import and installation of various Project related components. A detailed account of the construction process is included in **Chapter 5 Construction**.

Vehicle Routes

The main existing access to the Site is via Heron Road. This entrance would be used by construction traffic during initial Site preparation works. It is, however, proposed to construct a new Site entrance on Greenleaf Road. This would be used to access the main construction works. From either access point, vehicles would access Kooragang Island from the north over Stockton Bridge and Teal Street, as well as from the south via Tourle Street and Tourle Street Bridge.

Construction Staff Movements

It is estimated that during the construction phase there would be a maximum of approximately 340 construction staff. Therefore IPL proposed to limit the number of construction vehicle movements to the Site and operate a park and ride service during the construction phase. Under this scenario approximately 80 car park spaces would be available within the existing Site car park for use by the construction workforce with the remainder of the workforce travelling to the Site in buses operating between the Site and appropriate local transport hubs or suitable alternative locations.

Although construction traffic would not coincide with network peak period traffic, for purposes of this analysis, a worst case scenario has been assessed whereby the park and ride service would operate during the network peak hours 8 to 9 am and 5 to 6 pm.

Other Construction Traffic

The majority of the Project components would be delivered to the Site through the port via the Custom Transportable Buildings (CTB) berth on the eastern edge of Kooragang Island. Other deliveries would be made by road. **Table 15-4** provides the daily road traffic movements associated with the construction phase.

Ship Movements

Project components delivered by ship would be delivered to Newcastle Harbour on ocean going ships before being transferred to barges, moored at Kooragang Island and transferred to the Site. The modules are likely to be transferred from the ships onto the barges at the NPC Western Basin berths. The barges would then move the modules to the CTB wharf at 64 Greenleaf Road for unloading and transport to the Site. There are expected to be approximately 60 modules in total; these would require a maximum of 9 ship movements into Newcastle Harbour and maximum of 30 barge movements.

Table 15-4 Construction Transport Daily Vehicle Movements

Phase		Vehicle Class	Vehicles Per Day
1	Site Preparation& Civil Work	Heavy Vehicles (SPMTs, Low Loaders, Over Dimensional loads)	2
		Trucks (Semis, Large Trays etc.)	60-80
		Buses	8-10
		General Vehicles (Cars, Utes, General transport)	40
2	Module Installation	Heavy Vehicles (SPMTs, Low Loaders, Over Dimensional loads)	4
		Trucks (Semis, Large Trays etc.)	20-30
		Buses	15-20
		General Vehicles (Cars, Utes, General)	80
3	Mechanical/Piping Electrical/Instrument Installation	Heavy Vehicles (SPMTs, Low Loaders, Over Dimensional loads)	0
		Trucks (Semis, Large Trays etc.)	10-15
		Buses	15-20
		General Vehicles (Cars, Utes, General)	80
4	Pre-commissioning and Commissioning	Heavy Vehicles (SPMTs, Low Loaders, Over Dimensional loads)	0
		Trucks (Semis, Large Trays etc.)	2
		Buses	6-8
		General Vehicles (Cars, Utes, General)	50

Construction Impacts

The potential construction traffic impact has been assessed by calculating the baseline LOS in 2014. A 2.5% annual growth factor has been applied to the 2011 traffic volumes to predict the 2014 background traffic volumes. The estimated construction traffic from the Project can then be added to the calculated 2014 traffic figures. The predicted impact on the LOS for the midblock and intersections during the construction phase of the Project was then determined.

Midblock LOS Impacts

The majority of construction workers are expected to travel from the Newcastle area. They are likely to access the Site via Industrial Drive and Tourle Street, consequently Industrial Drive and Tourle Street have been identified as being the most vulnerable to impact from construction traffic. For the purposes of this assessment, it is assumed that all but a maximum of 80 construction workers would travel to the Site using the proposed park and ride services. On this basis, the impact that the construction stage of the Project would have on key roads surrounding the Site with respect to increased traffic volumes is presented in **Table 15-5.**

Table 15-5 2014 Midblock Impact Assessment of AM Peak Hour Vehicle Movements (two way)

Road	2014 Background Traffic [1]			2014 With Construction Traffic	
	Peak Hour Flows (two-way)	Peak Direction Flow (vehicles per lane) [2]	LOS	Peak Direction Flow (vehicles per lane) [2]	LOS
Tourle Street/ Cormorant Road	3,193	1,916	F	2,020	F
Industrial Drive (West)	2,927	878	C	886	C
Industrial Drive (East)	4,944	1,483	E	1,583	E

Notes:

1. Based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.
2. Assuming a 60:40 split in peak direction travel.

The assessment shows that the LOS on the identified roads is not likely to reduce as a result of the construction phase of the Project and would therefore the local highway network would not require any specific mitigation measures.

Intersection Assessment

The expected impact on the pre-identified, worst performing, intersections are shown in **Table 15-6**.

Table 15-6 2014 Peak Construction Year Intersection Performance

Time of Day	2014 Background		2014 With Construction Traffic		
	Degree of Saturation	Average Intersection LOS	Degree of Saturation	Average Intersection LOS	Worst Performing Movement
AM	0.88	B	0.89	B	Industrial Drive West Through
PM	0.91	C	0.93	C	Industrial Drive East Right Turn

Note:

Background traffic based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.

The assessment shows that the LOS on the identified intersections is not likely to suffer as a result of the construction phase of the Project. It is therefore considered that there would be no significant traffic impacts relating to the additional vehicular movements associated with the peak construction activities at the Site.

Parking Provision

During the construction phase 80 spaces within the existing car park would be specifically allocated for contractor parking. The rest of the construction personnel would travel to the Site by park and ride bus. Parking for trucks during construction would be provided within the Lot. The existing parking provision on the Site is sufficient for the construction phase.

15.4.2 Operational Phase

Operational Activities

The Site would operate 24 hours per day, seven days per week. Ammonia would be delivered to the Site by ship and also, to a lesser extent, by road. Delivery of anhydrous liquid ammonia to the Site by ship would occur at the new NPC dolphin berth between the existing K2 and K3 berths on Kooragang Island, with ammonia being transferred from ship via pipelines connecting the wharf to the Site. Ship docking would be an irregular activity occurring approximately eight times per year.

TGAN and ANSOL would be distributed from the Site by road using B-Double trucks. The operational traffic generated by the Project would consist of approximately 35 heavy goods vehicles per day.

It is anticipated that the hours for employees arriving and leaving the Site would be between 5:30 am and 7 am and between 4 pm and 5 pm.

Operation Impacts

It is predicted that the Project would be operational in 2015; therefore a 2.5% annual growth factor has been applied to the 2011 traffic volumes to predict the 2015 background traffic volumes. In addition, a future design year assessment has also been completed to assess midblock and intersection performance in 2024, ten years after peak construction.

2015 Midblock LOS Impacts

The impact that the operational stage of the Project would have on key roads between the Site and the IPL Warkworth facility is presented in **Table 15-7**.

Table 15-7 2015 Midblock Impact Assessment of AM Peak Hour Vehicle Movements (two-way)

Road	2015 Background Traffic [1]			2015 with Operation	
	Peak Hour Flows (two-way)	Peak Direction Flow (vehicles per lane) [2]	LOS	Peak Direction Flow (vehicles per lane) [2]	LOS
Tourle Street/ Cormorant Road	3,272	1,963	F	1,977	F
Industrial Drive	3,000	900	C	914	C
Old Pacific Highway	5,067	1,520	E	1,534	E
New England Highway	5,399	1,620	F	1,634	F
Golden Highway	442	133	A	147	A

Notes:

1. Based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.
2. Assuming a 60:40 split in direction of travel during the peak hour.

Analysis of assessment results contained in **Table 15-7** indicate that operational traffic on the route between the Site and the Hunter Valley would not result in an increase in traffic sufficient to change the existing LOS of the highway network and would therefore not require any mitigation measures.

2015 Intersection Assessment

The expected impact on the pre-identified, worst performing, intersections are shown in **Table 15-8**.

Table 15-8 2015 Peak Operation Year Intersection Performance

Time of Day	2015 Background		2015 With Operational Traffic		
	Degree of Saturation	Average Intersection LOS	Degree of Saturation	Average Intersection LOS	Worst Performing Movement
AM	0.90	B	0.90	B	Industrial Drive East Right Turn
PM	0.93	C	0.93	C	Industrial Drive East Right Turn

Note:

Background traffic based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.

The assessment shows that the LOS on the identified intersections is not likely to change as a result of the operation phase of the Project. It is therefore considered that there would be no significant traffic impacts at the intersection associated with the operational phase.

2024 Midblock LOS Impacts

The impact that the Project would have on key roads between the Site and the Hunter Valley, during the 2024 design year, is presented in **Table 15-9**. An annual growth rate of 2.5% has been applied to the background traffic levels to predict 2024 traffic levels.

Table 15-9 2024 Midblock Impact Assessment of AM Peak Hour Vehicle Movements

Road	2024 Background Traffic [1]			2024 with Operation	
	Peak Hour Flows (two-way)	Peak Direction Flow (vehicles per lane) [2]	LOS	Peak Direction Flow (vehicles per lane) [2]	LOS
Tourle Street/ Cormorant Road	4,087	2,452	F	2,466	F
Industrial Drive	3,747	1,124	D	1,138	D
Old Pacific Highway	6,328	1,899	F	1,913	F
New England Highway	6,743	2,023	F	2,037	F
Golden Highway	552	166	A	180	A

Notes:

1. Based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.
2. Assuming a 60:40 split in direction of travel during the peak hour.

Analysis of assessment results contained in **Table 15-9** indicate that operational traffic on the route between the Site and the Hunter Valley in 2024 would not result in an increase in traffic sufficient to change the existing LOS of the highway network and would therefore not require any mitigation measures.

It should be noted that the future route between the Site and the Hunter Valley would utilise the new Hunter Expressway scheduled to open in late 2013, which would provide a higher capacity, direct and efficient route for freight movements between the Hunter Valley and the Port of Newcastle. Equally RMS is working on identifying short term and longer term options to improve traffic flow across Kooragang Island. Most recently this has been evidenced by the widening of Cormorant Road in 2011. RMS is also planning for the duplication of Cormorant Road and Tourle Street in the longer term.

2024 Intersection Assessment

Table 15-10 illustrates the intersection performance during the 2024 design year for both the AM and PM peak hours.

Table 15-10 2024 Design Year Intersection Performance

Time of Day	2024 Background		2024 With Project Traffic		
	Degree of Saturation	Average Intersection LOS	Degree of Saturation	Average Intersection LOS	Worst Performing Movement
AM	1.1	F	1.1	F	Industrial Drive East Right Turn
PM	1.1	F	1.1	F	Industrial Drive East Right Turn

Note:

Background traffic based on compound annual growth rates calculated from RMS Stockton Bridge automatic count location between 2004 and 2010 AADT data and the assumption that approximately 10% of the AADT represents the peak traffic volume.

The assessment shows that the LOS on the identified intersections is not likely to change as a result of operation of the Project in 2024. It is therefore considered that there would be no significant traffic impacts at the intersection associated with the operational phase. The fact that demand exceeds capacity is due to the level of future year background traffic rather than Project traffic.

Parking Provision

The existing car park on the Site contains 160 spaces. During operation, the Site would employ approximately 100 personnel and up to 60 contractors. Certain additional parking is provided in other parts of the Lot, therefore it can be concluded that the parking provision on the Site would be sufficient for operation.

Whilst trucks would not be expected to park on the Site during operation, some limited truck parking would be provided on widened internal roads within the Lot.

15.4.3 Ship Movements

The construction and operation of the Project would require a number of ship and barge movements. Newcastle Port Corporation are currently developing a new berthing schedule that requires users of the port to provide a 12 month plan for the expected ship movements at the various berths including the Western Basin berths and the K2 and K3 berths. The exact date of ship movements in the plan would need to be confirmed two weeks prior to arrival to allow for scheduling. The expected date of ship deliveries and barge movements would need to be confirmed with NPC to allow for scheduling at the port and to avoid any constraints to port operations.

15.5 Mitigation Measures

The TIA has identified that the Project would have only a marginal additional impact on the existing road network both during construction and operation. In order to manage construction traffic, a Traffic Management Plan would be developed as part of the CEMP. A similar plan would also be developed during commissioning of the Project for the operation of the Site. These Traffic Management Plans would include:

- hours of permitted vehicle activity;
- designated routes for construction and operational traffic and defined access points to the Site;
- designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction;
- sequence for implementing traffic works and traffic management devices should these be required; and
- procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.

Details regarding the proposed park and ride service during the construction phase and the process for informing NPC of any future ship or barge movements would also be provided.

15.6 Cumulative Effects

The Project could result in a minor increase in vehicle movements when compared with predicted background conditions. Therefore a cumulative traffic assessment has been completed which considered cumulative projects along Tourle Street / Cormorant Road / Teal Street that could also affect the LOS in 2014 when the Project is in its construction phase.

Six projects were identified with potential to have a cumulative effect upon this section of the road network. A summary of traffic generated by these cumulative projects is presented in **Table 15-11**.

Table 15-11 AM Peak Hour Cumulative Project Traffic Generation

Development	Cormorant Road / Tourle Street	Industrial Drive
Dredging and remediation of the Hunter River	40	-
Kooragang Coal Loader Project	30	-
PWCS Coal Loader Expansion T4 Project	240	-
Orica Expansion Project	20	-
Gloucester Gas Project	-	-
Newcastle Gas Storage Facility	-	-
Bulk Fuel Storage	-	14
Total	**330**	**14**

Table 15-12 provides an indication of the likely cumulative impact on the surrounding road network during the peak construction phase.

Table 15-12 AM Peak Hour Cumulative Impacts

Road	2014 Background Traffic		2014 With Project Construction Traffic		2014 with Project and Cumulative Projects	
	Peak Direction Flow per lane	LOS	Peak Direction Flow per lane	LOS	Peak Direction Flow per lane	LOS
Tourle Street	1,916	F	2,020	F	2,350	F
Industrial Drive (West)	900	C	914	C	928	C
Industrial Drive (East)	1,483	E	1,583	E	1,597	E

As shown in **Table 15-12**, the LOS for the peak construction year remains unchanged when considering the relevant cumulative projects. The Tourle Street / Industrial Drive intersection operates close to capacity with the addition of Project traffic. The further addition of traffic relating to cumulative developments may mean that some additional delay is caused to traffic using this junction; however the cumulative scenario does not result in a change in LOS across this intersection. Therefore no significant cumulative adverse traffic impacts are expected as a result of the Project.

15.7 Proposed Management and Mitigation Measures

This section provides an opportunity to give a brief conclusion to the chapter and then to outline in a table format the various measures presented in the chapter.

Table 15-13 Management and Mitigation Measures – Traffic and Transport

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Traffic Management Plan (TMP) would be produced as part of the CEMP for the Project. This TMP would outline: • hours of permitted vehicle activity; • designated routes for construction traffic and defined access points to the Site for each construction stage; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic works and traffic management devices should these be required; and • procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.		✓	
The TMP for the construction phase would include details of the construction personnel park and ride service. Details would include drop off and pick up locations and timings, as well as identification of an appropriate 'parking' location.		✓	
A Traffic Management Plan (TMP) would be produced as part of the OEMP for the Site. This TMP would outline: • hours of permitted vehicle activity; • designated routes for operation traffic and defined access points to the Site; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic works and traffic management devices should these be required; and • procedures and/or principles for vehicle speed limits and the safe operation vehicles.			✓
During construction, barge movements from the western berths to the CTB wharf would be discussed with NPC to ensure that any movements did not conflict with port operations.		✓	
During construction, traffic movements along NPC managed roads would be managed in liaison with NPC. A licence to move modules from the CTB wharf to the Site would be sought from NPC.		✓	
During operation all ship movements would be prescheduled for entry to the port and would undertake pilot assisted navigation to the appropriate berth with berthing movements assisted by tugs.			✓

16 Waste Management

16.1 Introduction

The DGRs require an assessment of waste to include the '*classification of all potential sources of liquid and non-liquid wastes, quantities, storage, treatment and disposal or reuse*'. The DGRs also ask that the Project have regard to the requirements of section 45 of the *Protection of the Environment Operations Act 1997* and provide sufficient information to enable NSW OEH to determine appropriate limits for the revised EPL which will apply to both the existing IPL operations on the Site and the new facilities on the Site. This chapter identifies and assesses the streams, volumes and impacts of waste generated from the construction and operation of the Project. The chapter also describes the proposed waste mitigation and management procedures to be implemented as part of the Project.

16.2 Legislation and Planning Policy

16.2.1 Commonwealth Requirements

National Waste Policy: Less Waste, More Resources (EPHC 2009)

The *National Waste Policy: Less Waste, More Resources* (EPHC, 2009) builds on the 1992 *National Strategy for Ecologically Sustainable Development* (ESD) (COAG, 1992) commitments to improve the range, variety and quality of environmental resources and reduce the environmental impacts of waste disposal.

The aims of the National Waste Policy are to:

- Avoid the generation of waste and reduce the amount of waste (including hazardous waste) for disposal;
- Manage waste as a resource;
- Ensure that waste treatment, disposal, recovery and re-use is undertaken in a safe, scientific and environmentally sound manner; and
- Contribute to the reduction in greenhouse gas emissions, energy conservation and production, water efficiency and the productivity of the land.

This policy drives accurate business reporting to the National Pollutant Inventory.

National Environment Protection Measures (Implementation) Act 1998

Under the *National Environment Protection Measures (Implementation) Act 1998*, the National Environmental Protection Council (NEPC) was established to set national environmental goals and standards for Australia through the development of National Environment Protection Measures (NEPMs). The NEPMs outline a set of national objectives for protecting or managing particular aspects of the environment, through a combination of goals, guidelines, standards, and protocols.

The following NEPMs are relevant to this Project:

- **National Environment Protection Measure (Movement of Controlled Waste between States and Territories)** - The goal of NEPM (Movement of Controlled Waste between States and Territories) is to reduce the environmental impacts resulting from the movement of controlled wastes from one state or territory into another by establishing a nationally consistent management system comprising tracking systems, prior notification systems and licensing of transporters and regulation of producers and facilities.

- **The National Environment Protection (National Pollutant Inventory) (NPI) Measure** - The National Pollutant Inventory (NPI) National Environmental Protection Measure (NEPM) (NEPC, 2008) establishes goals to assist in reducing existing and potential impacts of certain substances being emitted to air, land and water. Where the use of an NPI substance triggers the established threshold for that substance, emissions of that substance must be reported to the NPI. An internet database provides publicly available information on the types and amounts of certain substances being emitted. In 2008, the NPI NEPM was varied to require mandatory reporting of NPI substances in waste transferred to a destination for containment or final disposal. Emissions to land, air and water from the Project would be reported annually in accordance with the NPI Guide (DSEWPaC, 2011).

16.2.2 State Legislation and Policy

Protection of the Environment Legislation Amendment Act 2011 (NSW)

The *Protection of the Environment Legislation Amendment Act 2011(NSW)* (PELA Act) received assent in NSW in November 2011. This Act amends the *Protection of the Environment Operations Act 1997 (NSW)* (POEO Act) and aims to improve the reporting and management of pollution incidents in NSW.

Key changes from the POEO Act include the stricter notification requirements for pollution incidents and new duties to prepare and implement pollution incident response management plans (PIRMPs). These changes apply to holders of environment protection licences under the POEO Act and appropriate persons who undertake activities resulting in a pollution incident.

The PELA Act also introduces a new Part 5.7A of the POEO Act which requires licensees to prepare PIRMPs in relation to each licensed activity. Licensees must also ensure that the PIRMP is kept at the premises to which it relates, it is tested in accordance with the Regulations and it is implemented when a pollution incident occurs.

Protection of Environment Operations Act 1997

The *Protection of Environment Operations Act 1997* (POEO Act) defines 'waste' for regulatory purposes and establishes management and licensing requirements along with offence provisions to deliver environmentally appropriate outcomes. The Act also establishes the ability to set various waste management requirements via the *Protection of the Environment Operations (Waste) Regulation 2005* (POEO Waste Regulation).

Section 45 of the POEO Act requires that this assessment consider the following matters relevant to waste management.

- Protection of the environment policies;
- Pollution caused or likely to be caused by the Project and the likely impact of that pollution on the environment;
- Practical measures that could be taken;
- Licence application; and
- Waste strategy in force under the *Waste Avoidance and Resource Recovery Act 2001*.

Following extensive consultation, the POEO Waste Regulation introduced a mechanism on 28 April 2008 for recognising genuine resource recovery in NSW. Exemptions allowing land application and thermal application of waste-derived material were introduced under Section 51.

The POEO Waste Regulation also sets out provisions covering the way waste is managed in terms of storage and transportation as well as reporting and record keeping requirements for waste facilities. It provides for contributions to be paid by the occupiers of licensed waste facilities for each tonne of waste received at the facility or generated in a particular area; exempts certain occupiers or types of waste from these contributions; and allows deductions to be claimed in relation to certain types of waste. The Regulation also makes special requirements relating to asbestos and clinical waste.

It is the responsibility of those who generate the waste to classify it. To assist waste generators classify the wastes they produce, OEH has developed the *Waste Classification Guidelines (DECC)*, which outline a clear and easy-to-follow, step-by-step process for classifying waste under the current classification system.

Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) promotes waste avoidance and resource recovery by developing strategies and programs such as the extended producer responsibility scheme for industry. It defines the waste hierarchy ensuring that resource management options are considered against the following priorities:

- Avoidance including action to use resources efficiently and reduce the amount of waste generated;
- Resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources; and
- Disposal including management of all disposal options in the most environmentally responsible manner.

NSW Waste Strategy 2007

The NSW Waste Strategy 2007 proposes priority areas and actions to guide the work of key groups in NSW in contributing to the minimisation of environmental harm from waste disposal and through the conservation and efficient use of our resources. It also includes a performance report set against the recycling and other targets set in 2003 and key programs implemented in NSW during this time.

16.3 Assessment Methodology

The waste assessment involved an analysis of the Project to identify potential or likely waste streams and volumes arising from the construction and operation of the Project. The assessment has been completed using information provided by the Proponent and the requirements of legislation and policy outlined above.

16.4 Existing Environment

The existing operation on the Site acts as a primary distribution centre (PDC) that receives, stores, blends, bags, and despatches both bulk and bagged solid and liquid fertilisers, handling approximately 155,000 tonnes per annum. The existing operation produces and manages the following waste streams:

- general waste;
- scrap metal;
- paper;
- plastics;
- fertiliser spillages;
- storage tank bund water;
- asbestos;
- waste oils;
- tyres; and
- batteries.

Current waste management procedures for waste streams generated during existing operations are shown below in **Table 16-1**.

Table 16-1 Existing Waste Management Procedures

Waste Stream	Volume	End use	Waste Contractor
General waste	42 tpa	Disposal at Landfill	Cleanaway
Scrap metal	7 tpa	Recycled	Sims Metals
Paper & Plastics	5 tpa	Recycled	Veolia Environmental Services
Asbestos	As required	Disposal at licenced landfill	Veolia Environmental Services
Waste oils	<1,000 lpa	Recycled	Transpacific
Tyres	Not currently measured	Unknown	Contract maintenance provider
Waste batteries	Not currently measured	Unknown	Contract maintenance provider
Fertiliser spillages and street sweeper waste	Not currently measured	Recycled on-site or disposal at landfill	Transpacific
Storage tank bund stormwater	Not currently measured	Stormwater, infiltration or licenced disposal	Transpacific

These waste streams are managed by adherence to the following Site management plans and procedures:

- Waste Management Plan;
- Disposal of Hazardous Waste Procedure;
- Sulphuric Acid Spill Management Plan;
- Solid Fertiliser Spill Management Plan; and
- Bund Water Discharge Procedure.

16.5 Impact Assessment

16.5.1 Waste Streams

Construction and operation of the Project would generate a number of waste streams. This section of the chapter describes the likely waste streams, volumes and characteristics in order identify potential impacts. The characteristics of the waste streams have been determined based on Project specific information and data from similar projects of this type and scale.

16.5.2 Construction Phase

The construction phase for the Project is scheduled to occur over a 28 month period. A number of construction activities (refer to **Chapter 5 Construction**) could potentially result in the generation of various waste streams. The main waste streams that would be generated during the construction phase of the Project are discussed in **Table 16-2**. Conservative estimates for waste generation for the construction phase of the Project are also presented in **Table 16-2**. These estimates have been based on information from the proponent and accepted volumes for various waste streams from construction and operation of similar projects.

16.5.3 Operational Phase

The operational phase of the Project would generate a number of waste streams. Wastewater from the Project would be treated and disposed of through a discharge to south arm of the Hunter River. Impacts related to this waste stream are discussed in **Chapter 13 Surface Water and Wastewater**. Potential impacts related to discharges to air are discussed in **Chapter 10 Air Quality**. Other waste streams would be generated from the Project processes, associated industrial activities, maintenance of the Project, administration activities and associated services (e.g. water treatment and sewage treatment). Operational waste streams and their potential volumes are discussed in **Table 16-3**.

16.5.4 Identification of Waste Impacts

Given the characteristics and volume of waste expected during the construction and operational phases of the Project, the following potential impacts could occur:

- water pollution caused by the release or spills of liquid waste, either directly or indirectly via stormwater run-off, to receiving waters from waste contaminated areas/sites;
- soil and water (surface and groundwater) contamination as a result of spills or inappropriate storage, handling, transportation and disposal of solid and liquid wastes;
- impacts on local wildlife as a result of mismanaged waste through ingestion of waste or entrapment;
- increased population of vermin and spread of disease from inappropriate storage and handling of wastes;
- odours caused by improper storage and treatment of putrescible wastes;
- visual amenity impacts caused by poorly executed land clearing activities and inappropriate storage of waste; and
- inefficient and careless use of resources.

Mitigation measures to manage these potential impacts are discussed in **Section 16.6** below.

Table 16-2 Construction Waste Estimates

Waste Type	Waste Group	Description	Projected Volume	Notes
Soils	Inert material	Soils would be excavated during construction. Removed soils would be reused around the Site.	Limited excess soils are expected	Soil management is discussed in **Chapter 12 Soil and Groundwater**.
Green waste	Organic materials	Green waste includes vegetation that is cleared from the land. Construction of the Project is likely to lead to the generation of green waste.	Limited green waste is expected	-
Construction material (e.g. pipe offcuts, concrete, timber, pallets)	Inert material	Construction material includes waste created during the construction process. This includes pipe offcuts from installation of machinery and timber and pallets used in the delivery of Project components. Where practical, recyclable aspects of the construction material wastes would be removed and recycled.	300 m^3	Estimated figure considering soil conditions, piling activities and characteristics of Project foundations.
Scrap Metal	Recyclable		250 tonnes	-
Wood, Paper & Packaging	Recyclable		1,000 tonnes	Considering density of 0.6 te/m^3 (approx.) wood waste is estimated to be 1,666 m^3
Plastic	Recyclable		12 m^3	-
Hazardous Waste (oil rags, paints, contaminated soils etc.)	Regulated Waste	Hazardous wastes produced by the Project consist of materials contaminated with oils and paints. Materials such as cloths, metals and soils would be treated as regulated waste and separated from other inert and recyclable waste products.	34 m^3	-
Waste Oils	Regulated Waste	Waste oils would also be produced in the construction phase of the Project as components are installed and tested prior to commissioning.	5.8 m^3	-
Sanitary / Greywater	Regulated Waste	Sanitary wastes would be treated within the existing septic tanks or collected and treated off-site. The amount of sanitary waste and grey water would increase along with the number of construction staff on the Site, the fluctuations in construction staff on the Site is outlined in **Chapter 5 Construction**.	20.85 m^3/day	Estimation based on 150L/person/day and an average workforce of 139 per day over the 28 month construction phase
General Waste including putrescibles	General Waste	The amount of general waste and putrescibles associated with the construction of the Project would fluctuate as the construction progresses. General and putrescible waste would typically comprise food scraps, paper and cardboard, glass, aluminium cans, plastics and packaging.	175kg/day	Estimation based on 1.25kg/person/day and an average workforce of 139 per day over the 28 month construction phase

Table 16-3 Operation Waste Estimates

Waste Type	Waste Group	Description	Projected Volume	Notes
Green waste	Organic materials	Minimal volumes of green waste may be generated from the upkeep and maintenance of the Site and associated landscaping activities.	Minimal	Resulting from general land maintenance activities.
Maintenance waste	Inert material	During the operation of the Project it is anticipated that minor quantities of waste would be generated by scheduled maintenance.	Minimal	Resulting from general maintenance activities.
Hydrocarbon waste	Regulated Waste	Hydrocarbon waste materials would comprise used solvents, oils and lubricants produced from facility's processing activities and general maintenance as well as any oil removed from the Project's waste water system. The waste water system is expected to produce less than 1,000 L of oil each month. Hydrocarbon wastes would be collected into suitably bunded storage tanks and/or drums and disposed of off-site by a licensed contractor for reprocessing, recycling or final disposal. The AN Plant would use approximately 150 x 200 L drums of external additive per month.	1 m^3 / month	-
Waste oil and chemical drums	Regulated Waste		150 x 200 L drums 20 x 20 L drums	-
Oily Water	Regulated Waste	Oily water with traces of ammonia would be generated from the ammonia stripper.	0.6 m^3 / day	-
Sanitary waste	Regulated Waste	Sewage would be generated from the administration buildings and amenities. Black and grey water for each proposed building would be treated in individual septic tanks and via NCC approved sewage treatment systems.	24 m^3 / day	Estimation based on 150 L/person/day with a workforce of 160.
General Waste including putrescibles	General Waste	General municipal waste would be generated from the administration facilities and would typically comprise food scraps, paper and cardboard, glass, aluminium cans, plastics and packaging.	200 kg/day	Estimation based on 1.25 kg/person/day with a workforce of 160.

Waste Type	Waste Group	Description	Projected Volume	Notes
Plant Process Waste	Regulated Waste	Waste ANSOL and contaminated AN prill that cannot be recycled in the AN plant would be stored and concentrated on-site before being transported to the IPL facility at Warkworth in Hunter Valley for manufacture of fertiliser solutions.	4,500 t / yr	-
		The AN plant uses approximately 1000 x 25 kg bags of internal additive per month.	6 m^3 / mth	-
Spent Catalysts and Demin Resins	Regulated Waste	The NA plant oxidation catalyst and recovery gauzes would be changed every 8-10 months. The NOx abatement catalyst would be changed every 5-10 years. The N_2O abatement catalyst would be changed every 3-5 years. Demin resins would be changed every 5-10 years.	N/A	-

16.6 Mitigation Measures

16.6.1 Introduction

To manage the potential waste impacts, Waste Management Plans (WMPs) would be produced for both the construction and operational phase. These WMPs would be sub-plans to the CEMP and OEMP for the Project. During operation it is likely that a Site-wide WMP covering both existing and proposed operations would be produced. The WMPs would be based on the following overarching objectives, principles and strategies to deliver effective waste management across the Site.

16.6.2 Waste Management Objectives

The environmental objectives for the management of waste generated from the construction and operation of the Project would be to:

- minimise the waste generated throughout the lifetime of the Project and to maximise the reuse and recycling of waste materials produced; and
- store, handle, transport, and dispose of waste in an environmentally responsible manner that does not cause harm or contamination to soil, air or water.

16.6.3 Waste Management Hierarchy

The management of waste during construction and operation would be consistent with waste management hierarchy in order to achieve the environmental objectives of the Project and to minimise the potential waste impacts. The waste management hierarchy is presented below.

- **Avoid** by identifying appropriate materials and procuring;
- **Reduce** waste by optimising construction and operation methods;
- **Reuse** waste by identifying sources that can utilise the waste;
- **Recycle** waste by identifying facilities that are able to recycle waste;
- **Recover** energy from waste; and
- **Dispose** of waste at an appropriate licenced facility.

16.6.4 Cleaner Production

Cleaner production is a preventive continual environmental protection process that is designed to maximise resource efficiency and minimise waste. It involves reducing environmental impacts along the entire life cycle of a project by conserving resources (raw materials, energy and water), eliminating toxic raw materials and reducing the quantity and toxicity of all emissions and wastes. Cleaner production techniques and opportunities during the construction and operational phases of the Project include:

Construction

- Construction activities would not be expected to generate large quantities of waste as they would involve the installation of predominantly prefabricated modules which would be constructed off-site;
- Inclusion of sustainable procurement practices to ensure waste is eliminated before it is generated;
- The adoption of construction techniques that ensure minimum waste volumes are generated during construction;

- Provision of resource efficiency and waste minimisation procedures in contracts to encourage construction contractors consider environmental management objectives;
- Procurement of raw materials cut to required size from suppliers to eliminate off-cuts on-site, and the re-use of concrete formwork where feasible; and
- Provision of separate waste containers/skips to ensure waste material segregation and maximise the opportunities for re-use and recycling.

Operational

- Identification of industry best available technology (BAT) for processing techniques to ensure most efficient use of energy and resources (e.g. application of dual pressure Nitric Acid Plant process technology, that operates with mild and optimised reaction conditions and use of chilled water to reduce NO_x and maximises energy recovery) (refer to **Appendix E Air Quality and Odour**);
- Application of most efficient production processes to ensure utmost resourcefulness in the use of energy, water, and natural resources (e.g. use of process steam and condensate, energy recovery by expansion of NA plant tail gas to atmosphere, cogeneration of electricity, recycle of water and condensate streams);
- Identification and selection of energy efficient equipment at procurement;
- Minimisation of waste generated in day-to-day operations and ensuring that process residues are reused where possible or recycled (e.g. selective catalytic reduction of NO_x emissions, catalytic reduction of nitrous oxide (N_2O); recycling of process waste water streams; concentration and use of waste ANSOL streams);
- Capturing chemicals from all major vent streams and recycling back into the process;
- Safe storage and bunding of all chemicals including a double wall double integrity refrigerated liquid ammonia tank that is best available technology;
- Safe disposal of residual waste and process residues ensuring least amount of harm to surrounding environment; and
- Promotion of safe handling procedures in line with regulations and industry practices.

16.6.5 Waste Minimisation

Waste prevention and minimisation would be implemented, where feasible, through the consideration of alternative materials and products, using cleaner production and construction techniques, and the application of sustainable procurement practices including the provisions of contracts encouraging sustainable waste management practices and performance targets for contractors.

The design of the Project has already minimised waste in a number of ways. During the construction phase potential waste streams would be minimised by:

- importing pre-constructed Project components or modules on to the Site; and
- ensuring that construction equipment is kept in good working order to reduce waste oils and other chemicals.

During the operation phase potential waste streams would be minimised by:

- investing in a dual pressure NA process technology that improves conversion efficiency and increases the effective life of the NA oxidation catalyst;
- recycling waste ANSOL and AN prill fines and over-size where possible to reduce process waste; and
- reusing steam condensate and water streams to reduce liquid effluent from the Project.

Other waste minimisation options would be identified as the Project progresses and would be detailed within the WMP.

16.6.6 Source Separation and Segregation

The identification and separation of solid waste would be carried out at point of generation to aid the maximum reuse and recycling of materials. Appropriate containers and bins would be provided across the Site during construction and operation for reusable and recyclable materials. These containers would be clearly marked and identifiable to Site workers. All containers and bins would be placed in allocated areas. Once segregated and stored in suitable containers the wastes would be reused, recycled or disposed on-site or off-site as required.

All waste materials generated during the construction and operational phases of the Project, would be identified and classified in line with the *Waste Classification Guidelines* (DECC, 2008).

16.6.7 Waste Reuse

The reuse of waste would be achieved through identifying reuse opportunities on-site and subsequently identifying market demands for waste materials. During construction, opportunities to reuse packaging materials and surplus materials, such as timber and scrap metal would be investigated. Excavated soils would be appropriately stockpiled and reused during landscaping works. During operation, waste ANSOL would be collected, converted off-site to urea ammonium nitrate (UAN) then sold to the market as liquid fertiliser.

Throughout the Project, investigations into reuse opportunities would continue, both at the Site and with local businesses/industries. Additionally, the marketability of wastes would be regularly reviewed to ensure potential new and emerging opportunities for waste reuse are identified and maximised.

16.6.8 Waste Recycling and Recovery

The market demand for recyclables would be investigated and assessed before and during construction and operation of the Project. This assessment would consider the availability and capacity of local recycling facilities. **Table 16-4** below provides an indication of the recyclable product from construction and operation, potential end use and a qualitative assessment of the marketability of some waste streams.

Table 16-4 Recyclability of Project Waste Streams

Recyclable material	Potential end use	Potential marketability
Waste oils	Waste oils would be managed by a licensed third party recycling contractor. The oils would be taken from the Site, processed and distilled to produce re-refined base oil suitable for use as a lubricant, hydraulic or transformer oil.	Medium marketability for waste oil recycling
Construction materials (e.g. pipe off cuts, concrete, timber, pallets)	Construction materials would be managed by a licensed third party recycling contractor.	Low marketability. Dependent on the nature of the waste.
Paper and cardboard	Paper and cardboard waste would be managed by a licensed third party recycling contractor. The products would be removed from the Site and taken to a material recovery facility to sort to specifications, baled, shredded, crushed, or otherwise prepared for resale.	Medium marketability. Demand from Australian and global markets is unstable and will fluctuate.
Scrap (ferrous) metal	Scrap (ferrous) metal would be managed by a licensed third party recycling contractor. The product would be removed from the Site, shredded and either re-smelted or used in the smelting process. Any grade of steel can be recycled to top quality new metal.	High marketability. Continual high demand from local and global markets.
Scrap (non-ferrous) metal	Scrap (non-ferrous) metal would be managed by a licensed third party recycling contractor. The product would be removed from the Site, shredded and crushed into bales for resale before being smelted and forged. There is very little property differences between recycled and virgin non-ferrous metal.	High marketability. Continual high demand from local and global markets.
Spent precious metal catalysts	Spent precious metal catalysts would be managed by third party catalyst suppliers. The product would be removed from the Site, and sent to the catalyst suppliers for recovery and reuse of the precious metals.	High marketability. Continual high demand from local and global markets.

16.6.9 Waste Disposal

The disposal of waste materials would only be considered when all other options have been explored. All waste would be handled and disposed of in a manner that causes the least environmental harm. General waste would be transported to a local licensed landfill for disposal in line with regulatory requirements. Regulated wastes would be handled by a licensed waste contractor and transported to an appropriate regulated waste facility. Existing waste management facilities and licenced waste management companies would be used to manage the identified waste streams arising from the Project.

16.6.10 Waste Management Plans

The WMPs for the CEMP and OEMP would be based on the discussion above and would:

1) Identify requirements for waste avoidance, reduction, reuse and recycling;
2) Provide procedures for handling, stockpiling, and reuse of wastes;
3) Identify disposal routes and treatment options;
4) Set out procedures for meeting legislative requirements; and
5) Set out procedures for obtaining the required approvals for the management of waste.

Table 16-5 and **Table 16-6** present the key waste management strategies for the construction and operational WMPs respectively. Waste monitoring and auditing procedures also would be outlined within the WPMs. These procedures would help assess actual waste streams, assess the success of planned waste management strategies, respond to changing circumstances and new waste streams and understand and mitigate any potential impacts. This process would also allow the WMPs to be improved if required. Inspections of the waste management areas would be conducted on a weekly basis to ensure that correct waste management procedures are being followed. Monitoring and auditing processes would be appropriately documented. A database inventory would be used to record and report all waste, volumes and management measures for all waste streams arising during the lifetime of the Project. This database would be used to inform internal and external stakeholders, and government agencies on the types and volumes of waste being generated, re-use and recycling rates, and the types and quality of substances emitted to land, water and air. Annual reporting on the emissions for the Project would be undertaken in accordance with EPL and NPI reporting requirements and included in the IPL annual Sustainability Report. Where necessary, the existing management plans for the current operation would be amended or amalgam*mated with new management plans to include the Project.

Table 16-5 Construction Phase Waste Management

Waste Type	Characteristic	Management Strategy	Disposal Options
Soils	Inert material	Soils would be stripped and stockpiled in accordance with the Soil and Erosion Management Plan and reused on-site for landscaping. Stockpiles would be located within cleared areas and away from drainage lines.	Reused during landscaping works.
Green waste	Organic materials	Temporary stockpiles would be located within cleared areas away from drainage lines. Vegetation material (including mulching) would be used for landscaping if possible.	Reused during landscaping works or sent off-site for reuse or disposal.
Construction material (e.g. pipe offcuts, concrete / rubble, timber, pallets)	Inert material	Skips would be closed during rainfall events to prevent land and water contamination. A licensed waste management contractor would be contracted to supply bins, transport waste and dispose of non-recyclable waste at local landfills. Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices. Procurement of pre-fabricated materials would be encouraged to reduce the quantity of waste where practicable. Contracts with companies would be established to encourage the opportunities for timber recycling.	Reuse – through contracts for the take-back of surplus materials and re-usable packaging with suppliers. Recyclables - transported by a licensed contractor to a recycling facility. Non-recyclable - transported by a licensed contractor to a licensed landfill.
Scrap Metal	Recyclable	Scrap metal would be segregated and stored within designated areas in the waste management areas. Local business would be encouraged to take advantage of opportunities for reuse and recycling, if available. Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices. Procurement of pre-fabricated materials would be encouraged to reduce the quantity of waste where practicable.	Transported by a licensed contractor to a recycling facility.
Wood, Paper & Packaging	Recyclable	Paper and cardboard waste would be segregated and stored within the designated waste management area. Timber waste would be segregated and stored within the waste management area. Timber would be reused on-site and/or mulched on-site for rehabilitation purposes, where possible. Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices. Contracts with companies would be established to encourage the opportunities for paper, cardboard and timber recycling.	Transported by a licensed waste contractor to a recycling facility.

Waste Type	Characteristic	Management Strategy	Disposal Options
Plastic	Recyclable	Local business would be encouraged to take advantage of opportunities for re-use and recycling, if available. Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices. Procurement of prefabricated materials would be encouraged to reduce the quantity of waste where practicable	Transported by a licensed contractor to a recycling facility.
Hazardous Waste (oil rags, paints, contaminated soils etc.)	Regulated Waste	Bins and/or drums would be designated for the storage empty containers. Chemical wastes would be stored separately to solid wastes to minimise contamination of other wastes and environment Bins and/or drums would be sealed, labelled and stored within appropriately bunded areas in accordance with AS1940 and located within waste management areas. Spill kits would be strategically located throughout the facility.	Waste to be transported to a licensed regulated waste disposal facility.
Waste Oils	Regulated Waste	Waste oils would be collected and stored in IBCs. The IBCs would be sealed, labelled and stored within appropriately bunded areas in accordance with AS1940 and located within waste management areas.	Transported by a licensed contractor to a licensed facility for recycling where possible.
Sanitary / Greywater	Regulated Waste	Sanitary / Greywater waste would be collected and stored on-site	Waste to be transported by a licensed contractor to sewage waste disposal facility.
General Waste including putrescibles	General Waste	There would be designated waste management areas for general waste storage. These would be closed to prevent land and water contamination and access for vermin. A licensed waste management contractor would be contracted to supply bins, transport waste and dispose of non-recyclable waste at licensed landfills.	Transported by a licensed waste contractor to a suitable licensed facility for reprocessing.

Table 16-6 Operation Phase Waste Management

Waste Type	Waste Group	Management Strategy	Disposal Options
Green waste	Organic materials	Green waste would be appropriately stockpiled and managed. Temporary stockpiles would be located within cleared areas away from drainage lines. Vegetation material (including mulching) would be used for landscaping if possible.	Reused during landscaping works or sent off-site for reuse or disposal.
Maintenance scrap material	Inert material	Skips would be closed to prevent land and water contamination A licensed waste management contractor would be contracted to supply bins, transport waste and dispose of non-recyclable waste at local landfills Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices Procurement of materials would be encouraged to reduce the quantity of waste where practicable Contracts with companies (for the supply of materials) would be established encouraging sustainable waste management practices Contracts with companies would be established to encourage the opportunities for timber recycling.	Re-use – through contracts for the take-back of surplus materials and re-usable packaging with suppliers Recyclables - transported by a licensed contractor to a recycling facility Non-recyclable - transported by a licensed contractor to a licensed landfill
Waste Oils	Regulated Waste	Waste oils would be collected and stored in IBCs. The IBCs would be sealed, labelled and stored within appropriately bunded areas in accordance with AS1940 and located within waste management areas Spill kits would be strategically located throughout the facility	Transported by a licensed contractor to a licensed facility for recycling where possible. Remaining waste to be transported to a licensed regulated waste facility.
Waste Oily Water from Ammonia Stripper	Regulated Waste	Waste oily water would be collected and stored in IBCs or tank. The IBCs would be sealed, labelled and stored within appropriately bunded areas in accordance with AS1940.	Transported by a licensed contractor to a licensed regulated waste facility.
Waste Oil and Chemical Drums	Regulated Waste	Drums would be labelled and stored within appropriately bunded areas in accordance with AS1940 and located in the waste management areas Contracts with companies would be established to encourage the opportunities for recycling drums	Transported by a licensed contractor to a licensed facility for recycling where possible. Remaining waste to be transported to a licensed regulated waste facility.
Sanitary/Greywater	Regulated Waste	Sanitary / Greywater waste would be periodical monitored to ensure compliance with discharge standards.	On-site disposal with a septic system in accordance with Council requirements

Waste Type	Waste Group	Management Strategy	Disposal Options
General Waste including putrescibles	General Waste	Where feasible, these wastes would be segregated to facilitate recycling by the provision of recycling bins. Residual (non-recyclable) waste would be collected in suitable containers to be disposed at a local designated waste management facility. There would be designated waste management areas for general waste storage. These would be closed to prevent land and water contamination and access for vermin. A licensed waste management contractor would be contracted to supply bins, transport waste and dispose of non-recyclable waste at licensed landfills.	Transported by a licensed contractor to a licensed facility for recycling where possible. Remaining waste to be transported to a licensed regulated waste facility.
Plant Process Waste	Regulated Waste	Waste ANSOL would be sent to the IPL facility at Warkworth in Hunter Valley for manufacture of fertiliser solutions.	Transported by a licensed contractor to IPL Warkworth facility for beneficial use as fertiliser.
		Empty bags would be collected and stored in a waste skip.	Transported by a licensed contractor to a licensed regulated waste facility.
Spent Catalysts and Demin Resins	Regulated Waste	The NA Plant oxidation catalyst and recovery gauzes would be sent to the catalyst manufacturer for precious metal recovery and recycling. The NOx abatement catalyst would be sent to a licensed landfill for disposal. The N_2O abatement catalyst would be sent to the catalyst manufacture for regeneration. Off-site management by specialized companies that can recover the heavy or precious metals through recovery and recycling processes whenever possible. Demin resins would be sent to a licenced land fill.	Transported by a licensed waste contractor to a suitable licensed facility for reprocessing or disposal.

16.7 Proposed Management and Mitigation Measures

Table 16-7 outlines the measures that would be put in place to minimise waste impacts.

Table 16-7 Management and Mitigation Measures – Waste Management

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Waste Management Plan (WMP) would be compiled as part of the Construction Environmental Management Plan (CEMP) prior to commencement of construction.		✓	
A WMP would be included in the Operational Environmental Management Plan (OEMP) for the Project. This would be compiled prior to Project commissioning.			✓
Existing management plans for the Site would be amended or amalgamated to include the Project.			✓
The WMPs for the CEMP and OEMP would: • Identify requirements for waste avoidance, reduction, reuse and recycling; • Provide procedures for handling, stockpiling, and reuse of wastes; • Identify disposal routes and treatment options; • Set out procedures for meeting legislative requirements; and • Set out procedures for obtaining the required approvals for the management of waste.		✓	✓
The WMP would incorporate principles of the waste management hierarchy and cleaner production.		✓	✓
Waste produced on-site would be separated at source and stored in suitable containers and stored in designated waste management areas. All waste would be classified in accordance with Waste Classification Guidelines (DECC, 2008).		✓	✓
A licensed waste management contractor would be used to remove waste from the Site for reuse, recycling or disposal.		✓	✓
The WMPs would set out monitoring processes and scheduled inspections of waste management areas. The WMPs would be subject to regular audits and a system would be used to record and report types, volumes and management measures for all waste streams arising from the Project.		✓	✓
Annual reporting would be undertaken on the wastes for the Project.			✓

17 Visual and Landscape

17.1 Introduction

The Visual Impact Assessment (VIA) was prepared by Green Bean Design (GBD) and is included in full as **Appendix K Visual Impact Assessment**. The assessment was required by the DGRs for the Project which requested that visual '*impacts on the nearest sensitive receivers*' are considered.

A primary objective of the assessment was to determine the likely visual impact of the Project on people living and working in or travelling through the landscape surrounding the Project. The assessment involved an evaluation of the visual character of the landscape around the Site and an assessment of the potential visual impact that could result from the construction and operation of the Project. Where required, mitigation measures were identified. This chapter summarises the VIA.

17.2 Assessment Methodology

17.2.1 Introduction

The potential visual impact of the Project would result primarily from the combination of two factors:

- The level of visibility, or extent to which the Project would be visible, from surrounding areas.
- The degree of visual contrast between the Project structures and the capability of the surrounding landscape to visually accommodate them.

The potential visual impact from particular view locations is strongly dependant on the level of visibility from that location, which in turn is dependent on a number of criteria which are defined in **Table 17-1**.

17.2.2 Visibility

Visibility is a measure of the extent to which particular Project structures would be visible from surrounding areas. It considers the sensitivity of viewers, the period of the view, view distance and context of the view.

The influence of distance on visibility results primarily from two factors:

1. With increasing distance, the proportion of the horizontal and vertical view cone occupied by the Project's structures would decline.
2. As the distance between the Project and the viewpoint increases so does the visual effect of the dust and moisture in the atmosphere. This effect tends to make constructed elements of the Project appear grey thus reducing the contrast between the Project and the background against which it is viewed.

17.2.3 Desktop study

A desktop study was carried out to identify an indicative viewshed for the Project. This was carried out by reference to topographic maps as well as aerial photographs and satellite images of the Project area and surrounding landscape. Topographic maps and aerial photographs were also used to identify the locations and categories of potential view locations that could be verified during the fieldwork component of the assessment. The desktop study also outlined the visual character of the surrounding landscape including features such as landform, elevation, landcover and the distribution of residential dwellings.

17.2.4 Fieldwork and Photography

The fieldwork involved:

- site inspections to determine and confirm the potential extent of visibility of the Project;
- determination and confirmation of the various view location categories and locations from which the Project structures could potentially be visible; and
- preparation of a record for each view location inspected and assessed.

17.2.5 Assessment of Visual Impact

The visual significance of the Project on surrounding view locations is determined by a combination of the potential visibility of the Project and the characteristics of the landscape between and surrounding the view locations and the Project. The potential degree of visibility and resultant visual impact would be partly determined by a combination of factors including:

- level of importance attributed to the landscape within and surrounding the Site;
- distance between the view location and the Site;
- period of view from view location toward the Site;
- predicted impact of the Project on existing visual amenity;
- nature of predicted impacts; and
- visual sensitivity of locations from which views toward the Project exist.

17.2.6 Photomontages

Photomontages have been prepared from four view locations to illustrate the potential visibility of the Project following construction. Photomontages provide an image that illustrates an accurate representation of a development in relation to its proposed location and scale, relative to the surrounding landscape. The photomontage locations were selected to provide representative views from within the vicinity of residential dwellings as well as publicly accessible areas including road corridors.

17.2.7 Visual Assessment

A visibility rating for each view location has been assessed and determined against the criteria outlined in **Table 17-1.**

The visual impact criteria outlined below is used as a guide to determine significance of visual impact. The significance of visual impact for each view location is also considered against other factors, which include the overall visibility of the Project from surrounding view locations.

Table 17-1 View Location Assessment Criteria

View Distance	
Long (L)	> 3 km
Medium (M)	2 – 3 km
Short (S)	0 – 2 km
View Duration	
Long term (LT)	> 2 hours
Moderate term (MT)	30 - 120 minutes
Short term (ST)	10 – 30 minutes
Predicted Impact	
Adverse (A)	Predicted impact of the Project on existing view is likely to be negative.
Neutral (N)	Predicted impact of the Project on existing view is likely to be neutral.
Beneficial (B)	Predicted impact of the Project on existing view is likely to be positive.
Nature of Impact	
Temporary (T)	Visual impact would be temporary in nature.
Permanent (P)	Visual impact would be permanent in nature.
Reversible (R)	Visual impact would be considered reversible.
Irreversible (IR)	Visual impact would be considered irreversible.
Magnitude	
High (H)	Total loss of or major change to pre-development view or introduction of elements which are uncharacteristic to the existing landscape features.
Medium (M)	Partial loss of or alteration to pre-development view or introduction of elements that may be prominent but not necessarily uncharacteristic with the existing landscape features.
Low (L)	Minor loss of or alteration to pre-development view or introduction of elements that may not be necessarily uncharacteristic with the existing landscape features.
Negligible (N)	Very minor loss of or alteration to pre-development view or introduction of elements which are not uncharacteristic with the existing landscape features (resulting in a no change situation).
Receptor Sensitivity	
High (H)	Residential locations (within residence and curtilage), schools.
Medium (M)	Public recreation areas, beaches, parks and sports grounds.
Low (L)	Motorists, Business (commercial and industrial areas).

(GBD 2012: Appendix K)

17.3 Existing Environment

17.3.1 Site Context

The Site is relatively level and is surrounded by industrial development, including the Site, the existing ammonium nitrate facility to the south, owned and operated by Orica, and other industrial developments (including Port Waratah Coal's coal loaders; Hydro Aluminium; and redundant oil tanks). Land to the east and west of the Site is owned and managed by NPC.

The visual characteristics of the landscape surrounding the Site are predominantly industrial in nature and visually dominated by the Orica ammonium nitrate facility in the southern portion of Kooragang Island. The VIA took into account additional infrastructure associated with the proposed Orica ammonium nitrate expansion project which, in addition to existing infrastructure, would also include:

- an additional Prill Tower;
- a bulk load out building; and
- a NA plant, absorber, ammonia scrubber and cooling towers.

Tree and shrub planting extends along the east and west Lot boundaries to the Heron Road and Greenleaf Road corridors which, from a street level, provides a moderate degree of visual screening to existing structures within the Lot.

17.3.2 View Locations

A series of digital photographs were taken during the course of the fieldwork to illustrate existing views to the Site from a number of locations. These panoramic images were annotated to identify key existing features located within the field of view. **Figures 4 - 6** in **Appendix K Visual Impact Assessment** provide these view images. A photomontage of the existing view and the Project image is also included below in **Plate 17-1** and **Plate 17-2** with the proposed IPL structures labelled.

Plate 17-1 View of the Project from Stockton Bridge

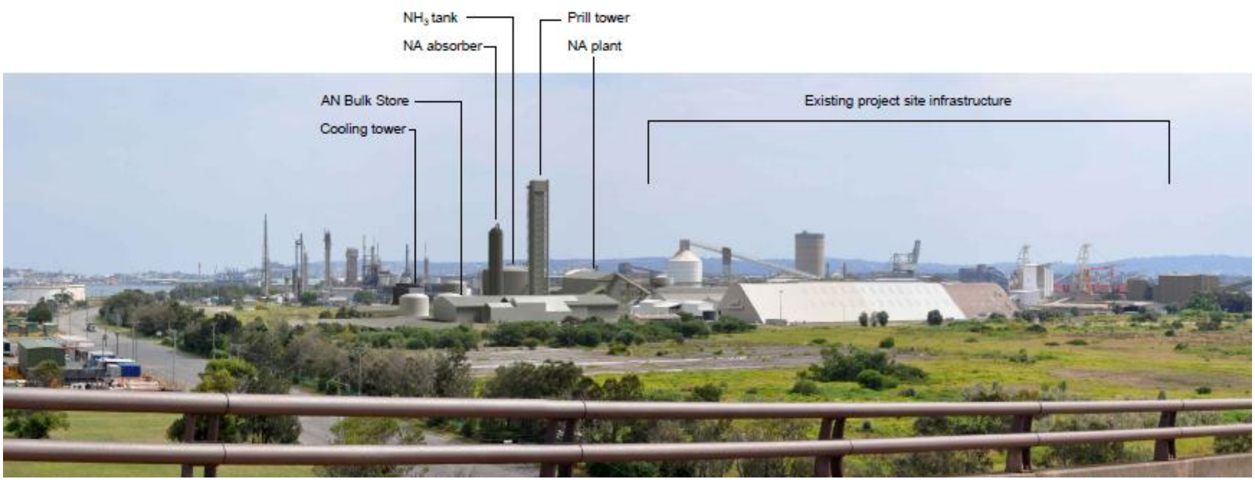


Plate 17-2 View of the Project from the Boat Ramp (West of Fullerton Street and Booth Intersection), Stockton

17.3.3 Existing light sources

Existing night time light sources are readily visible both within and surrounding the Site. Night time lights extend around the Newcastle Port loading berths, across the existing Orica ammonium nitrate facility and the Stockton Bridge. Navigation markers provide points of light along the Hunter River with lights from vehicles travelling along the local roads providing dynamic and temporary sources of light. Light sources are also available from surrounding residential and urban areas.

17.4 Impact Assessment

17.4.1 Visual Impact Assessment

The matrix presented in **Table 7-2** presents the assessment and determination of visual impact significance for selected representative view locations. The representative view locations are shown in **Figure 7-1**. To aid this assessment, four photomontages were also produced for view locations V1, V4, V6 and V7. These photomontages are shown **Figures 9 – 12** in **Appendix K Visual Impact Assessment**.

A total of thirteen view locations were identified as part of the VIA. These locations represented a range of typical view locations from surrounding areas including:

- residential dwellings;
- pedestrian access;
- public open space and recreation facilities;
- road corridors; and
- water bodies.

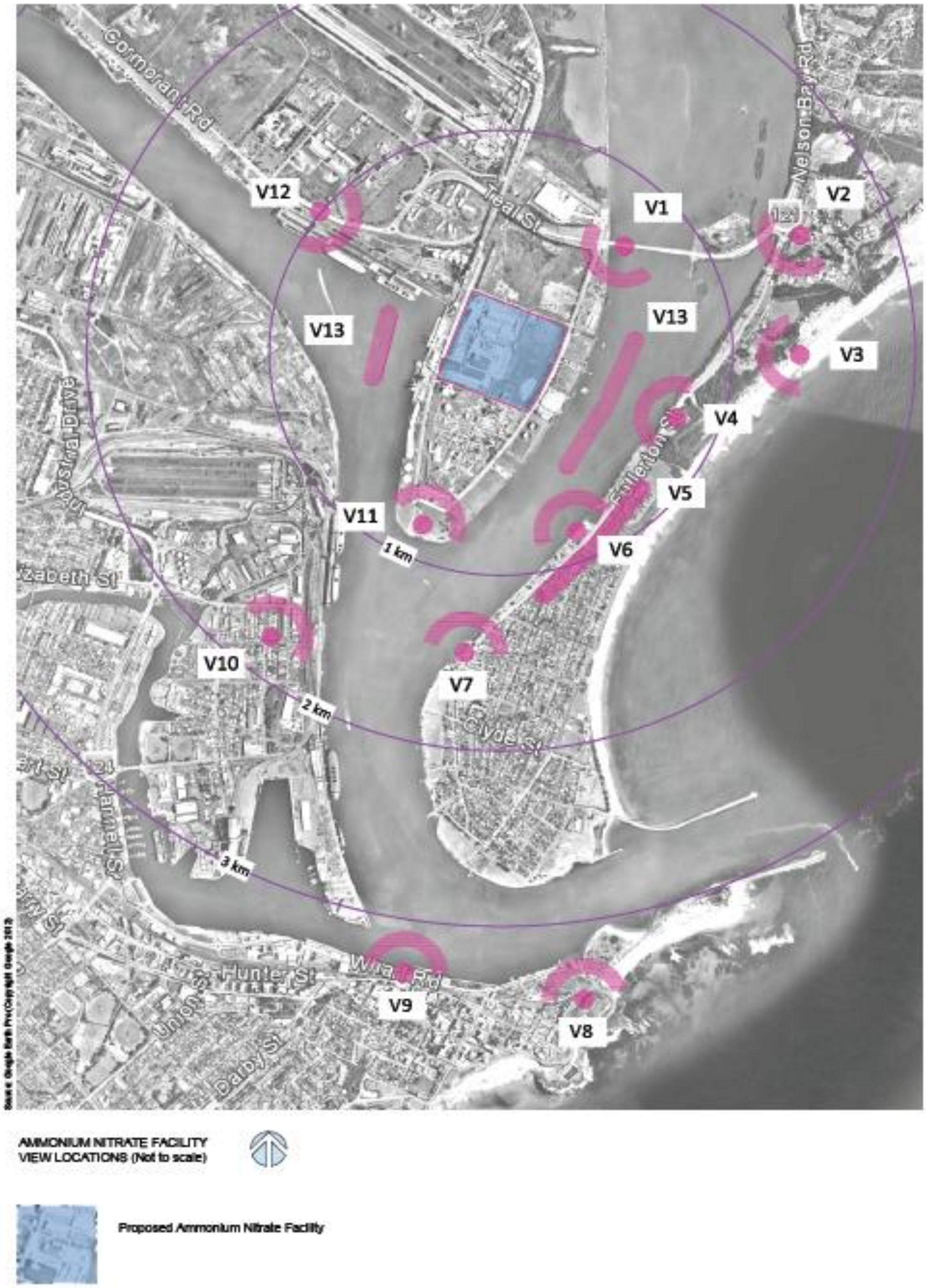
A total of seven view locations were assessed to have a low level of significance and six view locations were assessed to have negligible level of significance. Whilst a number of the view locations were determined to be of high sensitivity, the VIA identified that predicted impacts were likely to be neutral overall, with a low to negligible order of magnitude due to the extent and nature of existing and surrounding industrial development on Kooragang Island as well as industrial facilities located around the broader area of the Newcastle Port Corporation development.

Table 17-2 Visual Impact Assessment

View Location / ref	View Direction	Description	Distance			Duration			Predicted Impact			Nature of Impact				Magnitude	Receptor sensitivity	Significance
			L	M	S	LT	MT	ST	A	N	B	T	P	R	IR			
V1 Stockton Bridge	South – south west	Stockton Bridge (westbound). Partial and indirect short term views from motor vehicles travelling west bound lane across the Stockton Bridge. Infrequent pedestrian traffic along central reservation would experience direct and elevated views across the Santos site toward the Site.			✓			✓		✓			✓	✓		L	L	L
V2 Stockton Centre, Hunter Residences	South west	Potential for short distance views are largely mitigated and filtered by built development and tree planting within and bounding the facility.			✓	✓				✓			✓	✓		L	H	L
V3 Stockton Beach	West	Views toward the Site are largely obscured by landform rising to the west of the beach area as well as built development (residential areas) within Stockton.			✓		✓			✓			✓	✓		N	M/H	N
V4 Residences, Fullerton Street	West	Potential for direct and short distance views toward the Site with some screening or filtering afforded by tree planting along Project boundary (Greenleaf Road) as well as mangrove and cultural planting adjoining residences.			✓	✓				✓			✓	✓		L	H	L
V5 Residential housing, Stockton	North west	Potential for direct and short distance views toward the Site with limited screening or filtering afforded by tree planting.			✓	✓				✓			✓	✓		L	H	L
V6 Boat ramp, trailer park	North west	Potential for direct and short distance views toward the Site with limited screening or filtering afforded by tree planting.			✓		✓			✓			✓	✓		M	M	L
V7 Ballast Park (north)	North	Potential for direct and short distance views toward the Site with limited screening or filtering afforded by tree planting.			✓		✓			✓			✓	✓		L	H	L

View Location / ref	View Direction	Description	Distance			Duration			Predicted Impact			Nature of Impact				Magnitude	Receptor sensitivity	Significance
			L	M	S	LT	MT	ST	A	N	B	T	P	R	IR			
V8 Newcastle (Fort Scratchley)	North	Extensive and panoramic views from elevated land around the Fort would include distant views toward the Site. However, the proposed infrastructure would not be significantly prominent amongst existing industrial elements within the view.	✓				✓			✓			✓	✓		N	H	N-L
V9 Queens Wharf	North	Panoramic views along public foreshore areas of the Newcastle CBD would include distant views toward the Site. However, the proposed infrastructure would not be significantly prominent amongst existing industrial elements within the view.	✓				✓			✓			✓	✓		N	H	N
V10 Residential housing (Carrington)	North east	Potential for views toward the Site are largely blocked by Newcastle Port facilities (bulk storage buildings and berth/loading facilities).			✓	✓				✓			✓	✓		N	H	N
V11 Walsh Park Reserve	North-north east	Potential views from the Walsh Park Reserve toward the Site are largely screened by large scale industrial buildings adjoining Heron and Greenleaf Roads.			✓		✓			✓			✓	✓		N	H	N
V12 Cormorant Road (eastbound)	South east	Potential views toward the Site are predominantly screened by existing industrial infrastructure alongside the port berth facilities.			✓			✓		✓			✓	✓		N	L	N
V13 Hunter River (north and south arm)	West and east	Direct and short distance views would extend toward mid and upper portions of proposed infrastructure.			✓			✓		✓			✓	✓		L	M	L

Figure 17-1 Representative View Locations



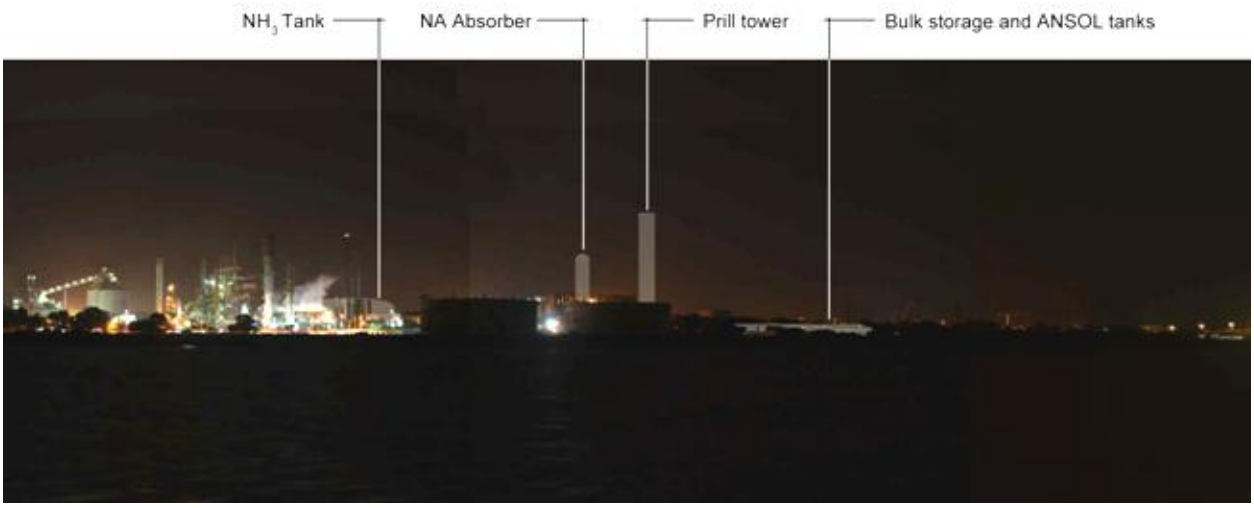
17.4.2 Night Time Lighting Assessment

The categories of potential views that may be impacted by night time lighting are largely restricted to residents and motorists. Irrespective of the total number of visible light sources, night time lights are more likely to be noticeable from a residential curtilage rather than building interiors where interior room lights tend to reflect and mirror internal views in windows, or curtains and blinds tend to be drawn.

Although visible from distances which would exceed the Project viewshed, the intensity of night time lighting would tend to diminish quickly with distance, and would be more likely to be screened by vegetation surrounding individual residential dwellings.

Low level lighting within the Site would be mitigated to some extent by existing large scale infrastructure beyond the Site, as well as existing tree planting along the Lot boundary to Greenleaf Road. Construction and operational night time lighting associated with the Project is unlikely to have a significant visual impact (or cumulative impact) on the majority of surrounding view locations. **Figure 13** in **Appendix K Visual Impact Assessment** shows the extent of existing night time lighting from view location V4 and indicates night time view of the Project. This figure is also presented below in **Plate 17-3**.

Plate 17-3 Night Time View of the Project from Fullerton Road



17.4.3 Impact Assessment Summary

The Visual Impact Assessment concluded that the Project would have a low visual impact on people living in or travelling through areas surrounding the Site. The low visual impact would be due to a combination of the following factors:

- The majority of view locations surrounding the Project, including sensitive residential locations, would experience a low visual impact in relation to the Project infrastructure.
- The Project would be located within a context of existing land use and built elements similar in nature to the proposed infrastructure.
- The extent and location of existing industrial infrastructure would result in a high visual absorption capability for the existing landscape to accommodate additional infrastructure development.
- Existing mature tree planting and vegetation surrounding the Lot would provide screening and visual filtering to some of the lower portions of proposed infrastructure on the Site.

- There are no significant views toward the Site from surrounding dedicated public lookouts. Distant public vantage points including Fort Scratchley and foreshore areas adjoining the Newcastle CBD would not be significantly impacted by the Project.
- The Prill Tower and NA absorber, which are the tallest structures associated with the Project, would be visible from a number of surrounding residential properties as well as surrounding local roads. The elements would also be visible above the skyline from some view locations surrounding the Site.
- Distant views (in excess of 3 km) toward the Project are likely to be influenced by atmospheric conditions which would tend to reduce the visibility of the taller structures.
- During a flaring event, the Project visibility may increase slightly. Flaring events are part of the Project emergency control system and would be only be used in non-routine circumstances. It is estimated that the flare would be used less than once every ten years and therefore would not represent a significant effect.

17.5 Mitigation Measures

The overall potential visual impact of the Project has been assessed as low. However, reducing the extent of visual contrast between the visible portions of the Project structures and the surrounding landscape would further mitigate the low and negligible impact.

Structures

The colour and texture of structures in the Project would be dark in tone and utilize non-reflective materials. This would potentially minimise the visual contrast between the structures and surrounding industrial background to a number of views locations surrounding the Site.

Lighting

Lighting would be required for 24 hour operation. However, lighting associated with the Project would be designed to avoid direct line of sight from areas surrounding the Site where possible. The top of the stacks and towers are not expected to require aviation obstacle lighting. Large floodlights would generally not be used, although it is likely that some lights may be required for emergency lighting to allow emergency maintenance. Security lighting would be designed to minimise light spill on to areas of the Site that do not require lighting, and to off-site areas.

17.6 Cumulative Impact

A cumulative visual impact could result from the Project being constructed in conjunction with other existing or proposed projects. Projects could also occur within the established viewshed of the Project, or be located within a regional context where visibility is dependent on a journey between each site or an individual project viewshed.

The Site is adjacent to an existing ammonium nitrate facility owned and operated by Orica. The Orica facility includes a number of constructed elements that are similar in scale and form to those proposed in the Project. The Orica facility is also subject to proposed development to expand existing operations and a visual assessment prepared for this development determined that "*the visual impacts of the proposed development are not likely to significantly alter the existing visual nature of the southern end of Kooragang Island. The site and surrounding landscape are industrial in nature and the proposed development is unlikely to result in a significant modification to the skyline*" (AECOM June 2009).

The Site is also located within the broader visual catchment of the Newcastle Port which includes the proposed Port Waratah Coal Loader (PWCL) development. This development would include construction of coal handling and ship loading facilities to the west of the Site. It has also been subject to a visual assessment as part of the development application process. The results of the PWCL visual assessment determined that the impact would be relatively low as the development would be located in an existing industrial/port zone.

The Project is considered to have limited potential to increase the significance of cumulative visual impact due to the relatively small scale of the Project and its proximity to existing and similar infrastructure on Kooragang Island, together with the wider occurrence of industrial infrastructure within the Newcastle Port facility. Therefore no significant cumulative visual impacts are expected.

17.7 Proposed Management and Mitigation Measures

The Project is industrial in nature and is located in an area that already features some significant industrial uses. As a result, the Project is not anticipated to have any significant impact on any visual receptors in the area surrounding the Project. **Table 17-3** outlines the measures that would be put in place to minimise any minor visual impacts.

Table 17-3 Management and Mitigation Measures – Visual and Landscape

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Materials used in the construction of the Project would be generally dark in tone and where possible non reflective.	✓	✓	
Lighting would avoid direct line of sight toward residences beyond the Site where possible.	✓	✓	✓
Top of the stacks and towers would not have aviation obstacle lighting.	✓	✓	✓
The use of large floodlights to be minimized where possible.		✓	✓
Lighting would be focused on to work areas during construction and operation. Areas away from work areas would not be lit and light spill would be reduced where possible.		✓	✓

18 Flora & Fauna (Ecology)

18.1 Introduction

The DGRs require IPL to address the potential impacts of the Project on ecological values. The DGRs specify the need to assess potential "*impacts on critical habitats, threatened species or populations or ecological communities and their habitats in the region and mosquito management".*

Within this assessment, particular emphasis has been placed on threatened species, populations and ecological communities listed under State and Commonwealth legislation. This assessment has been based on a combination of desktop and field investigations, focusing on the Site and surrounding study area.

This chapter describes the existing ecological setting for the Site, and assesses the potential impacts of the construction and operation of the Project in reference to the ecological values of the area. For the purposes of the ecological assessment, the study area consists of the Site, as well as the eastern foreshore stormwater outlet and the proposed western foreshore wastewater pipeline and discharge point. **Figure 18-4** shows the location of the Site, study area, and surrounding environs.

18.2 Legislation and Planning Policy

18.2.1 Commonwealth Legislation

18.2.1.1 Environment Protection and Biodiversity Conservation Act, 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on a Matter of National Environmental Significance (MNES) undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that '*has, would have or is likely to have a significant impact on a matter of national environmental significance*' may not be undertaken without prior approval from the Commonwealth Minister of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

The Administrative Guidelines for the EPBC Act (July 2000) set out criteria intended to assist in assessing whether an action requires approval. In particular, the Guidelines contain criteria for assessing whether a Project is likely to have a 'significant impact' on a MNES and namely the 'Significant Impact Criteria' (SIC) assessment guidelines. Should the proponent deem the Project to have a significant potential impact on a MNES, or should the proponent be uncertain as to whether impacts may be significant, a referral to the Commonwealth Minister for DSEWPaC would be undertaken to obtain a confirmation as to whether the Commonwealth considers the Project a 'controlled action'.

18.2.2 State Legislation

18.2.2.1 Threatened Species Conservation Act, 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia*, '*conserve biological diversity and promote ecologically sustainable development*'. The TSC Act covers the following:

- protection of '*threatened species, populations and ecological communities*', with endangered species, populations and communities listed under Schedule 1, '*critically endangered*' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;

- identification of 'Key Threatening Processes' listed under Schedule 3;
- preparation and implementation of Recovery Plans and Threat Abatement Plans;
- guidelines for the preparation of Species Impact Statements; and
- listing of identification of critical habitat for threatened species.

Schedules to the TSC Act provide the listings of terrestrial threatened species, populations and ecological communities that would be considered in this assessment.

18.2.2.2 Fisheries Management Act, 1994

The objects of the *Fisheries Management Act, 1994* (FM Act) are to conserve, develop and share the fishery resources of the NSW for the benefit of present and future generations.

Part 7a of the FM Act provides for the conservation of all biological diversity of aquatic and marine vegetation. It also ensures that the impact of any 'action' affecting threatened species, populations or ecological communities is appropriately assessed.

Schedules to the FM Act provide the listings of aquatic threatened species, populations and ecological communities that would be considered in this assessment.

18.2.2.3 Noxious Weeds Act, 1993

Under the NSW *Noxious Weeds Act, 1993* (NW Act), all councils are responsible for the control of noxious weeds within their Local Government Area (LGA). For this Project, the relevant council is the Newcastle Council LGA. The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Weeds may be considered noxious on a National, State, regional or local scale. All private landowners, occupiers, public authorities and councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act.

18.2.2.4 Native Vegetation Act, 2003

The NSW *Native Vegetation Act, 2003* (NV Act) was established to prevent broad scale clearing, protect native vegetation of high conservation significance, improve the condition of existing native vegetation and encourage the regeneration of native vegetation in NSW. In assessing applications, consent authorities apply the '*maintain or improve test*', which means assessing how the project maintains or improves environmental values such as salinity, water, soils and biodiversity. The NV Act requires approval from the relevant Council or Catchment Management Authority (CMA) for the clearing of native vegetation (with the exception of land listed in Schedule 1 of the Act).

Notwithstanding the above, projects assessed under the provisions of Section 89J of the EP&A Act as State Significant Development do not require consideration in terms of the requirements of the NV Act. However, the principles of the 'maintain or improve test' have still been used to guide this assessment.

18.2.3 State Environmental Planning Policies (SEPPs)

State Environmental Planning Policies (SEPPs) relevant to the proposed works are discussed in detail in **Chapter 6**. Two SEPPs directly relevant to ecological values within the study area are:

- SEPP 44 – Koala Habitat Protection; and
- SEPP 14 – Coastal Wetlands.

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) is considered to have potential relevance to the proposed works. SEPP 44 aims to encourage the '*proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline'*.

SEPP 44 requires that consent authorities making determinations under Part 4 of the EP&A Act consider whether 'potential koala habitat' and 'core koala habitat' would be affected. SEPP 44 applies to LGAs listed in Schedule 1 of the Policy, which includes Newcastle LGA. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management be prepared.

State Environmental Planning Policy No 14 - Coastal Wetlands (SEPP 14) aims to protect and conserve coastal wetlands by ensuring *"that the coastal wetlands are preserved and protected in the environmental and economic interests of the state*".

SEPP 14 provides guidance for consent authorities (consent authorities being the council of the LGA in which the proposed development is to be carried out), in terms of issues to consider when determining whether there is potential for a listed wetland to be affected by a Project. Under SEPP 14, a person must not clear land, construct a levee, drain or fill land within the area which is covered by the SEPP without consent. Activities on SEPP 14 wetlands which require development consent are deemed to be designated development, which means the development application must be accompanied by an Environmental Impact Statement (EIS) and be placed on public exhibition for public comment.

18.3 Assessment Methodology

18.3.1 Introduction

The ecological assessment methodology consisted of three key components:

- desktop review;
- field survey; and
- habitat suitability assessment.

Information gathered via the above listed methods was then used to assess the potential impacts on the ecological values of the study area.

The methodologies used for each stage are discussed the following sections.

18.3.2 Desktop Review

A thorough desktop review was completed to identify all potential ecological values with respect to State and Commonwealth listed threatened flora, fauna, populations and ecological communities, as well as all MNES within approximately 10 kilometres (km) of the study area. To this end, the following documentation was reviewed prior to the field survey:

- the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife online database was reviewed for all TSC Act listed species within a 10 km buffer around the study area on 23 August 2011 (refer to **Appendix L1**);
- a Geographic Information System (GIS) data request was sent to the Spatial Data Programs Unit of OEH for all records of threatened species within the Newcastle (9232-2S) 1:25,000 map sheet on 23 August 2011;

- the DSEWPaC Protected Matters Search Tool (PMST) online database for all species, communities and other MNES protected under the Commonwealth EPBC Act within a 5 km buffer around the study area on 6 July 2011 (refer to **Appendix L2**);
- the NSW Department of Environment and Conservation (DEC) CMA sub-region search online database for the Hunter CMA sub-region on 23 August 2011 (refer to **Appendix L3**);
- the NSW Primary Industries Fishing and Aquaculture Species Protection 'Find a Species by Geographic Region' online database for the Hunter/Central Rivers Catchment Management Area (CMA) on 23 August 2011 (refer to **Appendix L4**);
- a Spatial Data Request to the NSW Community Access to Natural Resources Information (CANRI) Program for the SEPP14 – Coastal Wetlands dataset on 15 March 2012; and
- Aerial and topographic maps of the study area.

18.3.3 Field Survey

The primary focus of the ecological field survey was the identification of flora, fauna and habitat resources within the study area. Surveys were also conducted outside of the Site, in order to identify ecological values associated with the study area and surrounding environs that had been identified through the desktop review.

The key ecological constraints considered for the study area include:

- NSW and Commonwealth-listed threatened species, populations and ecological communities;
- presence of noxious weeds and Weeds of National Significance (WoNS);
- habitat resources, including hollow-bearing trees (HBTs) and stags, coarse woody debris (CWD), rocky outcrops, water bodies, wetlands, corridors, burrows, and significant feed trees;
- potential threatened species habitat; and
- MNES.

The field survey was undertaken in a manner that referenced the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (DEC 2004) and *Draft Guidelines for Threatened Species Assessment* (DEC & DP&I 2005). Given the condition of the study area, existing levels of disturbance, and overall lack of habitat resources, the survey recommendations of the above listed guidelines were adapted to allow appropriate assessment of a highly modified study area.

The first field survey was carried out on 31 August 2011 for a period of 12 person hours by two ecologists: Jane Murray (botanist, lead ecologist) and Alex Cave (fauna ecologist). A second field survey was carried out on 12 June 2012 for a period of 8 person hours by one ecologist (Alex Cave). Given the disturbed nature of the study area, the modified surveys, adapted from the guidelines outlined above, included the following techniques:

- vegetation mapping and identification, including the identification of any vegetation communities present within the study area;
- recording of dominant flora species within the study area;
- recording of any noxious weeds or Weeds of National Significance (WoNS) within the study area;

- opportunistic observations of any fauna species observed within the study area, including migratory species in and around the Hunter River Estuary; and
- an assessment of the habitats present and their suitability for threatened species or populations predicted to occur within the study area.

The stratification of habitats and vegetation types to determine survey effort as recommended in the guidelines outlined above was not undertaken. This process was considered unnecessary and inappropriate to the survey requirements given the homogenous and disturbed nature of the study area. Random meander surveys (Cropper, 1993) were undertaken to determine the presence (if any) of threatened species, or potential suitable habitat within the study area. All field surveys aimed to ensure adequate sampling of the highly modified study area.

18.3.4 Habitat Suitability Assessment

An assessment of the likelihood of habitats present for TSC Act, FM Act and EPBC Act listed species, populations and ecological communities within the study area was undertaken during the field survey, and is provided in **Appendix L5**. This technique aids in the determination of the potential for listed species, populations or communities to occur within the study area rather than relying solely on one-off surveys that are subject to seasonal and weather limitations and provide only a snapshot of ecological assemblages present.

An assessment of the study area was undertaken to identify all landscape features, and develop flora and fauna species inventories. Significant habitat features, where present, were identified and mapped for the study area. Habitat features as part of the survey scope included; HBTs and stags, CWD, rocky outcrops, water bodies, wetlands, corridors, burrows, and significant feed trees.

Descriptions of habitat requirements for threatened species, populations and ecological communities that have the potential to occur within the study area are presented in the habitat assessment (refer to **Appendix L5**).

18.3.5 Evaluation of Impact

Assessments of State and Commonwealth listed threatened biota potentially impacted by this Project have been undertaken. Assessments of threatened biota listed under the NSW TSC Act and FM Act are addressed using the criteria provided in *Threatened Species Assessment Guidelines, the Assessment of Significance* (AOS) (DECC, 2008b). Assessments of threatened biota listed under the EPBC Act have been addressed using the criteria provided in DEWHA's (2009) *Matters of National Environmental Significance, Significant Impact Criteria* (SIC) assessment guidelines'. These assessments are shown in full in **Appendices L6** and **L7**.

Key Threatening Processes (KTPs) were also considered during the impact evaluation process. KTPs that are relevant to the Project are discussed in **Section 18.5.10**.

Mitigation measures have been proposed in subsequent sections of this chapter for species with the potential to be adversely impacted by the Project.

18.4 Existing Environment

18.4.1 Ecological Overview

The Site is located within the Hunter/Central Rivers CMA, within the Hunter subregion. The Site and study area falls within the Sydney Basin bioregion as defined in the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell 1995). **Figure 1-1** shows the location of the Site and study area on Kooragang Island within the Hunter River Estuary and **Figure 18-4** shows the location of the study area. The Site is separated from the south arm of the Hunter River in the west and the north arm of the Hunter River in east by NPC land. The Hunter Wetlands National Park is a Ramsar wetland, and is located 545 m to the north and north east of the Site (refer to **Figure 18-3**). This National Park includes the reserves formerly referred to as Kooragang Nature Reserve and Hexham Swamp Nature Reserve.

Kooragang Island originally consisted of seven islands within the Hunter River that were separated by narrow mangrove lined channels. In the 1950s these islands were reclaimed and became 'Kooragang Island' (DSEWPaC 2011). The islands were joined with dredged sand and silt material. Since that point the southern part of the island has been home to a number of industries, and as a result the ecology that has developed has been subjected to a high-level of disturbance arising from associated anthropogenic activities.

The Site is located within this industrial area and has undergone extensive historical modification and development. The Site consists largely of hard stand areas and infrastructure and small areas of garden bed plantings. The Site is dominated by historic stockpile remnants, exotic grasslands and roadside plantings.

The study area, within the immediate vicinity of the Site, includes the eastern foreshore stormwater outlets and proposed western foreshore wastewater pipeline and discharge point. The eastern foreshore stormwater discharge outlets are existing outlets situated on the north arm of the Hunter River at the edge of the reclaimed rocky foreshore area (refer to **Figure 18-4**). The immediate surroundings of the existing outlets include moderate quality habitat in terms of small beaches/berms that drop quickly in slope away to the deep waters of the estuary. The estuary at this point experiences slow tidal exchange and no aquatic flora (sea grasses or mega/minor algae's) apart from Grey mangroves (*Avicennia marina)* were seen during surveys. Other flora included a range of exotic species including the noxious weed, Bitou Bush (*Chrysanthemoides monilifera* ssp*. rotundata*).

The proposed western foreshore wastewater pipeline and discharge point would use the ammonia pipe rack crossing Heron Road from the Site to the NPC berth. The pipe would run from the NPC bulk liquids berth south to the K2 berth. The discharge point would be located under the K2 berth, at a depth of approximately 10 m below the mean water level. The estuary at this point is highly modified and falls away to deep waters abruptly, due to the dredged port area.

18.4.2 Desktop Review Results

The results of the desktop review have been summarised below, according to each of the desktop review components.

The results of the OEH Atlas of NSW Wildlife online database search are provided in **Appendix L1**. The results of the search indicate that a total of five threatened flora species and 43 fauna species have been recorded within 10 kilometres (km) of the study area.

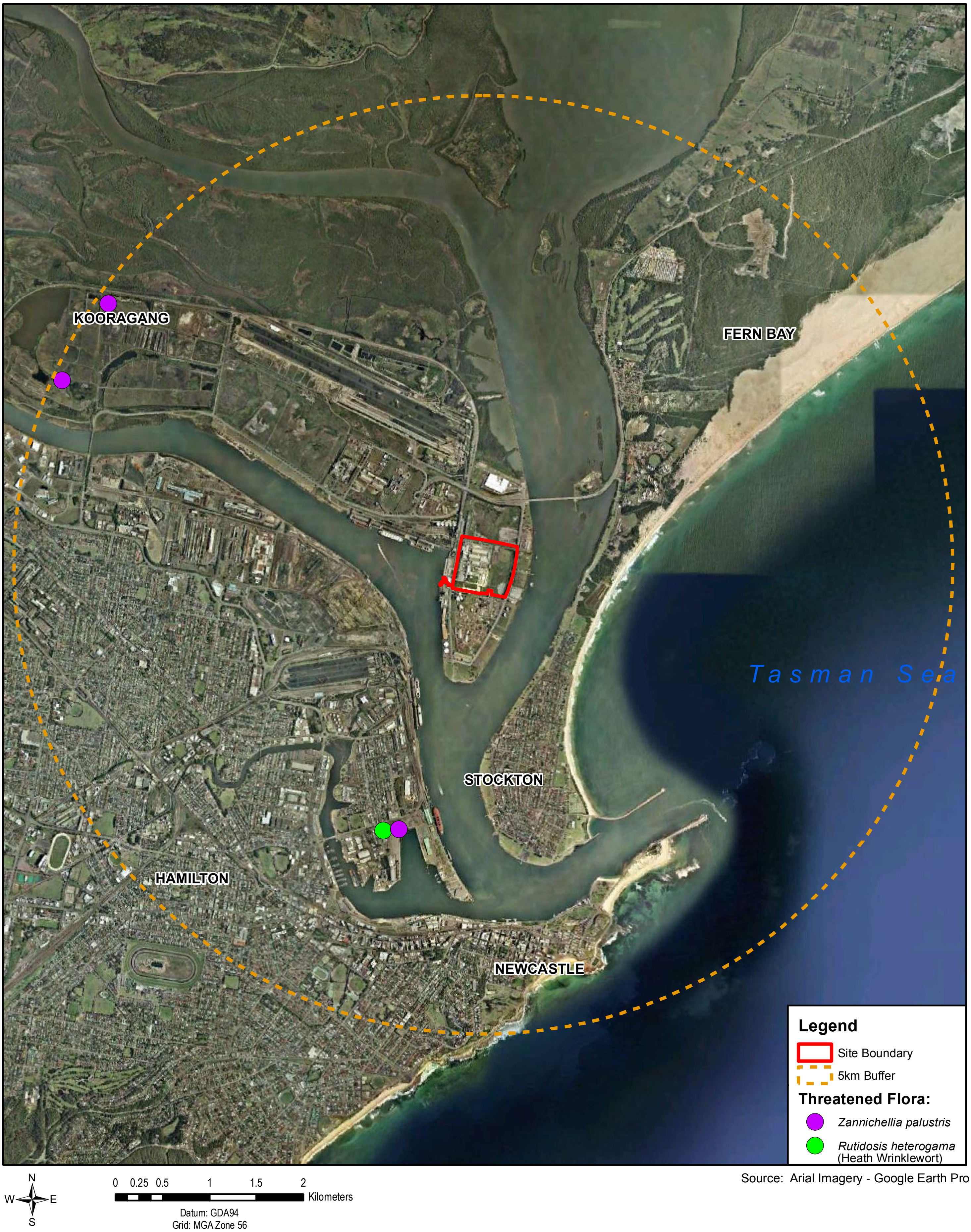
The results of the GIS Request to the Spatial Data Programs Unit of OEH are presented in **Figures 18-1** and **18-2**. There are records of two threatened flora species, and 41 threatened fauna species within 5 km of the study area, according to the results of the Newcastle 1:25,000 map sheet.

The results of the DSEWPaC PMST online database search of all MNES within 5 km of the study area are provided in **Appendix L2**, and are summarised in **Table 18-1** below.

Table 18-1 MNES within 5 km of the study area

MNES	Number Relevant to the Project
World Heritage Properties	Nil
National Heritage Places	Nil
Wetlands of International Significance (RAMSAR Wetlands)	1
Great Barrier Reef Marine Park	Nil
Commonwealth Marine Areas	Nil
Threatened Ecological Communities	1
Threatened Species	41
Migratory Species	66

The Hunter Estuary Wetlands Ramsar wetland is located approximately 545 m to the north of the Site. This Ramsar wetland is made up of two separate areas; the area referred to as Kooragang Nature Reserve, and Shortland Wetlands (the Hunter Wetlands Centre) (refer to extent of SEPP14 in **Figure 18-3**). While these two sites are not directly adjacent, they are considered to be linked both hydrologically, and by a wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island (DSEWPaC 2011). The PMST online database predicts the occurrence of a total of 41 threatened species, including: 18 birds, one amphibian, eight mammals, five flora species, five reptiles and four sharks.



Source: Arial Imagery - Google Earth Pro

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

THREATENED FLORA RECORDS (NSW OEH)

URS

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Figure: **18-1**

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Source: Aerial Imagery - Google Earth Pro

INCITEC PIVOT LIMITED

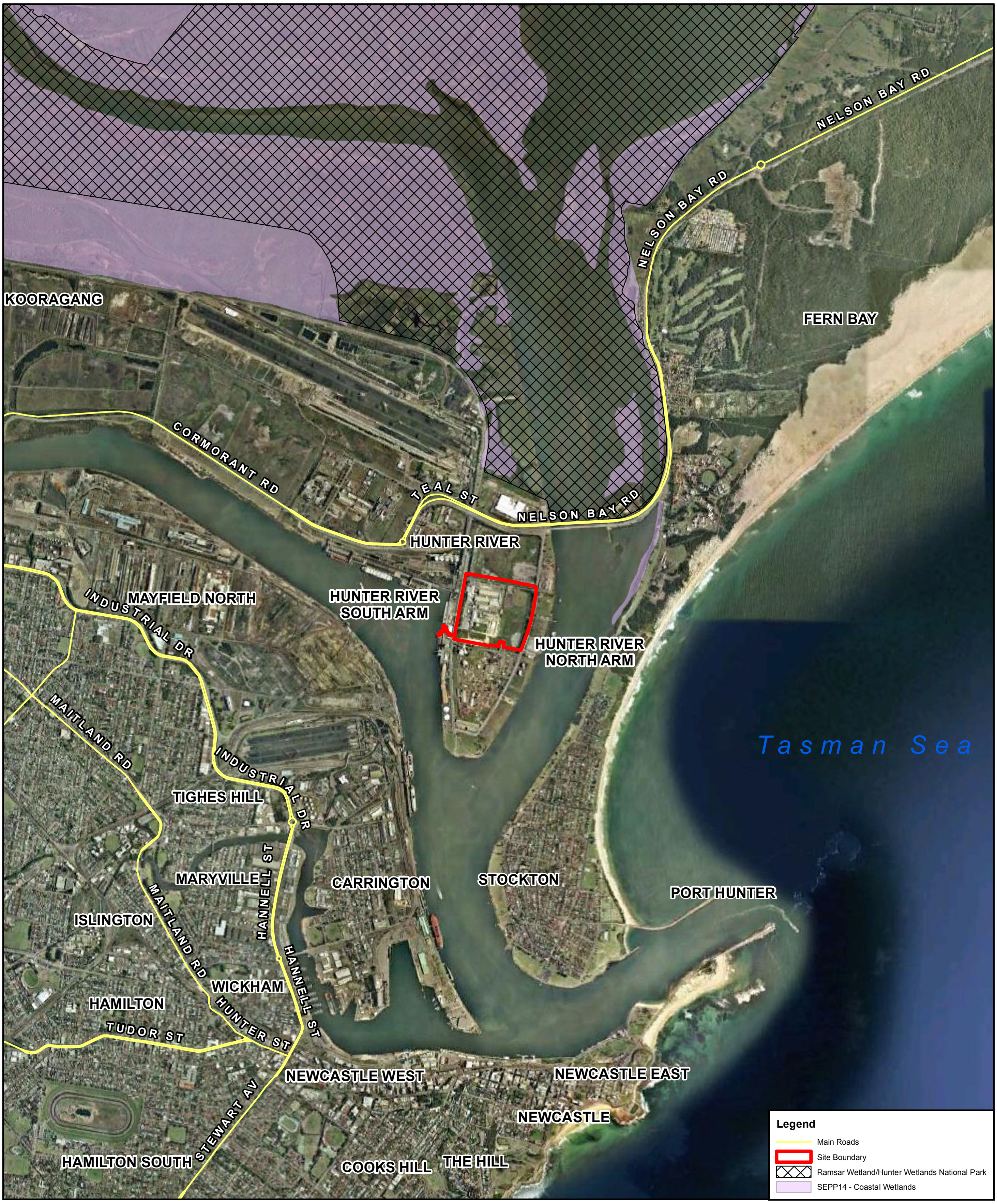
PROPOSED AMMONIUM NITRATE FACILITY

THREATENED FAUNA RECORDS (NSW OEH)

URS

File No: 43177771.053.mxd Drawn: STB Approved: WM Date: 27/08/2012

Figure: **18-2** Rev. **A** A4



N W E S

0 0.25 0.5 1 1.5 2 Kilometers

Datum: GDA94
Grid: MGA Zone 56

Source: Aerial Imagery - Google Earth Pro
'SEPP14 - Coastal Wetlands': Spatial Data Download of metadata for SEPP14 - Coastal Wetlands protected areas. Accessed through the NSW CANRI website, 15/3/2012.
Ramsar Wetlands - DSEWPaC, 12/03/2012

INCITEC PIVOT LIMITED

PROPOSED AMMONIUM NITRATE FACILITY

LOCATION OF SEPP14 COASTAL WETLANDS & HUNTER ESTUARY RAMSAR SITE

URS

File No: 43177771.035.mxd   Drawn: STB   Approved: WM   Date: 27/08/2012

Figure: 18-3

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The NSW DEC CMA Sub-region search was undertaken to obtain information on the potential occurrence of threatened populations or ecological communities only (not species) with the potential to occur within the study area. The results of the NSW DEC CMA Sub-region search are provided in **Appendix L3**. The results indicate that four endangered populations and 17 Threatened Ecological Communities (TEC) have the potential to occur within the study area.

The results of the NSW Primary Industries online database search are provided in **Appendix L4**. The results indicate that four marine or aquatic species are predicted to occur within the Hunter/Central Rivers CMA.

18.4.3 Field Survey Results

Flora

Flora surveys were targeted towards determining whether threatened flora species and vegetation communities identified with the potential to occur through the desktop review (refer to **Appendix L5**) were present or absent within the study area.

Following targeted searches, no threatened flora or habitat suitable for such flora was located within the study area. Flora species present within the study area at the time of survey were identified and a list of dominant species is provided in **Appendix L6**. During the survey, no remnant vegetation was found to occur within the study area. The majority of vegetation present had been planted and comprised a mixture of native and exotic species. Native planted species found within the study area were generally not endemic to the local area.

Descriptions of vegetation within the study area were compared with the Vegetation Types Database (OEH 2012) to determine if the communities matched any recognised vegetation associations within the Hunter/Central Rivers CMA. None of the vegetation present in the study area was considered to form part of a vegetation type, formation or class as described by the Vegetation Types Database. In addition, none of the plantings within the study area or their formations resemble any locally occurring or threatened ecological community.

Vegetation within the Site and study area was found to be limited to highly modified and disturbed landscape plantings, and is dominated by exotic grassland. The eastern portion of the Site consists of an open grassy paddock dominated by sedges, and a linear strip of canopy vegetation consisting of both exotic plantings and native species, such as mature *Ficus* sp and *Casuarina* sp. The western portion of the Lot consists of hardstand and buildings with minimal plantings and garden borders.

The vegetation (including garden beds) within the Site is regularly maintained and subject to landscaping works. The understorey is generally lacking within all the garden beds with mulched soils in some areas. Dominant vegetation within the Site consists of isolated plantings of Oleander (*Nerium oleander),* New Zealand Christmas Bush (*Metrosideros excelsa*), Moreton Bay Fig (*Ficus macrophylla*), Radiata Pine (*Pinus radiata*), and Swamp Oak (*Casuarina glauca*).

The distribution of vegetation and other ecological constraints within the study area is shown on **Figure 18-4**.

Whilst every care is taken by URS to ensure the accuracy of the digital data, URS makes no representation or warranties about its accuracy, reliability, completeness, suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for any expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate in any way for any reason. Electronic files are provided for information only. The data in these files is not controlled or subject to automatic updates for users outside of URS.

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PROPOSED AMMONIUM NITRATE FACILITY

ECOLOGICAL VALUES

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Figure: 18-4

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Noxious Weeds

A total of 94 noxious weeds have been declared for the Newcastle LGA (Department of Primary Industries 2011). During field surveys, noxious weeds observed were recorded. A total of three were found to occur within the study area, shown in **Table 18-2**, and mapped on **Figure 18-4**.

Table 18-2 Noxious Weeds Found Within the Study Area

Scientific Name	Common Name	Class	Control Requirements
Chrysanthemoides monilifera subspecies rotundata	Bitou Bush	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Lantana camara	Lantana	4	The plant must not be sold propagated or knowingly distributed
Cortaderia selloana	Pampas Grass	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction

Fauna

A total of 31 fauna species were recorded within the study area during the field survey (refer to **Appendix L6**). None of the species recorded during the field survey were found to be threatened under the TSC Act, FM Act or EPBC Act. Several of the species recorded are considered to be feral species.

Habitat Resources

Habitat resources were mapped during the field survey, and the following habitat resources were found to exist within the study area, these included CWD, feed trees, and temporarily inundated water bodies. Other habitat resources suited to potentially occurring threatened species (refer to **Table 18-3**) include; buildings, tanks and structures suitable for birds and bat roosts, open grasslands and temporary standing water as well as the surrounding Hunter Estuary.

Overall, the study area was not found to support a high abundance or diversity of significant habitat resources. Very small amounts of CWD were identified along the eastern boundary of the Site, comprising of small sticks less than 10 cm in diameter. No HBTs, stags, rocky outcrops or permanent waterbodies were observed within the Site.

A number of feed trees were located within the study area. These comprised Swamp She-oak *(Casuarina glauca)*, Swamp Mahogany (*Eucalyptus robusta)* and Moreton Bay Figs (*Ficus macrophylla*) and are shown on **Figure 18-4**. Moreton Bay Figs in particular constitute significant feed trees for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (Vulnerable TSC Act, Vulnerable EPBC Act). Whilst *Eucalyptus robusta* is a known Koala feed tree (Schedule 2 SEPP 44) the trees do not *constitute at least 15% of the total number of trees in the upper or lower strata of the tree component* (SEPP 44 version 20 April 2000, NSW Government) and are isolated from other canopy/corridors in the area, in a highly disturbed environment, away from known 'potential' or 'core' habitat areas. As no 'potential' or 'core' Koala habitat, in terms connectivity or adult feed trees were identified within the study area during the field survey, SEPP 44 is not considered to have any further relevance to the Project.

The connectivity value of the study area to the surrounding landscape has also been taken into consideration, in terms of the potential significance of the study area as a corridor for use by threatened species in the region (NSW OEH 2011). Given the general lack of vegetation and habitat resources within the study area and surrounding infrastructure, industrial activities, and geographic location of the study area, it is not considered to form part of a developed habitat corridor. There is no freshwater aquatic habitat found within the Lot. However it is noted that the visit took place after rainfall, and this weather had resulted in the formation of a number of temporary pools of water.

Aquatic habitat types in the Hunter River estuary, adjacent to Kooragang Island include some shallow intertidal waters suitable for seagrasses, rocky algal reefs, mangrove areas and an array of aquatic flora and fauna species. Although seagrass beds have not been observed along the lower Hunter River foreshores for at least 30 years, some small patches of Sea Tassles (*Ruppia* spp.), have been recorded in small channels on Kooragang Island and in the nearby Hexham Swamp (Williams 2000).

Recent estuarine habitat mapping of the Hunter River undertaken by NSW DPI (2006) investigated the extent of habitats in the Hunter River estuary, including seagrasses. The map shows that around Kooragang Island, only extensive Mangrove and Mangrove/Saltmarsh habitats exist on the eastern fringe, and to the further north and north-east of the Site and study area. No seagrass communities were found to be present in or around Kooragang Island (NSW DPI 2006).

The mangrove and saltmarsh habitats in the region are mostly concentrated to the north of the Site, in and around the Kooragang Nature Reserve, which are largely synonymous with the extent of SEPP 14 – Coastal Wetlands for the region, Hunter Wetlands National Park (refer to **Figure 18-3**).

Threatened Flora, Fauna, Populations and Ecological Communities

Of the total nine threatened flora species located within 10 km of the study area, potential habitat was considered to exist for two species (refer to **Appendix L5** and **Table 18-3**). The habitat required by these two flora species is outlined in **Appendix L5**. However, neither of these species were found to occur within the study area during the field survey.

Of the total 69 threatened fauna species located within 10km of the study area, potential habitat was considered to exist for 24 species (refer to **Appendix L5** and **Table 18-3**). However, none of these species were found to occur within the study area during the field survey.

Of the four threatened populations identified through the desktop review, none are considered likely to occur within the study area (refer to **Appendix L5**). As such, it is considered that there would not be an impact to any threatened populations as a result of the Project.

A total of 18 TECs were predicted to occur within the study area based on desktop reviews (refer to **Appendix L5**). The field survey aimed to confirm whether any of these TECs occurred within the study area of surrounding environs, in order to assess potential impacts. The results of the field survey confirmed that none of the predicted TECs, as defined by either the TSC Act or EPBC Act, occur within the study area.

18.4.4 Habitat Suitability for Threatened Biota

The results of the desktop review were combined with information gathered during the field survey to undertake a detailed habitat assessment of all threatened species, populations and/or ecological communities predicted to occur within the study area (refer to **Appendix L-5**). This habitat assessment compared the habitat requirements of all threatened species, populations and/or communities, with the habitat resources available within the study area. By conducting a habitat assessment in this manner, a list of species, populations and/or ecological communities that are considered likely to occur, based on the presence of suitable habitats has been compiled. The results of this assessment are presented in **Table 18-3**.

Table 18-3 Threatened Biota with Potential to Occur Within the Study Area

Scientific Name	Common Name	FM Act Status	TSC Act Status	EPBC Act Status
Flora				
Rutidosis heterogama	Heath Wrinklewort	N/A	Vulnerable	Vulnerable
Zannichellia palustris	-	N/A	Endangered	Endangered
Fauna				
Amphibia				
Litoria aurea	Green Golden Bell Frog	N/A	Endangered	Vulnerable
Aves				
Calidris tenuirostris	Great Knot	N/A	Vulnerable	Migratory
Charadrisu leschenaultia	Greater Sand Plover	N/A	Vulnerable	Migratory
Charadrius mongolus	Lesser Sand-plover	N/A	Vulnerable	Migratory
Circus assimilis	Spotted Harrier	N/A	Vulnerable	N/A
Epthianura albifrons	White-fronted Chat	N/A	Vulnerable	N/A
Haematopus fuliginosus	Sooty Oystercatcher	N/A	Vulnerable	N/A
Haematopus longirostris	Pied Oystercatcher	N/A	Endangered	N/A
Hieraaetus morphnoides	Little Eagle	N/A	Vulnerable	N/A
Limicola falcinellus	Broad-billed Sandpiper	N/A	Vulnerable	Migratory
Limosa limosa	Black-tailed Godwit	N/A	Vulnerable	Migratory
Lophoictinia isura	Square-tailed Kite	N/A	Vulnerable	N/A
Ninox strenua	Powerful Owl	N/A	Vulnerable	N/A
Stagonopleura guttata	Diamond Firetail	N/A	Vulnerable	N/A
Sterna albifrons	Little Tern	N/A	Endangered	Migratory
Xenus cinereus	Terek Sandpiper	N/A	Vulnerable	Migratory
Mammalia				
Falsistrellus tasmaniensis	Eastern False Pipistrelle	N/A	Vulnerable	N/A
Miniopterus australis	Little Bentwing-bat	N/A	Vulnerable	N/A
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	N/A	Vulnerable	N/A
Mormopterus norfolkensis	Eastern Freetail-bat	N/A	Vulnerable	N/A
Myotis macropus	Southern Myotis	N/A	Vulnerable	N/A
Pteropus poliocephalus	Grey-headed Flying-fox	N/A	Vulnerable	Vulnerable
Scoteanax rueppelii	Greater Broad-nosed Bat	N/A	Vulnerable	N/A
Fish				
Epinephelus daemelii	Black Cod	Vulnerable	N/A	N/A

No populations or threatened ecological communities were considered likely to occur within the study area.

In addition habitat resources found during the field survey have been mapped and proved in **Figure 18-4**.

18.5 Impact Assessment

This section assesses the potential impacts of the Project on the native flora, fauna, populations and/or ecological communities identified through the desktop review and field survey outlined in previous sections.

18.5.1 Flora

The Project would require the permanent clearing of degraded, fragmented vegetation from within the study area. Vegetation to be removed is dominated by exotic grassland, with additional vegetation to be cleared, including the landscaped gardens. Flora to be removed includes:

- Oleander *(Nerium oleander*);
- New Zealand Christmas Bush (*Metrosideros excelsa*);
- Moreton Bay Fig (*Ficus macrophylla*);
- Radiata Pine (*Pinus radiata*); and
- Swamp She-oak (*Casuarina glauca*).

There is unlikely to be any indirect impacts resulting from the removal of vegetation from within the study area. The vegetation to be removed is dominated by either exotic grassland or landscaped plantings. The removal of such vegetation is not unlikely to result in a significant loss or overall reduction in the genetic material within the local region, nor would it result in a reduction in seed stock for native endemic species within the region.

18.5.2 Fauna

Clearing required for the Project would result in the direct impact of the permanent loss of degraded and fragmented vegetation from within the study area. This vegetation, while extremely degraded and modified, does have the potential to provide habitat for a number of common and threatened native fauna species. While the study area contains known feed trees (e.g. *Ficus macrophylla, Eucalyptus robusta* and *Casuarina sp.*), the study area was not found to support any areas of rocky outcrops, extensive CWD, stags or HBTs. The linear strip of canopy vegetation on the eastern side of the Site has the potential to aid limited fauna movement, and thus act as a habitat corridor/patch for a number of fauna species including microbats, birds of prey and nocturnal hunting birds. Habitat resources that were present within the study area, suited to threatened fauna species**,** include; buildings, tanks and structures suitable for birds and bat roosts/perches, open grasslands and wet soaks suitable for amphibians as well as the surrounding Hunter Estuary.

The works associated with the Project would be concentrated in the central and western portion of the Site. The exotic grassland vegetation in this location provides foraging habitat for birds of prey such as the Nankeen Kestrel (*Falco cenchroides*), which was observed hunting within the Lot during the field survey. Due to the presence of European Hares (*Lepus europaeus*) in the eastern portion of the Lot, this area may also provide suitable hunting grounds for a number of bird species, including the Little Eagle (*Aquila morphnoides*), Osprey (*Pandion cristatus*), and Powerful Owl (*Ninox strenua*).

The clearing of exotic grassland vegetation for the Project is unlikely to result in significant habitat fragmentation or loss of habitat corridors, as the Project would not bisect or isolate any substantial areas of native vegetation. The Project is considered unlikely to have a significant impact upon the movement and foraging potential of native fauna within the region due to the existing fragmented and isolated nature of the study area and the relatively small amount of clearing required for the Project.

Despite also being largely degraded and highly modified due to past land use, the surrounding environs contain a higher number of habitat features than present within the study area. The aquatic environment nearby also provides a range of potential habitats for migratory and threatened species.

18.5.3 Threatened Flora

As a result of the literature review and habitat suitability assessment, two threatened flora species listed under the TSC Act were considered to have the potential to occur within the study area:

- Heath Wrinklewort (*Rutidosis heterogama*); and
- *Zannichellia palustris.*

Neither of these species was observed during field surveys of the study area. To ensure adequate assessment, an Assessment of Significance (AOS) as outlined in DECC (2008b) has been conducted for each of these species and has determined that there is not likely to be a significant impact to either of these species (refer to **Appendix L7**).

The results of the AOS indicate that the Project is unlikely to result in a significant impact to either of the flora species listed under the TSC Act. Consequently it is concluded that a Species Impact Statement (SIS) is not required for any NSW threatened flora species.

The results of the literature review and habitat suitability assessment indicate that one threatened flora species listed under the EPBC Act, also protected by the TSC Act as listed above, was considered to have the potential to occur within the study area:

- Heath Wrinklewort (*Rutidosis heterogama*).

To ensure adequate assessment, a Commonwealth Significant Impact Criteria (SIC) assessment as outlined in DEWHA (2009) has been conducted for this species to determine whether the Project has the potential to result in a significant impact (refer to **Appendix L8**).

The results of the SIC assessments indicate that the Project is unlikely to result in a significant impact to this flora species. Consequently, it is concluded that a referral to the Minister is not required for Heath Wrinklewort.

18.5.4 Threatened Fauna

As a result of the literature review and habitat suitability assessment, threatened fauna species listed under the TSC Act, and threatened fauna species listed under the FM Act were considered to have the potential to occur within the study area. These comprised one frog, 15 birds, seven mammals and one fish.

None of these species were observed during field surveys of the study area. To ensure adequate assessment, an AOS as outlined in DECC (2008b) has been conducted for each of these fauna to determine whether the Project has the potential to result in a significant impact to these species (refer to **Appendix L7**).

The results of the AOS indicate that the Project is unlikely to result in a significant impact to any fauna species listed under the TSC Act. Consequently, it is concluded that an SIS is not required for any NSW threatened fauna species.

The results of the SIC assessments (refer to **Appendix L8**) indicate that the Project is unlikely to result in a significant impact to any fauna species listed under the EPBC Act. As a precautionary measure, mitigation measures are proposed. Consequently, it is concluded that a referral to the Minister is not required for threatened fauna species.

18.5.5 Threatened Populations

The results of the desktop review and field survey indicate that no threatened populations occur within the study area. As such, the Project would not result in any impacts to any listed threatened populations.

18.5.6 Threatened Ecological Communities

The results of the desktop review and field survey indicated that no TECs occur within the study area. Consequently, it is concluded that the Project would not result in any impacts to any listed threatened ecological communities.

18.5.7 Other Matters of National Environmental Significance

The Project has the potential to result in impacts to the following MNES not already discussed above:

Migratory Species- Following the desktop review a total of 63 migratory species were predicted to occur within 5 km of the study area. These migratory species comprised 49 birds, seven mammals, five reptiles and two sharks.

Following the habitat assessment, this number was refined to a total of 28 species considered to have the potential to occur within or to utilise the study area and its resources (refer to **Appendix L5**).

A SIC assessment (as per DEWHA 2009) has been undertaken for the 28 migratory listed species have the potential to use the study area (refer to **Appendix L8**). The results of the SIC assessment indicate that the Project is unlikely to result in a significant impact to any migratory species.

Wetlands of Significance - The Hunter Estuary Wetlands (comprising both Kooragang Nature Reserve and Shortland Wetlands) is a Ramsar listed wetland located within the surrounding environs, approximately 545 m to the north and north east of the Site. The Hunter Estuary Wetlands are listed under the SEPP 14 as Wetland No. 823.

This wetland was listed as a Ramsar wetland in 1984 and meets the following criteria for listing:

- *Criterion 1: The Hunter Wetlands Centre component of the* Ramsar *site is unique as it has a combination of high conservation value near-natural wetlands, such as the Melaleuca Swamp Forest, and high conservation value artificial wetlands. It is the only complex of this type found within the Sydney Basin region. The Melaleuca Swamp Forest in particular represents a wetland type that, although once very widespread, is poorly represented in the Sydney Basin region.*

- *Criterion 3: The* Ramsar *site is ecologically diverse and maintains a high biological diversity. For example, Kooragang Nature Reserve possesses 112 plant species at Kooragang Island, including particularly good examples of mangrove and saltmarsh communities. Furthermore, the Hunter Wetlands Centre contains a remnant Melaleuca Swamp Forest, dominated by Broad leaved Paperbark, a community that is now rare in the Sydney Basin region. The Hunter Estuary Wetlands are also important for maintaining a high diversity of birds within the region with over 250 species recorded.*

- *Criterion 4: The Hunter Estuary Wetlands* Ramsar *site provides important habitat for 45 migratory bird species listed under international migratory conservation agreements. These species utilise the site as an important migration stopover and foraging habitat. The* Ramsar *site also supports a large number of species at a critical seasonal stage of their breeding cycle. Furthermore, the Hunter Estuary Wetlands provide refuge during periods of critical inland drought for a number of species such as Freckled Duck, Pink-eared Duck, Australian Pelican, and Glossy Ibis.*

- *Criterion 6: Kooragang Nature Reserve component of the* Ramsar *site regularly supports between 2% and 5% of the East Asian-Australasian Flyway population of Eastern Curlew*.' (DSEWPaC 2011).

Figure 18-2 shows the extent of SEPP 14 listed coastal wetlands close to the study area. No construction activities would be undertaken within SEPP 14 or Ramsar site boundaries.

The Project would require construction of a new wastewater outfall to the west of the Site and would require the use of existing stormwater outfalls on the east of Kooragang Island. Stormwater would be collected from the clean parts of the Site and discharged either through the existing stormwater system on-site to the south arm of the Hunter River, or through a new stormwater system that links to existing outfalls that discharge to the north arm of the Hunter River. The conclusions of **Chapter 13 Surface Water and Wastewater** and **Appendix H Water Management Report** indicate that these increased stormwater flows into the Hunter River are unlikely to affect the water quality in the estuary. Therefore stormwater from the Project is not likely to adversely affect either the SEPP 14 wetlands or the Ramsar site.

Wastewater discharge into the south arm of the Hunter River was chosen to ensure that the Project would not have any significant adverse impacts on the SEPP 14 wetlands and/or Ramsar site. Unlike the stormwater discharge, the wastewater outfall would be higher in certain compounds including nitrogen and phosphates. The results of the hydrodynamic modelling (refer to **Appendix H Water Management Report**) confirmed that the receiving environment in this location is already high in these and other nutrients, and that water quality is likely to be maintained at current levels. The modelling also indicated that the outfall would need to be located approximately 10 m below the surface water level to ensure sufficient mixing. For this reason, the wastewater outfall and diffuser have been located and designed to ensure that the wastewater stream from the Project would mix and be diluted to background levels before being flushed out to sea. Therefore it is considered unlikely that wastewater discharge to the Hunter River would impact the SEPP 14 wetlands or Ramsar site located on the north arm of the Hunter River.

Due to the location, scale and extent of the proposed wastewater outfall and stormwater discharges and relative distance of the Site from the SEPP 14 wetlands and Ramsar site, it is considered unlikely that the Project would result in a substantial or measurable change in the hydrological regime of the adjacent wetlands.

Due to the proximity of the study area to the Ramsar Wetland, a SIC assessment (as per DEWHA 2009) has been undertaken for the Hunter Estuary Wetlands (refer to **Appendix L8**). This SIC outlines the various potential impacts resulting from the Project on the nearby Ramsar Wetland. The results of the SIC assessment indicate that the Project is unlikely to result in a significant impact to the Hunter Estuary Wetlands. Additional information on potential impacts to the Hunter River is available in **Appendix H Water Management Report**.

18.5.8 Construction Impacts

The Project is unlikely to cause direct ecological impacts given the location of the Project footprint, the proposed nature of works to be undertaken and the current disturbed nature of the study area. Nevertheless, the Project has the potential to result in three indirect ecological impacts during the construction phase:

- Increased sedimentation and nutrient loading through stormwater discharge;
- Potential changes to the existing water flows of the area, which have the potential to impact on the quality of the surrounding waterways; and
- Increased noise and vibration levels during the construction process, which have the potential to deter a range of native fauna species from using surrounding habitat resources.

Measures to manage or avoid these impacts are described in **Section 18.6**.

18.5.9 Operational Impacts

Operational impacts are likely to be long term and indirect. Operational impacts resulting from the proposed works may include; changes to water flow and quality in the Hunter River, potential impacts from spills or chemical leaks, changes to lighting and noise and potential impacts to fauna from collisions with vehicles. These matters are discussed below.

The Project has the potential to result in impacts to waterways throughout its operational lifespan. These alterations are likely to be as a result of changes to existing discharges into surrounding waterways, including an increase in the discharge of nutrients and volume. Such alterations may result in an increased potential for water column stratification and nutrient enrichment in the Hunter River. To mitigate this impact, stormwater and process water from different parts of the Site it would be captured and routed to three separate systems: a Waste water System to deal with contaminated stormwater and Project related wastewater; a First Flush System; and a Stormwater System. These systems are discussed in detail in **Chapter 4 Project Description**. Water considered to be contaminated would be treated prior to discharge. If nutrient levels were unacceptable, the water would be collected and sent offsite for disposal at a licenced waste facility. As discussed in **Section 18.5.7**, it is unlikely that discharges to the Hunter River would result in significant adverse impacts on identified ecological constraints (e.g. threatened biota or the RAMSAR wetland).

During operation there is the possibility that contamination may enter the stormwater system as a result of a leak, spill or from contaminated water in the unlikely event of an incident. To stop contaminated water and major spills entering the Hunter River, the stormwater design has included a retention pit, which includes an isolation value controlled from the control room on-site. The pit has been designed to retain the likely level of contaminated liquid following a major incident. Any retained water would be tested and released if it meets EPL limits. If the water does not meet licence limits it would be either disposed of through waste water system or be collected and sent offsite for disposal at a licenced waste facility. This measure would ensure that it is unlikely that discharges to the Hunter River would result in a significant impact on threatened biota or the RAMSAR wetland.

Increases to the lighting and noise levels in the Project area have the potential to permanently deter a range of native fauna species from using the area due to increased disturbance. Night time security and/or operational lighting can discourage native species from using habitat where exposed to diffuse light. The nocturnal regimes of nocturnal native mammals and birds can be disrupted and they can become vulnerable to predation by feral species. Light spill into adjoining areas of habitat may occur in some parts of the Site. As such, it is recommended that fauna sensitive lighting techniques be used, as described below (**Section 18.6**) to minimise impacts to fauna.

Collisions with wildlife (such as macropods and arboreal mammals) within and around the Site are possible as a result of increased vehicle movements around the Site. Such collisions with native species are considered unlikely within the Site. However, collisions along the existing access road and surrounding local roads are possible, particularly during dusk and dawn when macropods are active. Mitigation measures should aim to provide guidance on traffic management to ensure the potential impact of increased traffic within the area is addressed.

18.5.10 Key Threatening Processes

A threatening process is defined as a Key Threatening Process (KTP) if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community (DSEWPaC 2011). The Project could potentially cause or result in an increase in the impact of a number of KTPs listed under the TSC Act, FM Act, and EPBC Act.

KTPs under the TSC Act

The following KTPs listed under the TSC Act are considered to have potential relevance to the Project:

- *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* – Stormwater and wastewater discharges from the Project have the potential to alter the natural flow regime of the Hunter River.

- *Anthropogenic climate change* - The Project would emit various greenhouse gases and would increase greenhouse gas emissions (refer to **Chapter 14 Greenhouse Gas**). The key potential greenhouse gas emissions from the Proposal are nitrous oxide (N_2O) and carbon dioxide (CO_2). Greenhouse gas emissions would also result from increased traffic from the transport of product.

- *Competition and grazing by the feral European rabbit (Oryctolagus cuniculus)* - A number of rabbits and rabbit warrens were observed in the Site. Clearing of vegetation as a result of the Project would potentially decrease the amount of habitat available for foraging by the European rabbit. It is unlikely that the Project would increase the presence or abundance of the European Rabbit.

- *Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments* – This KTP is defined as pollution by human-generated objects, mostly consisting of fishing equipment, packaging materials, convenience items and raw plastics. Although it is considered unlikely that the Project would further augment this KTP, the mismanagement of waste during construction and operation could potentially increase the amount of anthropogenic debris in adjacent waterways. For this reason this KTP is considered to be relevant to the Project. Mitigation measures regarding waste management are discussed in **Chapter 16 Waste Management**.

- *Invasion and establishment of exotic vines and scramblers* - A number of exotic vines and scramblers cause significant adverse effects on native biodiversity. Exotic scramblers and vines smother native vegetation and seedlings, preventing recruitment especially in riparian areas. Construction of the Project has the potential to increase the spread and establishment of exotic vines and scramblers through the disturbance of soils and the spread of seeds. Where exotic vines and scramblers are already present within the study area, there is potential for these species to be spread via construction vehicles and natural dispersal into cleared and disturbed areas.

- *Invasion, establishment and spread of Lantana camara* - Lantana is an invasive weed that forms thickets of dense vegetation outcompeting native species and preventing recruitment. Lantana was recorded within the Lot. The Project has the potential to increase the spread and establishment of Lantana during construction and operation, through the movement of vehicles and increased disturbance within the study area.

- *Invasion of native plant communities by Chrysanthemoides monilifera* (bitou bush and boneseed) - The Project has the potential to increase the presence of Bitou Bush during construction and operation of the Project, through the movement of vehicles and increased disturbance within the study area. The Project therefore has the potential to cause the spread of this species off site, through wind and water seed dispersal.

KTPs under the FM Act

The following KTP listed under the FM Act is considered to have potential relevance to the Project:

- *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* – Stormwater and wastewater discharges from the Project have the potential to alter the natural flow regime of the Hunter River.

KTPs under the EPBC Act

The following KTPs listed under the EPBC Act are considered to have potential relevance to the Project:

- *Competition and land degradation by rabbits* - A number of rabbits and rabbit warrens were observed in the eastern portion of the Lot. Clearing of vegetation as a result of the Project would potentially decrease the amount of habitat available for foraging by the European rabbit. It is unlikely that the Project would increase the presence or abundance of the European Rabbit.

- *Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris* - Although it is considered unlikely that the Project would further augment this KTP, the mismanagement of waste during construction and operation could potentially increase the amount of anthropogenic debris in adjacent waterways. For this reason this KTP is considered to be relevant to the Project. Mitigation measures regarding waste management are discussed in **Chapter 16 Waste Management**.

- *Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants* - Escaped garden plants can have negative implications on a number of native species and ecological communities throughout Australia. They can be spread by wind, water, insects, birds and other animals. A number of invasive garden plants are now recognised as Weeds of National Significance (WoNS). The five WoNS most commonly implicated as threatening biodiversity in NSW are various species of Lantana, Bitou Bush (*Chrysanthemoides monilifera*), Blackberry complex (*Rubus fruticosus* agg. species), Kikuyu (*Pennisetum clandestinum*) and Scotch Broom (*Cytisus scoparius*). The construction and operation of the Project has the potential to increase the presence of escaped garden plants due to increased soil disturbance resulting in the spread of seeds. The Project would require the removal of some vegetation which has the potential to facilitate the establishment of fast growing, competitive exotic species. Where escaped garden plants are already present within the Lot there is potential for these species to be spread via construction vehicles and natural dispersal (wind, water, etc.) into cleared areas as well as the Hunter River.

- *Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases* - The Project would emit various greenhouse gases and would increase greenhouse gas emissions (refer to **Chapter 14 Greenhouse Gas**). The key potential greenhouse gas emissions from the Proposal are nitrous oxide (N_2O) and carbon dioxide (CO_2). Greenhouse gas emissions would also result from increased traffic from the transport of product.

18.5.11 Critical Habitat

There are no areas of recommended or declared critical habitat listed under the TSC Act on the register of Critical Habitat kept by the Director-General, OEH or Primary Industries that are likely to be impacted by the Project.

There are no areas of critical habitat listed under the EPBC Act that are likely to be impacted by the Project.

18.6 Mitigation Measures

The following section identifies measures to mitigate the potential impacts of the Project on the ecological values associated with the Site, study area and surrounding environs. This section has been structured according to the layout recommended in the *Draft Guidelines for Threatened Species Assessment* (DEC/DPI 2005); namely to avoid, mitigate and offset.

18.6.1 Impact Avoidance

Impacts on ecology have been avoided by locating the Project footprint in areas where the vegetation is of poor condition and has low ecological value. The study area supports minimal native vegetation, with the vegetation present dominated by exotic grassland and landscape plantings. The majority of the trees bordering Greenleaf Road have been retained. A new entrance on to the Lot would require the removal of some trees; however this new entrance has been located to avoid the best feed trees in the south east corner of the Lot. Equally the wastewater outfall for the Project has been located in the south arm of the Hunter River to avoid any potential impacts on the habitats and communities found in the north arm.

18.6.2 Impact Mitigation

Measures to assist in the mitigation of impacts to ecological values of the study area are provided below.

Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) would be prepared for the construction phase of the Project. This plan would include measures to minimise or avoid impacts on native flora, fauna and ecological communities. These measures would be included in the CEMP via the following sub-plans:

- Flora Management Plan;
- Fauna Management Plan;
- Weed & Pest Management Plan; and
- Mosquito Management Plan.

These plans would address the potential implications of the Project on all threatened species identified as likely to occur or with potential habitat within the study area as outlined in **Appendix L5**. The CEMP would also include ongoing monitoring requirements, performance indicators, timing and responsibilities. Details regarding the relevant sub-plans are discussed below.

Flora Management Plan

A Flora Management Plan would be developed to mitigate impacts on flora as a result of vegetation clearing associated with the Project. The plan would include the following strategies:

- only vegetation that needs to be removed for construction of the Project would be disturbed. Exclusion zones around areas that would not be impacted by the Project during the construction phase would be clearly marked to reduce unnecessary disturbance. Specific attention would be paid to the large fig trees present within the Lot and the remaining line of trees along Greenleaf Road. The use of flagging tape or similar would be used to denote exclusion zones or other sensitive areas during the construction process;
- any areas outside of the Project footprint that are impacted by the construction process would be rehabilitated. Native endemic species would be used for any revegetation works where necessary; and
- future landscaping works would incorporate native flora species that have the potential to provide foraging resources for native fauna species. Landscaped vegetation should provide a range of stratum to allow a wide variety of fauna species to use them, and should aim to address any areas of bare ground that have been severely degraded as a result of past use.

Fauna Management Plan

A Fauna Management Plan would be developed to mitigate impacts on fauna as a result of the Project. The plan would include the following measures:

- wash down protocols to prevent the spread of amphibian chytrid disease *chytridiomycosis*. Protocols would be consistent with OEH guidelines (DECC 2008c). Wash down would occur whenever vehicles enter or leave an excavation, damp, wet or boggy area;
- use of ‘frog friendly’ and ‘wetland friendly’ herbicides such as RoundUp® Biactive for the control of weeds. Amphibians have been found to be very sensitive to some herbicide products and are particularly sensitive to the surfactants, or wetting agents used to improve the effectiveness of many herbicides (Mann and Bidwell 1998);
- rehabilitation works would be undertaken with the aim to promote connectivity within the immediate Kooragang Island environment and potentially into future to the surrounding suburbs;
- feral animal control where necessary;
- vehicle speed limits, appropriate fencing and signage on the Site and on Greenleaf Road would be developed to limit fauna road fatalities and protect habitat;
- lighting would be managed in order to reduce light spill on to areas of retained vegetation and avoid impacts on nocturnal fauna. All lighting would be directed inwards so as to minimise any spill outside the areas of activity; and
- key workers would be educated as to the appearance and location of any threatened species and noxious weeds present or likely to be present within the study area. Identified threatened species would have their locations marked onto Site plans and would be managed accordingly.

Weed & Pest Management Plan

Three noxious weeds and a number of non-native pest species were recorded on and close to the study area during the field survey. To ensure appropriate management of these weeds and pests the following measures would be implemented within the CEMP:

- Noxious weeds would be identified prior to construction commencing and would be managed in line with NCC and DPI control requirements shown in **Table 18-2**. Noxious weed material would be carefully stockpiled and stored to ensure propagates, seeds and vegetative material do not spread prior to disposal. All declared noxious weeds would be removed from Site, as per the NW Act, and would be disposed of at an appropriate location.
- Brands that that are suitable for use around sensitive environments and waterways such as RoundUp® Biactive would be used to control weeds should chemicals be required. If in doubt, advice would be sought from suitably qualified personnel.
- All plant and machinery would be free from mud, soil or root material to minimise the spread of any weeds, pathogens or diseases such as root-rot fungus (*Phytophthora cinnamomi*).
- Throughout construction, the Project work areas would be regularly monitored to ensure noxious weeds do not re-establish or spread within the Lot.
- Control of pest fauna, such as, Red Fox and European Rabbit.

Mosquito Management Plan

A mosquito management plan would be developed prior to construction. This plan would address any standing water on the Site and include methods to reduce mosquito habitat. The plan would detail potential risks from mosquitoes, as well as recommended treatment and abatement actions recommended by NSW health authorities. The plan would also detail methods to monitor mosquito population numbers within the Site. If required, education material would be provided to staff working on the Site.

Sediment, Erosion and Stormwater Management

Sedimentation, erosion and stormwater runoff resulting from construction activities has the potential to influence water quality and vegetation condition in the surrounding areas. Standard industry measures for erosion control and sediment run-off should be implemented according to *Managing Urban Stormwater: Soils and Construction Volumes 1 and 2* (Landcom 2004; DECC 2008d). Sediment and erosion control measures would be implemented prior to vegetation and soil disturbance to manage impacts to sites during construction and operation of the Project. These measures have been discussed in **Chapter 12 Soil and Groundwater** and would be implemented through a Soils and Erosion Management Plan within the CEMP.

Operational Environmental Management Plan

An Operational Environmental Management Plan (OEMP) would be developed to ensure appropriate mitigation measures are employed during the operation of the Project. This plan would address long term management actions designed to mitigate and minimise the ongoing potential impacts upon the natural environment as a result of the Project. The OEMP would incorporate all relevant measures outlined in this chapter, plus any other measures that become necessary in the face of changing environmental conditions. Key measures to be included in the OEMP include:

- the retention and management of the remaining vegetation on-site. Areas that are not required for operation of the Project would be clearly marked to prevent machinery and equipment being stored, dumped or driven into adjacent areas;
- new lighting would be designed and focused in to the Lot to reduce any light spill into areas of retained vegetation; and
- monitoring and control programmes for noxious weeds and mosquito management on the Site.

18.6.3 Impact Offset

A key principle presented in the DEC/DPI (2005) guidelines is that proposals should 'maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable biodiversity 'offset' in order to maintain or improve biodiversity values.

The Project would not involve the clearing of any TEC vegetation, and is unlikely to result in any impact on threatened flora or fauna species. Consequently, it is concluded that a biodiversity offset is considered unnecessary.

18.7 Proposed Management and Mitigation Measures

Provided the measures outlined above are incorporated into CEMP and OEMP for the Project, any significant adverse impacts are unlikely. Management and mitigation measures are provided in **Table 18-4**.

Table 18-4 Management and Mitigation Measures– Ecology

Management and Mitigation Measures	Implementation of Mitigation Measures		
	Design	Construction	Operation
A Flora Management Plan would be developed to mitigate impacts on flora as a result of vegetation clearing associated with the Project. Mitigation measures would include strategies such as: • exclusion zones around areas that would not be impacted by the Project during the construction phase; • use of flagging tape or similar to denote exclusion zones or other sensitive areas during the construction phase; • rehabilitation/ landscaping works to incorporate native flora species (sourced locally) that have the potential to provide foraging resources for native fauna species; and • no unnecessary vegetation clearance. The Project footprint to be fenced off to prevent damage.		✓	
A Fauna Management Plan would be developed to mitigate impacts on fauna as a result of the Project, including the following: • wash down protocols to prevent the spread of amphibian chytrid disease chytridiomycosis; • use of 'ecologically friendly' herbicides; • low vehicle speed limits on and throughout the Site to reduce fauna road fatalities; • educate HSE specialists as to the appearance and location of any threatened species and pest species potentially and/or present on-site. Works to cease in the event threatened species be found in construction areas; and • design lighting to reduce light spill into areas that are not required to be lit and may have potential for nocturnal fauna.		✓	✓
A Weed and Pest Management Plan would be developed as part of the CEMP. This plan would include: • noxious weeds would be identified prior to construction commencing and would be managed in line with NCC and DPI control requirements. Noxious weed material would be carefully stockpiled and stored to ensure propagates, seeds and vegetative material do not spread prior to disposal. All declared noxious weeds would be removed from the Site, as per the NW Act, and would be disposed at an appropriate location; • brands that that are suitable for use around sensitive environments and waterways such as RoundUp® Biactive would be used to control weeds should chemicals be required. If in doubt, advice would be sought from suitably qualified personnel. • all plant and machinery would be free from mud, soil or root material to minimise the spread of any weeds, pathogens or diseases such as root-rot fungus (*Phytophthora cinnamomi*); • throughout construction, the Project work areas would be regularly monitored to ensure noxious weeds do not re-establish or spread on-site; and • control of pest fauna such as, Red Fox and European Rabbit.		✓	
A mosquito management plan would be developed prior to the commencement of works associated with the Project.		✓	✓
An Operational Environmental Management Plan (OEMP) would be developed to ensure appropriate mitigation measures are employed during the operation of the Project. The OEMP would address potential habitat and the implications of development for all threatened species identified as likely to occur or with potential habitat within the Lot, as outlined in **Appendix L5**.			✓

19 Heritage

19.1 Introduction

This chapter outlines the potential impact of the Project on indigenous and non-indigenous heritage.

The DGRs have requested an assessment of, "*Aboriginal and non-Aboriginal heritage items and values of the site and surrounding area, taking into account the NSW Heritage Manual and Assessment Heritage Significance Guidelines*".

The assessment described below is based upon the findings of various Heritage Impact Assessment (HIA) reports commissioned by URS and conducted by the Australian Museum Business Services (AMBS) between September 2011 and January 2012. Copies of the Indigenous and the Non-indigenous Heritage Assessment Reports are available in **Appendix M Heritage Impact Assessment**.

19.2 Legislation and Planning Policy

A comprehensive explanation of the applicable Commonwealth Legislation, as well as the relevant State Legislation and Planning Policy for the Project is included in **Chapter 6 Legislation and Planning Policy**. However, set out below is a summary of the legislation and policy that specifically relates to the heritage assessment undertaken.

19.2.1 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

In 2004 a new National Heritage List (NHL) was established under the Commonwealth EPBC Act, to protect places that have outstanding value to the nation.

The Commonwealth Heritage List (CHL) was also been established to protect heritage items and places owned or managed by Commonwealth agencies.

However, the assessments undertaken for the purposes of this EIS confirmed that no items of Heritage relevant to the Site are listed on the NHL or the CHL.

19.2.2 State Legislation and Policy

NSW Heritage Act 1977

The NSW Heritage Act establishes the Heritage Council of NSW whose role is to assess and then either approve or decline proposals involving modification to heritage items or places listed on the State Heritage Register (SHR).

However, the assessments undertaken for the purposes of this EIS confirmed that there are no items or places listed on the SHR which are either on, or in close proximity to, the Lot.

Other State Legislation

The *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that environmental impacts, including cultural heritage, are considered at the land-use planning and decision-making level. Under the EP&A Act, Aboriginal heritage is protected in three different ways in NSW:

- Firstly, through planning instruments such as State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

- Secondly, section 90 of the EP&A Act (Part 4, Division 5) lists impacts to the environmental resource, including cultural heritage, which must be considered before development approval is granted.
- Thirdly, all State government agencies acting as determining authorities on environmental issues must consider a range of community and cultural factors, including heritage, in their decision-making process.

The *National Parks and Wildlife Act 1974* (NPW Act) also needs to be considered as it provides for the protection of Aboriginal objects (including sites, objects and cultural material) and Aboriginal places. The NPW Act protects aboriginal sites, but if certain sites are deemed as having great significance, they can be further protected by a heritage order, which is issued by the Minister, pursuant to the *Heritage Act 1977*, on the advice of the Heritage Council.

This Project is being assessed as State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979.* As such, no permits would be required under the Heritage or NPW Act. Nevertheless, works would be undertaken by IPL in a manner that avoids, protects and preserves heritage items where necessary.

Newcastle Local Environment Plan (LEP) 2012

Part 5, clause 5.10 of the *Newcastle LEP 2012,* headed “Heritage Conservation” provides for the protection of certain identified heritage items on Kooragang Island.

Heritage studies for the Project commenced before the gazettal of the 2012 LEP, therefore within this chapter and the Heritage reports contained within **Appendix M Heritage** consideration has also been given to the provisions of the 2003 Newcastle LEP.

Items listed with in the Newcastle LEP are discussed below in **Section 19.4.**

19.3 Assessment Methodology

The indigenous heritage assessment undertaken for this Project is consistent with a number of guiding documents, namely:

- the principles and guidelines of the Burra Charter (*The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance);* and
- and the requirements of the Office of Environment and Heritage (OEH), Department of Premier & Cabinet (comprising the former Department of Environment, Climate Change and Water [DECCW], and
- Heritage Branch, (NSW Department of Planning) guidelines as specified in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010).

The non-indigenous heritage assessment undertaken for this Project is consistent with:

- the principles of the Burra Charter (The Australia ICOMOS charter for the conservation of places of cultural significance);
- the policies of the relevant government department, the Office of Environment and Heritage (OEH);
- the Department of Premier & Cabinet (comprising the former Heritage Branch, Department of Planning and Department of Environment, Climate Change and Water [DECCW]).

- current heritage best practice guidelines as identified in the *NSW Heritage Manual*, published by the Heritage Office and Department of Urban Affairs and Planning (now Heritage Branch, OEH); and
- associated guideline documents, in particular *Assessing Heritage Significance (2001) and Assessing Significance For Historical Archaeological Sites and 'Relics'* (2009).

In order to complete both indigenous and non-indigenous assessments, detailed desktop reviews were undertaken. The desktop work involved reviewing numerous historical texts and reports in order to gain an understanding of the history of Kooragang Island. It also involved a review of the various heritage registers that exist at a Commonwealth, State and local level. The following sources were reviewed to compile a list of heritage features within close proximity to the Lot:

- The National Heritage List;
- The Commonwealth Heritage List;
- The NSW State Heritage Register; and
- *Newcastle LEP 2012*.

This desktop review was followed up by a walkover and survey of the Site conducted by two AMBS Heritage Consultants on 23 September 2011.

The findings of the desktop reviews and Site survey were used to understand the heritage baseline on the Site and around the Site and to understand whether the Project was likely to have an adverse impact on any indigenous or non-indigenous heritage values.

19.4 Existing Environment

19.4.1 Indigenous Heritage

Archaeological evidence from the wider Hunter region suggests that the Newcastle area has been inhabited for at least 35,000 years. Research throughout the twentieth century has yielded discoveries which provide sound archaeological evidence of widespread inhabitation in the area prior to European settlement.

Due to the Project location, on an island reclaimed from the Hunter River Estuary during the latter half of the twentieth century, it is considered unlikely that any new archaeological finds would be discovered on the Site or on Kooragang Island.

A search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on 16 August 2011. This search identified 73 registered Indigenous Heritage sites within a search area of 6 km by 6 km around the Site. The majority of these finds were located in Stockton. The results of the AHIMS Search are summarised in **Table 19-1**.

Table 19-1 Results of the AHMIS Search

Site Type	Count
Indigenous Resource and Gathering	22
Open Camp Site	19
Midden	13
Burial/s	7
Indigenous Ceremony and Dreaming	6
Stone Arrangement	1
Potential Archaeological Deposit (PAD)	1
Isolated Find	1
Indigenous Ceremony and Dreaming, Midden	1
Indigenous Ceremony and Dreaming, Midden, Burial/s	1
Natural Mythological (Ritual)	1
Total	**73**

A complete explanation of the type and location of the finds is included in the Indigenous Heritage Impact Statement included in **Appendix M Heritage Impact Assessment.**

During the AHMIS Search only one heritage site was identified as being potentially located within the Site. This site, an open camp site, identified as 'Stockton 13B', was located in the AHMIS on the south eastern corner of the Site. An assessment of the data indicated that the heritage site might in fact be registered in the wrong location. This conclusion was confirmed by AMBS during a consultation process involving the site recorder, Mr Leonard Anderson, and OEH. Further information regarding this site is provided in **Appendix M1**.

Therefore as no sites of indigenous heritage were recorded on the Site from the AHMIS Search and no further discoveries were anticipated due to the reclaimed and disturbed nature of the Lot, a specific indigenous heritage field visit was not required.

19.4.2 Non Indigenous Heritage

Early European settlers arrived in the Newcastle area shortly after coal was discovered in 1797. As the fertile lands in the Hunter Valley were settled for agricultural uses, the area became known for a combination of agriculture, industry and mining. As well as providing rich supply of natural resources, early settlers found an ample supply of shells in the indigenous middens of Stockton Beach which were used to make the lime for building works in Sydney.

The area around what is now Kooragang Island was first charted in 1801 and at the time consisted of three large islands, Greville, McKellar and Ash Island. The Site is located in an area that was to the east of these islands on what was once an inter-tidal sandbar. Kooragang Island was reclaimed during a staged process that began in the late 1890s and was completed in the 1950s. This reclamation process included the dredging of the harbour sands onto the island and the deposition of industrial waste.

Kooragang Island was established in its current form after implementation of the *Newcastle Hunter Improvement Act.* The first lease on the Island was granted to Australian Fertilisers, in 1964. This lease included the Site.

A study of *Newcastle LEP 2012* identified a number of heritage items on Kooragang Island. These are listed in **Table 19-2.**

Table 19-2 Heritage Items Listed within the Newcastle LEP 2012

Ref	Name	Primary Address	Significance
1208	Tongues Tree Fig	Kooragang Nature Reserve	Local
1209	131 Radar Igloo (building)	200 Kooragang Street	Local
1210	School Master's House	200 Kooragang Street	Local

19.5 Assessment of Impacts

19.5.1 Indigenous Heritage

It is considered unlikely that any Indigenous Heritage items would be discovered on the Site during construction of this Project due to the extensive development and disturbance that has occurred, principally over the last 100 years. Any Indigenous sites that were present in the vicinity of the Site are likely to have been lost during the reclamation of Kooragang Island or during flooding prior to the stabilisation of sea levels approximately 6,500 years ago.

The heritage assessment undertaken is considered to meet the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010).

No further Aboriginal heritage assessment or consultation is therefore considered to be required for this Project.

19.5.2 Non-indigenous Heritage

None of the heritage items listed in either the *Newcastle LEP 2012* would be impacted by the Project.

No further items were identified in the vicinity of the Site during the field visit. Although some items that are to be removed from the Lot as part of the Project were found to hold some architectural interest, they are of a type that is found to be common throughout the wider area and therefore not worthy of special consideration.

The background research and physical assessment of the Site, and its local environment, has determined that there are no heritage constraints for this Project.

19.6 Mitigation Measures

Notwithstanding the conclusions discussed above, should any heritage items be discovered during the construction process, work shall cease until the discovery can be assessed by a qualified heritage consultant.

19.7 Proposed Management and Mitigation Measures

The Project is located on a Site that was reclaimed from the Hunter River in the later part of the last century and has been used solely for industrial purposes since this time.

There are no items of heritage significance located within the boundaries of the Site.

No impacts are anticipated on recorded items of heritage significance surrounding the Site. Should any items be discovered during the construction process, work would cease until an investigation can be conducted by a trained archeologist.

Table 19-3 outlines the mitigation measure to be employed during the construction of the Project.

Table 19-3 Management and Mitigation Measures – Heritage

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Should any heritage items be discovered during the construction process, work shall cease until the discovery can be assessed by a qualified heritage consultant.		✓	

20 Resource Implications

20.1 Introduction

This chapter evaluates the potential resource implications resulting from the Project including electricity, water, natural gas, and diesel. It describes the existing resource use and the proposed resource use and whether the Project will have any adverse impacts on the availability of those resources as well as highlighting where certain savings can or would be made. This assessment has been completed using planning and design documentation provided by IPL.

20.2 Existing Site Activities

The Project will be added to an existing facility on the Site which operates as a primary distribution centre (PDC) which receives, stores, blends, bags and despatches both bulk and bagged solid and liquid fertilisers. The PDC handles approximately 155,000 tonnes per annum of fertilisers.

Under current operations the Site operates single daily shifts from 7 am to 4.30 pm, five days per week. However, flexible hours based on customer demands during peak periods are extended, i.e. 12 hours shifts plus additional overtime. Security guards operate permanently 24 hours a day, seven days a week. Further details regarding the existing operation on the Site can be found in **Chapter 3 Project Location and Existing Environment**.

20.3 Current Resource Use

The key resources currently consumed during the daily operation of the Site include water and electricity. Other infrastructure including telecommunications and sewerage (via on-site septic systems) currently exists on the Site and will be available for the Project.

20.3.1 Electricity

The existing operation on the Site receives its supply of electricity from Ausgrid infrastructure via an electrical substation located on the Site. The current electricity demand is 1,070 megawatt-hours (MW-h) per annum.

20.3.2 Water

The water requirements for the Site are supplied by the local water authority, Hunter Water Corporation (Hunter Water). This supply is taken directly from the mains supply via an underground potable water line. The current demand for water from existing operation is 0.15 kilolitres (kL) per hour.

20.3.3 Natural Gas

The existing IPL operation does not currently use natural gas. However, the Lot is serviced by a gas pipeline. This pipeline is owned and maintained by Jemena. This gas supply from AGL would be available for any future operations.

20.3.4 Diesel

Diesel is currently stored on the Site in a double skinned relocatable containerised tank. Diesel is used for fuelling IPL vehicles and other portable equipment. The existing facility uses 76,000 litres per annum of diesel.

20.4 Resource Impacts

IPL has conducted an assessment of the various utilities currently servicing the Site and those required for the Project. IPL has then approached the relevant electricity, water and natural gas suppliers to evaluate their ability to meet those required supply demands.

These discussions with the utility suppliers have concluded that the available utility infrastructure has sufficient capacity to service both IPL's current resource requirements and those which would be required for the Project. As such, there is therefore no adverse impact likely on resource supplies to third parties in the area.

Further information regarding the Project can be found in **Chapter 4 Project Description**. The key resource requirements for the Project are outlined below.

20.4.1 Construction Phase

Electricity

During construction of the Project would require a supply of up to 16 Mega-Watt hours (MW-h) per day of electricity imported from the grid or generated on-site from portable generators. This electricity would be required prior to the commissioning of the NA plant. During the commissioning and Project start up stage, the electrical demand would peak at up to 10MW for short periods with consumption increasing during the commissioning phase from approximately 30MW-h per day to a peak of approximately 120MW-h per day.

Water

Water would be required during the construction phase of the Project for construction use and general workforce amenities. This water would be potable water supplied by Hunter Water. During normal periods there would be demand of approximately 12 kL per day. Peak demand would be for hydro testing on-site constructed tanks and may be in excess of 5,000 kL per day for short periods. There is also a provision for 1,700 kL of demineralised water to be utilised if required.

Natural Gas

During the construction phase natural gas would also be required for commissioning of the Auxiliary Boiler and Flare systems. Normal usage would require a demand of 20 gigajoules per hour (GJ/hr) of natural gas, peaking at 170 GJ/hr.

20.4.2 Operational Phase

Electricity

During steady state operations the Project is expected to require less than 2 megawatts (MW) of electricity from the grid. The various exothermic reactions, the generation of steam and the operation of a steam-driven generator within the NA plant would provide enough electricity for the Project during steady state operations. This steam-driven generator would provide approximately 7.5 MW.

During start up and shutdown or other upset conditions, the Project would require a maximum of 10 MW of electricity from the grid. The electricity requirement is estimated to be 8 MW when the NA plant is shutdown and AN plant is running, which would be the case for approximately 7 days per year.

Water

Water for the Project would be sourced from the existing Hunter Water mains supply. Water would be used as cooling tower make-up, potable water, firewater and feed for the Site amenities. Water would also be converted into demineralised water for a number of processes including boiler feedwater. The anticipated increase in water demand for the Project is shown in **Table 21-1**.

Table 20-1 Proposed Water Demand

Project Operation Condition	Project Requirement (kL/hr)	Increase in Demand from existing (kL/hr)
Steady State	180	179.85
Start up/Shutdown	220	219.85

Given the low level of water use from the existing operation (approximately 0.15 kL per hour), the uplift in water demand for the Project is significant when compared to the existing operation on the Site. A number of measures to reduce water demand were therefore considered as part of the design process and opportunities to re-use water streams have now been included in the design. These processes include recycling process condensate to the absorption tower and the re-use of boiler blowdown in the cooling tower. Steam condensate recovery and recycling is also utilised to minimise the consumption of boiler feedwater makeup. Where practicable, rainwater would also be harvested to reduce the water consumption.

It may be possible to further reduce the water consumption by increasing the cooling tower cycles of concentration. However this would increase the nutrient concentration of water discharged from the Site and therefore decisions surrounding any further reductions must be balanced against compliance with the EPA licence conditions imposed on the Project.

Natural Gas

Natural gas is a key fuel for the Project. The Auxiliary Boiler would run off Natural Gas continually during plant operation, with peak demand during NA Plant start-up and shutdown. The steam produced by the boiler during start up and shutdown would be used to start key equipment items and heat the catalysts in the NA plant, allowing them to run at peak efficiency, thereby reducing NOx emissions. During steady state operation, natural gas would be required to provide Low Pressure and High Pressure Steam for maintaining temperature in critical systems and generating electricity. A small amount of natural gas would also be required at all times for the flare pilots and purging process.

The proposed Natural Gas consumption for the Project is presented in **Table 21-2.**

Table 20-2 Proposed Natural Gas Consumption

Proposed Consumption	Quantity (GJ/hr)	Increase in Demand (GJ/hr)
Steady State	75	75
Start up/Shutdown	170	170

Diesel

Diesel is required for the fuelling of light vehicles, forklifts, portable equipment and the emergency generator. The diesel would be stored in the existing double skinned relocatable containerised tank.

The proposed Diesel consumption for the Project is presented in **Table 21-3**.

Table 20-3 Proposed Diesel Usage

Current Usage (L/pa)	Proposed usage (L/pa)	% increase from current usage
76,000	100,000	32%

20.5 Discussion and Conclusions

Discussions with the various utility providers have confirmed that the existing utility infrastructure servicing the Lot is suitable for the construction and operation of the Project.

The Project has been designed to reduce resource use as far as possible. During steady state operations, the Project would require a small amount of electricity from the grid and would only require a relatively small amount of natural gas.

Larger amounts of electricity and natural gas would be required during start up and shutdown.

The Project would also require both water and diesel fuel. The amount of diesel required is likely to fluctuate slightly, but would not be tied to the operational condition of the Project. The Project would require significantly more water from the mains system than the existing IPL operation requires. However it has been confirmed with Hunter Water that the water requirements for the Project are available and would not result in water shortages or place significant demands on the existing water supply.

As discussed above, a number of measures have been included to help reduce the water demand of the Project. Therefore, in summary, a significant impact on the utilities in the Newcastle area, including the water supply, is considered unlikely and according to the utility suppliers can be accommodated.

21 Socio-Economic

21.1 Introduction

This chapter discusses the socio-economic impact assessment which was undertaken of the Project. That assessment considered the current and historical demographic, employment and industrial socio-economic data relevant to the Project area and then assessed the economic and employment generation impacts which would be associated with the Project.

21.2 Assessment Methodology

21.2.1 Baseline Analysis

The statistical analysis for this assessment has been based on Australian Bureau of Statistics (ABS) data collected as part of the 2006 census for the Newcastle LGA. This data is currently the most recent available.

21.2.2 Assessment Methodology

The Input-Output tables for the Australian economy produced by the ABS provide the means to estimate the impact of the proposed investment of the Project on the Newcastle LGA (the 'study region'). In essence, these tables are constructed by categorising the Australian economy into 109 industry sectors. They provide a detailed dissection of intermediate transactions within these sectors and the ability to describe the supply and use of the products in the total economy.

The Input-Output tables also enable the derivation of multipliers. These are summary measures used for predicting the total impact on all industries in an economy, of changes in the demand for the output of any one industry, such as the changes in demand that would result from the proposed Project investment by IPL. Several types of multipliers can be derived to capture different levels of associated activity within an economy as a result of a change in demand in one sector.[1]

An 18 sector Input-Output table of the Australian economy was derived from the 109 Sector Table published by the ABS. Multipliers for each of these sectors were then derived based on the methodology employed by the ABS.

Given the nature of the Project, the Construction and Manufacturing sectors were selected as being most representative of the construction and operational stages of the Project. For the Construction and Manufacturing sectors, the derived Type 1a multipliers are 1.65 and 1.55 respectively. The use of Type 1a multiplier limits the potential to overestimate the overall economic impact on the Australian economy of an increase in demand for the output of a particular sector.

Project information has been supplied by IPL as the proponent and all figures are expressed in Australian Dollars for 2012 or in 'real terms' ($A2012).

[1] ABS, Catalogue No 5246.0, Information Paper; Australian National Accounts; Introduction to Input-Output Multipliers.

21.3 Existing Environment

21.3.1 Study Region

The Project is situated in an existing industrial sector of Newcastle that includes the major international shipping port facilities located at the Port of Newcastle. The area is well connected to both rail and road land transport infrastructure. The study region for the Project also includes a residential population from which much of the labour, skills and expertise to service the needs of the commercial and industrial enterprises of the region can be drawn. It is estimated that approximately 75% of this labour for construction of the Project would be sourced from within the study region.

21.3.2 Existing Operation

The existing operation on the Site would continue during the construction and operation of the Project. Accordingly, this means that the current employment of some 40 staff and contractors and associated expenditure in operating the existing facility, would be largely unaffected by the construction and operation of the Project. Therefore the impacts of the Project on the economic activity within the study region would be additional to the impacts from the existing operation.

21.3.3 Statistical Socio-Economic Analysis

This section examines the socio-economic breakdown for the Newcastle LGA in order to assess the potential impact of the Project on the study region.

Population Age Structure

Figure 21-1 shows the breakdown of age groups in the study region compared to the average for NSW. The age breakdown in the study region closely mirrors the average from across the State (ABS 2006). The same is true of the share of the population aged between 16–64 years. This part of the population is referred to as 'the labour force bracket'. The population for the study region was recorded at 141,753 at the time of the 2006 Census.

Labour Force

An insight into the skills, expertise and capability of the local labour force to construct and operate the Project can be gained from the level of educational attainment, occupation by profession and trade, and the relative level of economic activity in different sectors of the regional economy. These aspects are presented in **Figures 21-2** to **21-5** for the study region. All charts have been prepared using data sourced from the ABS relating to the 2006 Census.

Based on the information presented in the figures, about 40 % of the potential workforce from within the study region hold post-secondary qualifications (refer to **Figure 21-2**). When combined with the number of people employed as 'technicians and trade workers' and 'machinery operators and drivers' (refer to **Figure 21-3**), as well as the share of the workforce employed in 'manufacturing', 'construction' and 'professional, scientific and technical services' sectors of the economy (refer to **Figure 21-4**), it can be concluded that the workforce required to construct and operate the Project would be available locally.

Although the unemployment rate in the study region remains relatively low (given the relative strength of the Australian economy), the Project itself should not give rise to labour supply pressures and associated cost increases, particularly given the relatively long construction period of 28 months.

Figure 21-1 Age Breakdown for the Newcastle LGA and NSW

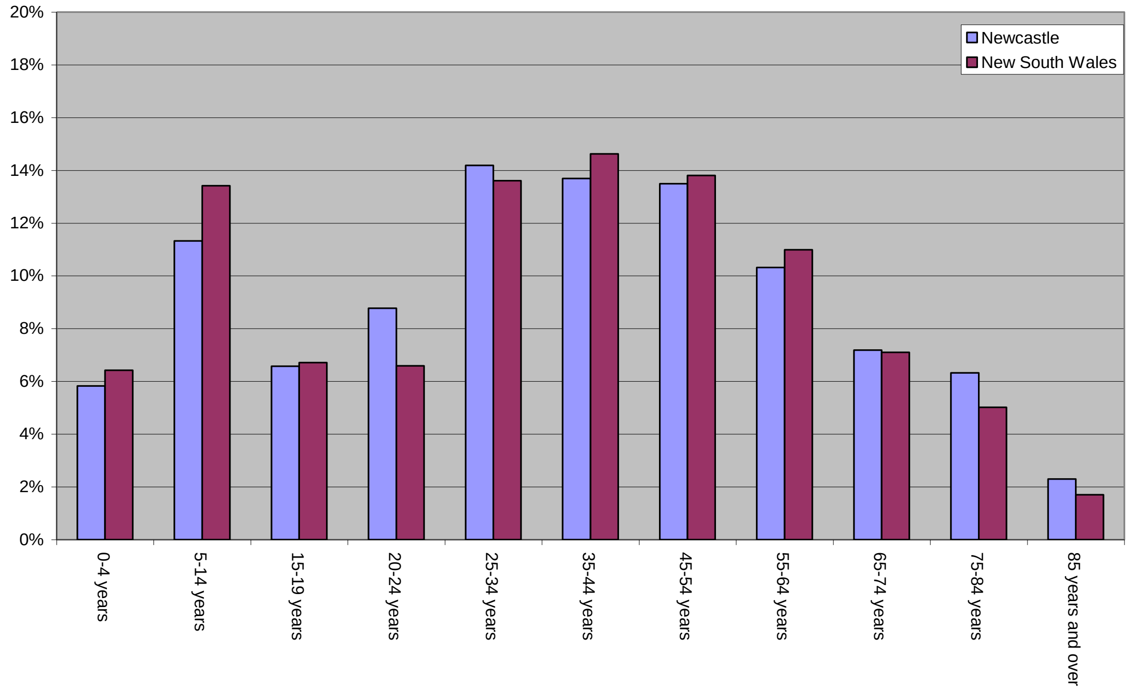


Figure 21-2 Level of Educational Attainment – Newcastle

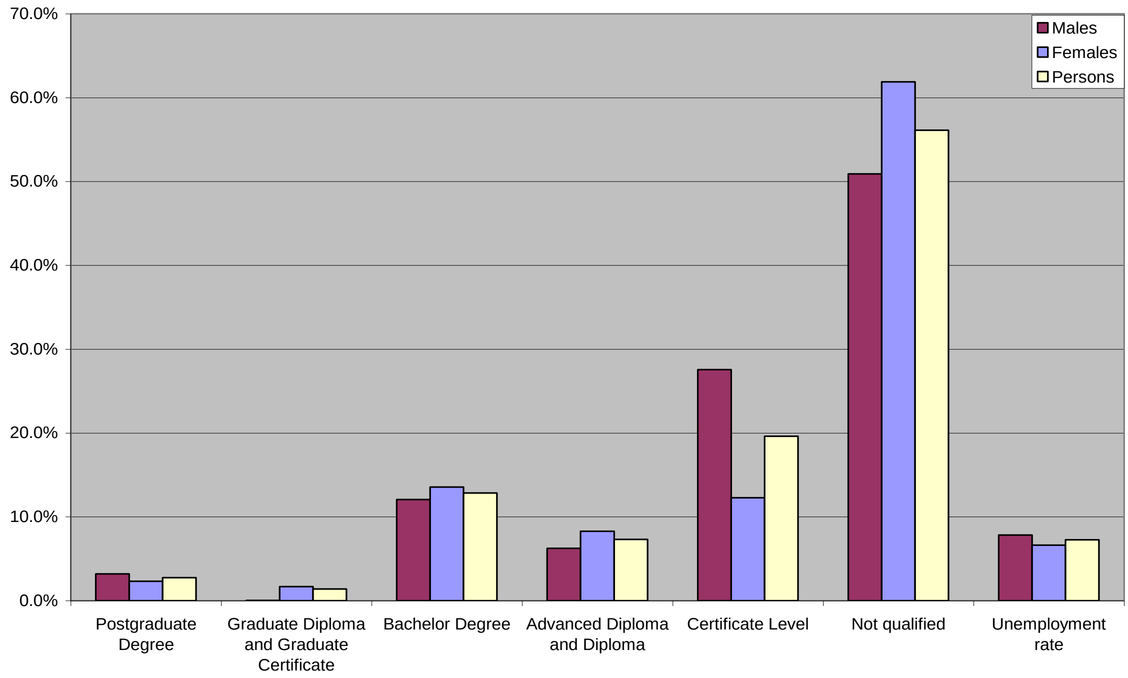


Figure 21-3 Labour Force of Newcastle LGA

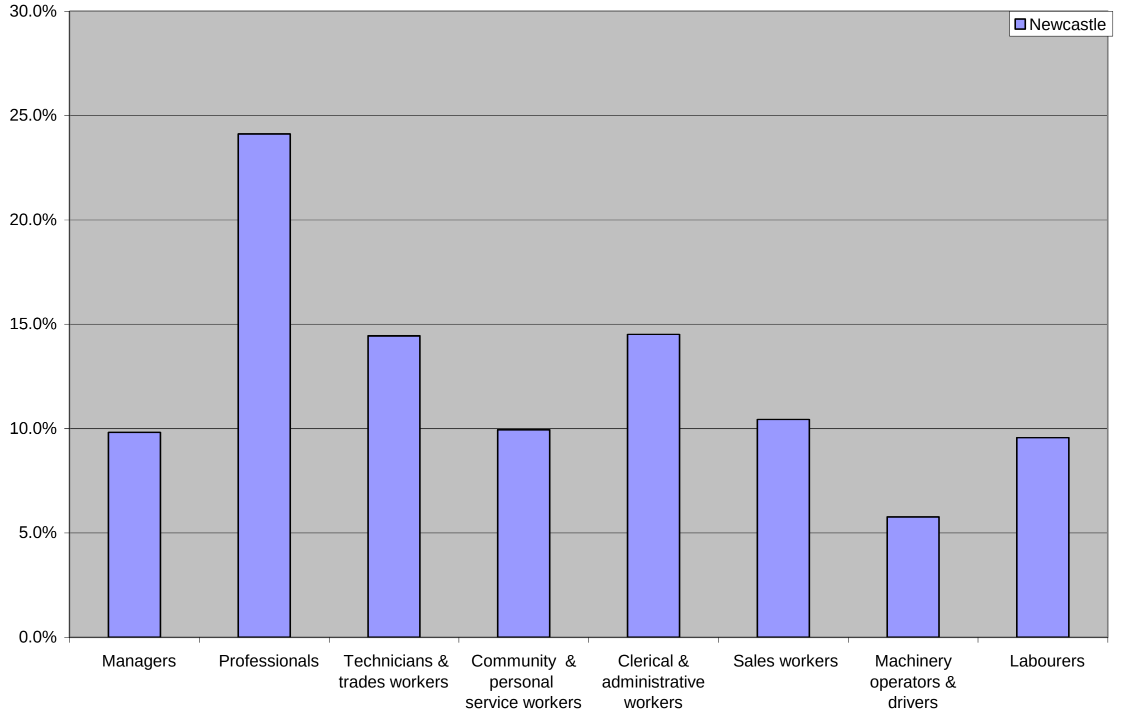
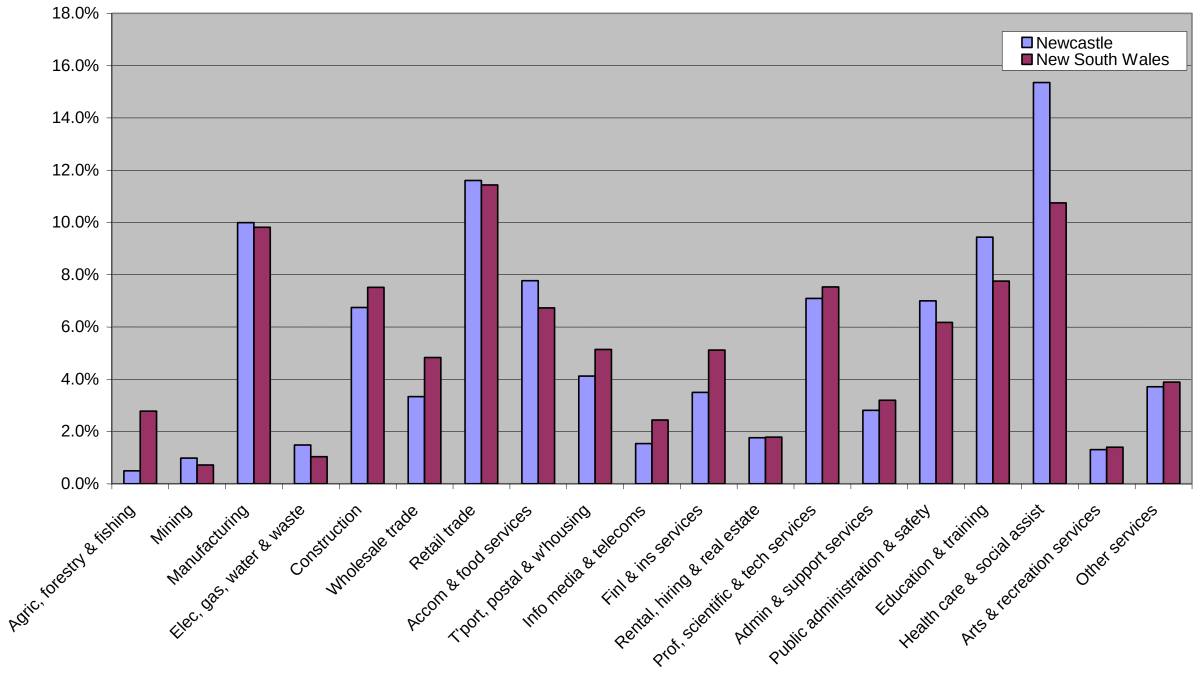


Figure 21-4 Industry Breakdown: Newcastle LGA and NSW



21.4 Assessment of Impacts

This section provides an assessment of the potential economic impacts on the study region which may arise as a result of the Project. These include impacts on employment and the local economy during the construction and operational phases of the Project. No changes to land ownership would occur as a result of this Project. Land use is expected to remain the same with the Project being compatible with current zoning applicable to the Site.

21.4.1 Project Information

The cost of the Project is expected to be $600 million of which an estimated $319 million (53%) would be for Australian sourced inputs, and $281 million (47%) would be for imports. For the Australian sourced inputs, $223 million (70%) would be for labour and $96 million (30%) for materials and equipment. All of the labour input would be from Australia, with an estimated 75% of this labour to be sourced locally from within the study region. The share of Australian materials and equipment to be sourced locally is estimated at $48 million (50%).

The Project is expected to be constructed over 28 months. The peak construction phase employment is estimated to be between 300 and 340 people.

Ongoing fixed operational and maintenance costs are estimated at $22 million a year, of which $12 million (56 %) would be for labour and $10 million (44%) would be for materials and equipment. All of the labour would be sourced locally and an estimated $7 million (71%) for materials and equipment would also be sourced from local suppliers.

In addition, a number of variable costs would be incurred based on the level of operation of the new facility. Given the design capacity for the new facility, these costs are expected to be $11 million a year and include the costs of handling imported ammonia, Prill coating and additives and ANSOL production.

Once operational, the new facility would operate 24 hours a day, seven days a week. It would employ 60 full time employees, as well as contractors for maintenance, security and transport.

21.4.2 Construction Phase

Construction Phase Expenditure

Construction of the Project would commence in the 2012–2013 financial year, with the new facility being scheduled to commence operations in mid-2015. Some initial expenditure on imported capital items is scheduled to occur during the 2012-2013 financial year; these purchases would have no material impact on the level of economic activity in the study region.

The expenditure information for the construction phase is presented in **Table 21-1**. Also shown is a breakdown of the expenditure that would be incurred on Australian sourced inputs ($319 million) based on the allocation that 70% of this amount would be on labour ($223 million) and the other 30% ($96 million) on materials and equipment.

Of the expenditure on labour, 75% would be sourced from within the study region, with the remaining 25% being ‘imported’ from outside the region. For the labour that is imported, 75% of their income is expected to be spent on goods and services sourced from within the study region. Taken together, these aspects determine the overall increase in total labour income that is spent in the study region as a result of the Project investment. This increase in total labour income is a key driver of the regional economic impact of the Project.

Concerning the expenditure on Australian sourced materials ($96 million), half ($48 million) would be sourced from suppliers in the local region, with the other half being sourced from other areas of Australia outside the study region. As for total labour income spent locally, it is the expenditure on materials sourced locally which is the other driver of the regional economic impact of the Project. Conversely, imported materials and equipment would have no impact on the level of economic activity in the study region or for Australia.

Table 21-1 Project Expenditure Breakdown — Construction Phase (2012-2013 to 2014-2015)

Capital Expenditure	Total $ million
Australia	319
Imports	281
Total	**600**
Australian Materials	96
Share sourced locally (50 %)	48
Australian labour	223
Local labour (75 %)	167
Non-local labour	56
Share non-local labour spent locally (75 %)	42
Total labour income spent locally	**209**

Total impact of construction expenditures on the local regional economy

Using the expenditure as summarised in **Table 21-1**, especially the share of labour income to be spent locally and the share of materials and equipment to be sourced locally, together with the derived Type 1a multipliers for the Manufacturing and Construction sectors, the total impact of the Project on the study region economy can be assessed. The assessed impacts for the Project as a whole are presented in **Table 21-2**.

Table 21-2 Impact of Proposed Capital Expenditure: Total Project Construction Phase

Description	Labour	Capital	Total
Project Expenditure ($m)	$223	$377	$600
Project Expenditure in Region - Newcastle Local Government Region ($m)	$167	$48	$215
Share from local area (%)	75%	13%	
Share of wages spent locally by non local labour	75%		
Construction multiplier Type 1a (National I-O)	1.65		
Manufacturing multiplier Type 1a (National I-O)		1.55	
Total impact of Project expenditure ($m)	**$345**	**$74**	**$419**
Value added share	100%	56%	
Contribution to Gross Regional Product ($m)	**$345**	**$41**	**$386**

Overall, the expenditure of $223 million on Australian labour would result in a total value to the local economy of $345 million during the construction phase (using the Construction Sector multiplier of 1.65).

With respect to the proposed capital expenditure on materials and equipment of $377 million, it is necessary to make adjustments for the share of materials/capital that would be imported (estimated to be $281 million), the share that would be imported from outside the study region and the share to be sourced from within the study region. This latter amount is calculated to be $48 million. Using the multiplier for the Manufacturing Sector of 1.55, the total impact of this expenditure on the local economy is calculated to be $74 million.

Contribution to Gross Regional Product

The calculated total impact of the expenditure associated with the Project of $419 million overestimates the contribution of the investment to the local economy. This is because the figures include the value of intermediate goods/services (inputs) sourced by IPL from other sectors of the economy. The value of these inputs needs to be removed to determine the contribution that the Project makes to the value of Gross Regional Product of the local economy.

In the case of capital expenditure on materials and equipment, the adjustment to remove the value of intermediate inputs is derived from the 18 Sector Input/Output table for the Australian economy with reference to the Manufacturing Sector. Based on these tables, the gross value added of the Manufacturing Sector to the Australian economy represents 55.8% of the value of intermediate inputs. This percentage share is then used to adjust the calculated total impact of $74 million from the capital expenditure on materials and equipment (if 50% of Australian inputs are sourced locally) to derive the contribution of that expenditure to Gross Regional Product for the study region. The contribution to the study region is therefore calculated at $41 million.

With respect to the calculated total impact of labour expenditure of $345 million, no adjustment is required for intermediate inputs associated with personal consumption. Accordingly, all of the labour expenditure in the study region makes a direct (or 100 %) contribution to Gross Regional Product. Therefore the total contribution to the Gross Regional Product of the study region during the construction phase is calculated to be $345 million.

21.4.3 Operational Phase

The associated annual variable and fixed operating costs for the Project are summarised in **Table 21-3**.

Table 21-3 Ongoing Fixed and Variable Annual Operating Costs

Description	Detail	Costs ($million)
Variable Operating Costs	**Volume dependent**	
Imported Ammonia (handling costs)	All sourced locally	0.6
AN Prill Coating and Additives	All sourced locally	1.1
Utilities	All sourced locally	6.2
Water Treatment	All sourced locally	1.5
Other	All sourced locally	1.6
Total Local		**11.0**
Fixed Operating Costs	**Manufacturing**	
Labour	All sourced locally	12.0
Total Local Labour		**12.0**
Materials and equipment		9.5
Total Local Materials and Equipment	**75 % sourced locally**	**6.8**

Using the expenditure information presented in **Table 21-3**, the impact of Project operation on the study region and contribution to Gross Regional Product per annum would be as presented in **Table 21-4**.

Table 21-4 Annual Impact of Proposed Operational Expenditure

Description	Labour	Materials	Total
Project Expenditure ($m)	$12	$21	$33
Project Expenditure in Region - New Castle Local Government Region ($m)	$12	$18	$30
Share from local area (%)	100%	87%	
Construction multiplier Type 1a (National I-O)	1.65		
Manufacturing multiplier Type 1a (National I-O)		1.55	
Total impact of Project expenditure ($m)	**$20**	**$27**	**$47**
Value added share	100%	56%	
Contribution to Gross Regional Product ($m)	**$20**	**$15**	**$35**

Overall, the ongoing operational expenditure of $12 million for locally sourced labour would be expected to have an aggregate annual contribution of $20 million on the regional economy. Similarly, because of the relatively high share of expenditure on materials and equipment to be sourced from the study region, the impact of this annual expenditure of $21 million is estimated as a $27 million contribution to the regional economy. This gives a total aggregate impact on the regional economy of $47 million a year from a total expenditure outlay of $33 million.

If an allowance is made for the purchase of intermediate inputs associated expenditure on materials and equipment, the total annual contribution to the Gross Regional Product of the study region during the operational phase is calculated to be $35 million.

21.5 Conclusion

Based on the proposed expenditure during both the construction and operational phases, the Project would be expected to have a significant positive impact on local regional economy, despite the relatively high share (47%) of total expenditure during the construction on imported materials and equipment.

The major reason for this positive impact is the ability of IPL to source the required labour during both phases from the local region. This ability arises because the required skills and expertise would be readily obtainable from local residents based on the labour force information provided in **Section 21.3.3**.

Overall, the expenditure of $223 million on labour during construction is calculated to make a total contribution to the Gross Regional Product of $345 million over this phase, mainly from labour income.

Ongoing annual operational expenditure is estimated at $33 million and this in turn would make a contribution of $35 million to Gross Regional Product per annum after adjustments are made for intermediate inputs purchased from other areas of Australia.

22 Cumulative Effects

22.1 Introduction

As requested by the DGRs, certain technical assessments have considered not only the impacts of the Project alone, but also the potential cumulative effects of the Project alongside other proposed developments. This chapter summarises the findings of those cumulative assessments.

The DGRs requested that the EIS consider the following with regard to cumulative effects:

- '*Hazards and Risks including … a summary of the results of a PHA undertaken for the proposed development. The PHA should be prepared in accordance with HIPAP No. 6 – Guidelines for Hazardous Industry, and in particular … estimate the cumulative impacts from the overall site and surrounding potentially hazardous developments (existing and proposed) and demonstrate that the proposed development does not increase the cumulative risk of the area to unacceptable levels.*'
- '*Air Quality including … cumulative impacts of the proposal in relation to existing and approved developments in the area.*'

During consultation with the RMS, they also asked for '*consideration of the traffic impacts on existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development. The traffic impact shall also include the cumulative impact of the other proposed developments in the area.*'

The assessment below has responded to these requests.

22.2 Assessment Methodology

Cumulative Effect Assessment (CEA) is a receptor led assessment, i.e. in order to have a cumulative effect, two projects or impacts need to affect the same receptor. Cumulative effects can be antagonistic, synergistic or additive. They are often caused by an action in combination with other past, present, and reasonably foreseeable future human actions.

In order for a project to have an adverse cumulative effect, it must:

- have a residual adverse effect; and/or
- result in another project's mitigation measures being less effective.

The first stage in any CEA is to understand the adverse residual impacts from the Project. The second stage is to identify any other projects nearby that may affect similar receptors and/or affect the efficacy of each other's mitigation measures. Other relevant projects that may have a cumulative impact with this Project have been identified using the following assessment parameters:

- Spatial parameter – The spatial parameter will depend on the characteristics of the environmental impact and the likely distance that any residual impact would travel. For example an air quality impact would potentially affect a wider area than a noise impact and would therefore affect different human or environmental receptors in different ways.
- Temporal parameter- Projects that are on exhibition, have completed exhibition but are not yet determined, have gained development approval, or have gained development approval but are not yet operational have been considered. Projects that are operational have been considered as part of the baseline for the assessment. Projects that are not on exhibition do not contain enough detail on residual effects or final design to allow a robust cumulative assessment to take place.

In order to identify relevant projects which are proposed in the area of the Site, two databases were reviewed:

- Major Project Assessments register on the NSW DP&I website; and
- Public notices and invitations to comment register on SEWPaC's website.

A review of these databases was considered the most effective way of identifying future projects that are likely to have significant residual impacts, and therefore may have a cumulative effect with this Project.

22.3 Cumulative Impact Assessment

22.3.1 Cumulative Assessment Scoping

As discussed, for a cumulative effect to occur, two impacts need to affect the same receptor. The key receptors in the local area include the communities of Stockton, Fern Bay, Mayfield and Carrington, the Hunter River and its aquatic communities and surrounding industrial land uses.

The Project has the potential to cause a number of environmental impacts. These impacts have been grouped, assessed and discussed under thirteen environmental aspects, as presented in **Chapters 9-21**. For the majority of these aspects there are no significant residual impacts during construction or operation on any of the identified receptors. As such in many cases a CEA is not required. Provided management measures are employed in line with the measures presented in **Chapter 23 Proposed Management and Mitigation Measures** no significant adverse impacts are expected for the following environmental aspects:

- Soil & Groundwater;
- Surface Water & Wastewater;
- Waste Management;
- Flora & Fauna;
- Heritage; and
- Socio Economics.

The nature of the Greenhouse Gas and Resource assessments mean that CEAs are not applicable.

Therefore specific CEAs are not required and have not been completed for these environmental aspects.

Conversely, the Project may have a cumulative effect with other developments for the following assessments.

Hazards & Risks

The Orica AN facility is located on the lot neighbouring the Site. The DGRs have therefore requested that a cumulative assessment of the associated Hazards & Risks of the Orica and IPL Projects operating in tandem be completed.

As assessed within **Chapter 9 Hazard and Risk**, the maximum cumulative individual fatality risk for Orica's AN plant and the Project is significantly lower than the NSW DP&I risk criterion for residential land uses applicable for a single proposed development. Therefore, it can be concluded that the Project, when combined with the existing and planned expansion of the Orica facility next door, would not increase the cumulative individual fatality risk to an unacceptable level.

Air Quality

As assessed within **Chapter 10 Air Quality and Odour**, existing air quality in the local area could be affected by the Project and a number of other projects being proposed on Kooragang Island.

The cumulative NO_2 emissions for the Project and the Orica expansion project would not exceed the OEH NO_2 criteria provided within the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (OEH, 2005) at the discrete receptor locations. Based on this assessment the potential for the Project to result in adverse cumulative air quality impacts is considered to be low.

Noise & Vibration

The acoustic environment surrounding the Project is described in **Chapter 11 Noise and Vibration**. The noise environment at the nearest residential receptors is already influenced by existing industry. Additional proposed projects may add to the ambient and background noise further.

This assessment concluded that during operation, the Project would meet the Project Specific Noise Limits (PSNLs) provided by the Industrial Noise Policy (EPA, 1999). By meeting the PSNL the Project would not contribute to the noise level at the affected receptors and would therefore not cause a cumulative impact with either the existing or proposed Orica operation, or any other proposed project.

Traffic & Transport

Whilst not a significant impact, the Project would add vehicle movements to the local road network, particularly on Kooragang Island. Other proposed developments on Kooragang Island could also add to vehicle movements and result in a significant impact. A cumulative assessment of this potential impact was requested by RMS.

As described in **Chapter 15 Traffic and Transport**, the Level of Service for the peak construction year remains unchanged when considering the relevant cumulative projects. Therefore no significant cumulative adverse traffic impacts are expected as a result of the Project.

Visual

The Project is located in an industrial context, which is described in **Chapter 17 Visual and Landscape**. Additional development in this location may have cumulative visual impact.

The Project is considered to have limited potential to increase the significance of cumulative visual impact due to the relatively small scale of the Project and its proximity to existing and similar infrastructure on Kooragang Island, together with the wider occurrence of industrial infrastructure within the Newcastle Port facility. Therefore no significant cumulative visual impacts are expected.

22.4 Conclusion

A number of environmental aspects were required to be assessed in order to complete CEAs. These assessments have all concluded that the Project is unlikely to result in a significant adverse cumulative impact on any of the surrounding community or environmental receptors.

23 Management and Mitigation Measures

23.1 Introduction

The preceding chapters of this EIS describe the potential impacts of the Project and identify a range of measures to manage risk, and avoid, mitigate or eliminate impacts. This chapter provides a summary of these mitigation measures. It outlines how these measures would be implemented and monitored through the Construction Environmental Management Plan (CEMP) and Operations Environmental Management Plan (OEMP).

23.2 Proposed Management and Mitigation Measures

The adoption of the mitigation measures discussed in **Chapters 9 - 19** is an important component of the Project and reinforces IPL's commitment to mitigation and management of the environmental impacts identified in this EIS.

Table 23-1 summarises these safeguard measures and sets out the timeframe for their implementation. If necessary, these measures would be updated following the Exhibition of the EIS, review of the submissions received and through discussions with DP&I and other stakeholders.

Table 23-1 Management and Mitigation Measures

Item	Management and Mitigation Measures	Implementation of mitigation measures		
		Design	Construction	Operation
	General			
A1	IPL would carry out construction and operation generally in accordance with the EIS and approval conditions	✓	✓	✓
A2	IPL would implement all practicable measures to avoid, or minimise, any impacts to the environment that may arise from the construction and operation of the Project.	✓	✓	✓
A3	Should the Project approval be granted, IPL would make a separate application to the NSW EPA for an amended Project specific Environment Protection Licence prior to construction of the Project.	✓		
A4	IPL would ensure that the Contractor prepares and implements a Construction Environmental Management Plan (CEMP) that would be reviewed and approved by an Environmental Management Representative (EMR).		✓	
A5	IPL would appoint a part-time EMR to monitor the implementation of all environmental management measures, The EMR would ensure that all mitigation measures are being effectively applied during construction and that the work is being carried out in accordance with the CEMP and all environmental approval and legislative conditions.		✓	
A6	IPL personnel and construction staff would undergo training in accordance with the CEMP and any other training commitments agreed as part of the Project Approval.		✓	
	Hazard and Risk			
B1	An inspection, testing and preventative maintenance program would be developed, implemented and maintained to ensure the reliability and availability of key safety critical equipment.	✓	✓	✓

Item	Management and Mitigation Measures	Implementation of mitigation measures		
		Design	Construction	Operation
B2	Safety Integrity Level (SIL) allocation and verification studies would be undertaken in accordance with IEC 61508 / 61511 as part of final design stage to ensure the probability of failure on demand of the following key safety critical equipment is consistent with the data estimates used in the PHA: • The overfill protection systems for the bulk Ammonia storage tank and Ammonia road tankers. • The automatic water quench system on the ANSOL tank. • The overheating protection system on the AN pumps. • The water quench system and overheating protection system on the Neutraliser vessel. • Level control and feedwater systems for the Absorber. • The ammonia road tanker driveaway protection system. A safety requirement specification (SRS) would also be prepared for the safety instrumented systems.	✓		
B3	The cryogenic (i.e. liquid) piping for ammonia would be designated as critical equipment and inspected / maintained accordingly.			✓
B4	To ensure a low likelihood of small liquid ammonia leaks from flanged joints, spiral wound gaskets would be provided for all liquid ammonia pipework (cryogenic and pressurised).	✓	✓	✓
B5	The final design would include physical protection measures to ensure the bulk ammonia storage tank is protected from impact by vehicles (including cranes, trucks, etc.). Also, the tank would be subjected to a hydrostatic test and full radiography for all welds of the lower five strakes during construction. Alternative non-destructive testing methods may be used in any locations where radiography is not practicable.	✓	✓	
B6	Measures (e.g. Fire detection and protection systems; storage limits per stack / pile; separation distances between stacks / piles; etc.) would be implemented to reduce the likelihood of an AN explosion due to fire, contamination or high energy impact. All of the listed engineering measures would be incorporated into the final facility design and the procedural control measures would be incorporated into the Site safety management system.	✓	✓	✓
B7	The gas detection system would be designed to ensure isolation within 3 to 15 minutes of the incident. Assessment such performance would be evaluated as part of the assessment for the Final Hazard Analysis. Similarly, as this system relies on human intervention, human factors would be evaluated as part of the system design (e.g. warning systems in control room, etc.) and its ongoing operation (training, etc.).	✓		✓
B8	For isolation of the marine loading arms at the berth, the automatic emergency release system would isolate a release within 25 seconds (15 seconds to detect; 5 seconds to send the signal to the isolation valve; and 5 seconds for the isolation valve to close). The final design of this pipework would ensure that a pressure surge cannot cause subsequent failure of the pipework due to this relatively short isolation time.	✓		✓
B9	An emergency systems survivability analysis (ESSA) would be undertaken during the detailed design stage to ensure all emergency isolation systems would perform their designed function in the event of a potential explosion (on- or off-site).	✓		
B10	A detailed structural analysis would be undertaken on the final design of the ammonia storage tank to determine the potential for leaks from the tank and associated pipework due to earthquake or strong wind events and these events would be included in the final hazard analysis (as relevant).	✓		
B11	The owner/operator of the trucks or road tankers would implement and maintain a robust Safety Management System			✓

Item	Management and Mitigation Measures	Implementation of mitigation measures		
		Design	Construction	Operation
B12	IPL would undertake formal audits of the vehicle owner's/operator's Safety Management System to verify it is adequate in managing the safety risks.			✓
B13	The audits of the transport contractor's Safety Management System would incorporate how the system manages the risks and maintain the risk controls related to the Major Accident Events. These would include:			✓
	• Random unannounced checks of the vehicles documentation to verify that the requirements for pre-use inspections are adhered to.			✓
	• Scheduled audits of the maintenance program to verify it is adhered to and that it is effective.			✓
	• Scheduled physical inspections of the vehicles to establish if they appear to be well maintained and licensed as a dangerous goods vehicle.			✓
	• An evaluation of the driver induction and compliance (including route familiarity).			✓
	• Evaluation of the driver competency and licence compliance, including product knowledge, emergency procedures, etc.			✓
	• Adequate program for disciplinary action if drivers break the rules (e.g. speeding, drug and alcohol, etc.) and enforcement of this program.			✓
	• Evaluation of the driver fatigue management program and its implementation.			✓
	• Adequacy of, and adherence to, secure parking.			✓
	• Inclusion of duress and GPS tracking systems in the vehicles			✓
	• Planned maintenance schedule.			✓
B14	If not already in place, the vehicle owner/operator would ensure that all vehicles have speed recording/limiting devices installed.			✓
B15	IPL would undertake random checks of the quality of the product restraining systems (for bags of TGAN) and record this as part of their Safety Management System			✓
B16	Adequate loading procedures would be implemented to ensure overloaded tankers are not allowed to leave the Site.			✓
B17	IPL and the transport contractor would consider the Hunter Expressway, once operational (planned for 2013), as an alternate main route to the Hunter Region, instead of the existing route (New England Highway).			✓
B18	A "Route Plan and Risk Assessment" similar to those existing for the current routes would be conducted by the transport contractor prior to commencing the regular use of the Hunter Expressway.			✓
	Air Quality and Odour			
C1	Dust suppression would be used during Project construction		✓	
C2	Ammonia would be refrigerated during import and storage to reduce the potential for external exposure to pollutant and odorous ammonia.			✓
C3	In the event of refrigeration failure within the ammonia storage facility, excess ammonia would be flared.			✓
C4	Catalytic control would be maintained throughout the operation to reduce the possible emissions of NOx and N_2O.			✓
C5	Bagging activities would be conducted within an enclosed area with sufficient filtering to remove suspended particles.			✓

	Noise and Vibration			
D1	Following detailed design, the Noise Model for the Project would be rerun to confirm the operational noise predictions for the Project and to ensure compliance with relevant limits.	✓		
D2	The CEMP for the Project would include a Noise Management Plan (NMP). The NMP would outline: • The locations of noise sensitive receptors; • Construction noise monitoring procedures; and • Construction equipment maintenance to ensure good working order.		✓	
D3	Low-noise plant and equipment would be selected, where practicable, in order to minimise potential for noise and vibration. All equipment would be regularly checked to ensure that the mufflers and other noise reduction equipment are working correctly.		✓	
D4	Equipment would be located to take advantage of the noise screening provided by existing site features and structures, such as embankments, storage sheds and/or boundary fences.		✓	
D5	Community consultation with local residents would be undertaken to assist in the alleviation of community concerns. A complaints register would be maintained.		✓	
D6	Any noise complaint(s) would be investigated immediately. Reasonable and feasible measures would need to be implemented to reduce noise impacts.		✓	
D7	General construction activities would be confined to between 0700-1800 Monday to Friday and 0800- 1300 Saturday. Construction work outside these hours would only take place if it was not audible at nearby residential receptors.		✓	
D8	Construction work would be scheduled to minimise the multiple use of the noisiest equipment or plant items near noise sensitive receptors.	✓	✓	
D9	Construction staff and contractors would undergo training in environmental noise issues including: • Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered; • Avoiding any unnecessary noise when carrying out manual operations and when operating plant; and • Switching off any equipment not in use for extended periods during construction work.		✓	
D10	Should any unexpected construction activities occur which could potentially generate significant noise not described in this report, monitoring would be undertaken to ensure equipment noise emission levels do not deteriorate.		✓	
D11	Where noise level exceedances cannot be avoided, consideration would be given to applying time restrictions and/or providing quiet periods for nearby residents.		✓	
D12	Heavy vehicle movements at night (22:00-07:00) would be limited to 175 per night.		✓	✓
D13	During operation a NMP would be produced as part of the OEMP for the Lot. This NMP would outline the monitoring programme for the Lot to ensure compliance with EPL limits.			✓
	Soil and Groundwater			
E1	A Soils and Erosion Management Plan would be developed as part of the CEMP to manage the excavation, testing, stockpiling, reuse and rehabilitation of soils. This plan would outline: • the areas where soil disturbance is likely; • soil testing procedures; • soil handling procedures; • locations where soil would be stockpiled onsite for either removal, treatment or reuse; • procedures to reduce erosion and the spread of dust; and • the rehabilitation of bare soil following completion of the construction works		✓	

E2	All materials would be stockpiled in accordance with 'The Blue Book' Managing Urban Stormwater – Soils and Construction Volume 1 and 2 (Landcom, 2004). Principal controls would include the following: • silt fences would be installed around stockpiles to reduce erosion as necessary; • stockpiles would be covered and wetted down in order to reduce dust creation; and • stockpiles would not be located in close proximity to any stormwater drainage systems		✓	
E3	Excavated soils would be tested for both for contaminants and odour using standard practices (e.g. soil vapour and soil, leachate and water sampling etc.)		✓	
E4	Clean materials would be separated from contaminated materials for reuse as backfill where required.		✓	
E5	A Contamination Management Plan would form part of the CEMP for the Project. This plan would outline measures for testing, handling, storing and managing contaminated soils and contaminated groundwater.		✓	
E6	Suspected contaminated materials would be classified in accordance with NSW (2009) *Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and disposed by a licenced contractor.		✓	
E7	Disposal of any contaminated soils or groundwater would be in accordance with NSW DECCW's *Waste Classification Guidelines* and the Contamination Management Plan (CMP) for the Project. Contaminated materials would be sent to appropriately licensed facilities in accordance with the *Contaminated Land Management Act (1997)*.		✓	
E8	If Acid Sulfate Soils (ASS) are encountered during construction, an ASS Management Plan would be prepared in accordance with the ASS Manual (ASS Management Advisory Committee 1998).		✓	
E9	A Groundwater Management Plan (GWMP) would be developed and included within the CEMP. This plan would outline the measures that would be used to manage the discovery, testing, dewatering, storage, movement and treatment of any groundwater during the construction phase. Measures would include: • the use of appropriate drip trays and interception techniques for any liquids stored on the Site; • regular inspection of construction equipment to ensure any hydrocarbon or other leaks are minimised and rectified; • management of vehicles leaving the Site to reduce soil on roads, production of dust and the introduction of contamination to the groundwater and/or stormwater system; • appropriate and timely disposal of any contaminated spoil, water or waste generated during construction; • regular inspection of erosion control structures and bunded areas; and • regular inspection and testing of containment areas and drainage lines		✓	✓
E10	Aquifer interference approval under the 1912 Water Act would be sought prior to construction starting.	✓		
E11	Dewatering works would be appropriately licensed, and carried out by suitably trained personnel.		✓	
E12	Groundwater removed by dewatering, and any runoff that may accumulate in excavations, would be periodically tested for elevated levels of contamination.		✓	
E13	Groundwater that is found to have elevated levels of contaminants, and cannot be either recharged into the groundwater or discharged via the stormwater system without impacting agreed EPA limits, would be treated on-site or stored and classified onsite before being transported offsite by a licensed contractor for appropriate treatment and disposal. Groundwater that is used for aquifer recharge would have to be the same or better than the quality of the existing groundwater in that part of the Site.		✓	
E14	No liquids or soils would be stored overnight within 100 m of arsenic plume affected area (as delineated by Figure 2 in the Orica EMP (2008)).		✓	

E15	Relevant monitoring wells would be fitted with data loggers to monitor any change in the direction or chemistry of the groundwater as construction progressed. This monitoring would be focused on the Orica arsenic plume.		✓	
E16	Where minor dewatering works are required, any potential change in groundwater gradient would be managed by locally recharging the aquifer with appropriate dewatered groundwater.		✓	
E17	Construction workers would be instructed in appropriate health and safety and handling protocols for minimising human contact with contaminated soils and groundwater.		✓	
E18	Stormwater runoff would be separated into wastewater, first flush and clean streams during operation to minimise contamination of soils, groundwater and surface water receptors. Stormwater considered to be contaminated would be retained and treated as required.	✓		✓
E19	Appropriate inspection, assessment, maintenance and repair programmes would be presented within the Operational Environmental Management Plan (OEMP) to reduce the likelihood for leaks or a loss of containment from the Project.			✓
	Surface Water and Waste Water			
F1	A Surface Water Management Plan (SWMP) would be developed as part of the CEMP to manage stormwater runoff during construction. This plan would be completed in line with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004). The plan would outline: • Measures to manage soils in line with the Soil and Erosion Management Plan; and • Measures to prevent the movement of contaminated run off to the Hunter River due to construction activities.		✓	
F2	A survey of the local drainage network relevant for the Project would be completed prior to detailed design.	✓		
F3	The quality of stormwater discharges would be monitored throughout the construction and operation of the Project to ensure that water quality levels are maintained within the limits of the EPL.		✓	✓
F4	Three stormwater management systems would be installed as part of the Project to manage stormwater quality. These systems include a contaminated water system, a first flush system and a 'clean' stormwater system.		✓	✓
F5	In order to minimise demands on the water supply, water would be reused and recycled within the Project process.	✓		✓
F6	Stormwater would be managed to ensure that there is no reduction in stormwater quality and that the current infrastructure is not operated over capacity			✓
F7	Fire water management would ensure that, in the event of a fire or ammonia leak on the Site, there is no loss of containment off the Site of potentially contaminated water.			✓
F8	Areas with a likelihood of containing potential contaminants would be appropriately bunded.	✓	✓	✓
F9	Soil stockpiles would be managed so as to reduce the impact from sediment during Project construction.		✓	
F10	Wastewater discharge will be continuously monitored with an automatic sampler and on-line for pH, temperature, volume and electrical conductivity.			✓

	Traffic and Transport			
G1	A Traffic Management Plan (TMP) would be produced as part of the CEMP for the Project. This TMP would outline: • hours of permitted vehicle activity; • designated routes for construction traffic and defined access points to the Site for each construction stage; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic works and traffic management devices should these be required; and • procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.		✓	
G2	The TMP for the construction phase would include details of the construction personnel park and ride service. Details would include drop off and pick up locations and timings, as well as identification of an appropriate 'parking' location.		✓	
G3	A Traffic Management Plan (TMP) would be produced as part of the OEMP for the Site. This TMP would outline: • hours of permitted vehicle activity; • designated routes for operation traffic and defined access points to the Site; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic works and traffic management devices should these be required; and • procedures and/or principles for vehicle speed limits and the safe operation vehicles.			✓
G4	During construction, barge movements from the western berths to the CTB wharf would be discussed with NPC to ensure that any movements did not conflict with port operations.		✓	
G5	During construction, traffic movements along NPC managed roads would be managed in liaison with NPC. A licence to move modules from the CTB wharf to the Site would be sought from NPC.		✓	
G6	During operation all ship movements would be prescheduled for entry to the port and would undertake pilot assisted navigation to the appropriate berth with berthing movements assisted by tugs.			✓
	Waste Management			
H1	A Waste Management Plan (WMP) would be compiled as part of the Construction Environmental Management Plan (CEMP) prior to commencement of construction.		✓	
H2	A WMP would be included in the Operational Environmental Management Plan (OEMP) for the Project. This would be compiled prior to Project commissioning.			✓
H3	Existing management plans for the Site would be amended or amalgamated to include the Project.			✓
H4	The WMPs for the CEMP and OEMP would: • Identify requirements for waste avoidance, reduction, reuse and recycling; • Provide procedures for handling, stockpiling, and reuse of wastes; • Identify disposal routes and treatment options; • Set out procedures for meeting legislative requirements; and • Set out procedures for obtaining the required approvals for the management of waste.		✓	✓

H5	The WMP would incorporate principles of the waste management hierarchy and cleaner production.		✓	✓
H6	Waste produced on-site would be separated at source and stored in suitable containers and stored in designated waste management areas. All waste would be classified in accordance with Waste Classification Guidelines (DECC, 2008).		✓	✓
H7	A licensed waste management contractor would be used to remove waste from the Site for reuse, recycling or disposal.		✓	✓
H8	The WMPs would set out monitoring processes and scheduled inspections of waste management areas. The WMPs would be subject to regular audits and a system would be used to record and report types, volumes and management measures for all waste streams arising from the Project.		✓	✓
H9	Annual reporting would be undertaken on the wastes for the Project.			✓
	Visual and Landscape			
I1	Materials used in the construction of the Project would be generally dark in tone and where possible non reflective.	✓	✓	
I2	Lighting would avoid direct line of sight toward residences beyond the Site where possible.	✓	✓	✓
I3	Top of the stacks and towers would not have aviation obstacle lighting.	✓	✓	✓
I4	The use of large floodlights to be minimized where possible.		✓	✓
I5	Lighting would be focused on to work areas during construction and operation. Areas away from work areas would not be lit and light spill would be reduced where possible.		✓	✓
	Flora and Fauna (Ecology)			
J1	A Flora Management Plan would be developed to mitigate impacts on flora as a result of vegetation clearing associated with the Project. Mitigation measures would include strategies such as: • exclusion zones around areas that would not be impacted by the Project during the construction phase; • use of flagging tape or similar to denote exclusion zones or other sensitive areas during the construction phase; • rehabilitation/ landscaping works to incorporate native flora species (sourced locally) that have the potential to provide foraging resources for native fauna species and • no unnecessary vegetation clearance. The Project footprint to be fenced off to prevent damage. .	✓	✓	✓
J2	A Fauna Management Plan would be developed to mitigate impacts on fauna as a result of the Project, including the following: • wash down protocols to prevent the spread of amphibian chytrid disease chytridiomycosis; • use of ‘ecologically friendly’ herbicides; • low vehicle speed limits on and throughout the Site to reduce fauna road fatalities; • educate HSE specialists as to the appearance and location of any threatened species and pest species potentially and/or present on-site. Works to cease in the event threatened species be found in construction areas and • design lighting to reduce light spill into areas that are not required to be lit and may have potential for nocturnal fauna.		✓	✓

J3	A Weed and Pest Management Plan would be developed as part of the CEMP. This plan would include: • noxious weeds would be identified prior to construction commencing and would be managed in line with NCC and DPI control requirements. Noxious weed material would be carefully stockpiled and stored to ensure propagates, seeds and vegetative material do not spread prior to disposal. All declared noxious weeds would be removed from the Site, as per the NW Act, and would be disposed at an appropriate location; • brands that that are suitable for use around sensitive environments and waterways such as RoundUp® Biactive would be used to control weeds should chemicals be required. If in doubt, advice would be sought from suitably qualified personnel. • all plant and machinery would be free from mud, soil or root material to minimise the spread of any weeds, pathogens or diseases such as root-rot fungus (*Phytophthora cinnamomi*); • throughout construction, the Project work areas would be regularly monitored to ensure noxious weeds do not re-establish or spread on-site; and • control of pest fauna such as, Red Fox and European Rabbit.		✓	
J4	A mosquito management plan would be developed prior to the commencement of works associated with the Project.		✓	✓
J5	An Operational Environmental Management Plan (OEMP) would be developed to ensure appropriate mitigation measures are employed during the operation of the Project. The OEMP would address potential habitat and the implications of development for all threatened species identified as likely to occur or with potential habitat within the Lot, as outlined in **Appendix L5**.			✓
	Heritage			
K1	Should any heritage items be discovered during the construction process, work shall cease until the discovery can be assessed by a qualified heritage consultant.		✓	

23.3 Environmental Management

The Project would require the preparation of a Construction Environmental Management Plan (CEMP). The CEMP will cover all environmental aspects associated with the construction of the Project and would include the controls and mitigation measures identified in this Environmental Impact Statement.

This system ensures that:

- all work complies with all relevant environmental statutes, regulations and standards;
- environmental factors are taken into account for each activity; and
- regular audits are performed to confirm compliance with environmental policies and standards.

IPL would appoint an independent Environmental Management Representative (EMR) to regularly audit the work activities to ensure that all mitigation measures are being effectively applied and that the work is being carried out in accordance with the CEMP and all environmental approval and legislative conditions.

23.4 CEMP Outline

The CEMP outlines the procedures that would be implemented to address and manage environmental impacts associated with construction of the Project. The CEMP shall be prepared by the Contractor engaged by IPL to carry out the construction works.

The primary purpose of the CEMP is to provide a reference document that ensures that the safeguards and mitigation measures specified as part of the Project approval are being implemented and monitored. The CEMP shall outline the key steps to be taken by all personnel to manage the environmental hazards and risks associated with the Project and to effectively minimise the potential for environmental harm. The CEMP will be subject to the EMR review prior to commencement of construction works and ongoing review throughout the construction period.

The CEMP shall include the following:

- a description of the proposed construction works;
- an outline of the proposed construction program;
- statutory requirements – licences and approvals required;
- standards and/or performance measures for the relevant environmental issues associated with the construction work;
- a description of what actions and measures would be implemented to mitigate the potential impacts associated with the construction works and ensure that these works would comply with the relevant standards and/or performance measures;
- a description of the procedures to ensure all employees are trained in regards to their responsibilities under the CEMP;
- a description of the procedures that would be implemented to register, report and respond to any complaints during the construction work;
- a description of the procedures that would be implemented to manage any environmental incidents and associated reporting requirements;
- identification of key personnel who would be involved in the construction works, and provide their contact numbers;
- monitoring procedures and a description of the process to be followed if any non-compliance is detected; and
- detailed:
  - Noise Management Plan;
  - Contamination Management Plan;
  - Groundwater Management Plan;
  - Surface Water Management Plan;
  - Soils and Erosion Management Plan;
  - Traffic Management Plan;
  - Waste Management Plans;
  - Flora Management Plan;
  - Fauna Management Plan;
  - Weed and Pest Management Plan; and

– Mosquito Management Plan.

These items are consistent with the management measures presented in **Table 23-1**.

23.5 OEMP Outline

An Operational Environmental Management Plan (OEMP) would be developed to ensure appropriate mitigation measures are employed during the operation of the Project. This plan would address long term management actions designed to mitigate and minimise potential impacts upon the biophysical environment as a result of the Project. The OEMP would incorporate all relevant measures outlined in this chapter, plus any other measures that become necessary in the face of changing environmental conditions.

24 Project Evaluation and Justification

This chapter provides an evaluation of the Project and the outcomes of this Environmental Impact Statement, including a discussion of the justification for proceeding with the Project. The chapter also provides:

- a residual risk assessment;
- an assessment of the Project against the principles of Ecologically Sustainable Development;
- a description of the Project's benefits;
- consideration of the consistency of the Project with the objects of the EP&A Act; and
- the justification for the Project.

24.1 Environmental Risk Analysis

The following Environmental Risk Analysis (ERA) provides an analysis of the environmental risks that have been identified and outlined as part of this EIS.

An initial qualitative environmental scoping exercise was completed in **Chapter 8 Environmental Scoping Assessment**. This exercise identified the key environmental issues for the Project, described them and categorised them according to their risk of impact.

The EIS process has confirmed the potential environmental impacts associated with the Project (construction and operation), proposed mitigation measures for those impacts and any potentially significant residual environmental impacts which still exist after the application of the proposed mitigation measures.

This ERA was undertaken using the methodology described below to determine the risk associated with each environmental issue. The ERA has been based upon the methodology outlined in Standards Australia's document *HB 203:2006 Environmental Risk Management – Principles and Process, Australian Standard AS/NZ 4360:2004 Risk Management*, and *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.*

The analysis categorised levels of risk for a given event based on the significance of effects (consequences) and the manageability of those effects (likelihood). The measures of likelihood categories and the measures of consequences categories as well as the risk ranking matrix are detailed in **Tables 24-1**, **24-2** and **24-3** below.

Table 24-1 Measures of Likelihood Categories for ERA

Rank	Likelihood	Description
A	Almost Certain	Happens often and is expected to occur
B	Likely	Could easily happen and would probably occur
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Unlikely to happen but may occur
E	Rare	Could happen, but only in extreme circumstances

Table 24-2 Measures of Consequence Categories for ERA

Rank	Consequence	Description
1	Extreme	Permanent and catastrophic impacts on the environment or population; Large impact area; reportable incident to external agency; large fines and prosecution; operational constraints; substantial community concern.
2	Major	Permanent and detrimental impacts on the environment or population; large impact area; reportable incident to external agency; may result in large fines and prosecution; operational constraints; high level of community concern.
3	Moderate	Substantial temporary or minor long term detrimental impacts on the environment or population; moderate impact area; reportable incident to external agency; action required by reportable agency; community interested.
4	Minor	Minor detrimental impacts on the environment or population; small impact area; reportable incident internally; no operational constraints; some local community interest.
5	Low	Nil or temporary impacts on the environment or population; small or isolated impact area; not reportable incident; no operational constraints; uncontroversial project no community interest.
1*	Extreme	Permanent and extremely beneficial impacts on the environment or population; Large impact area.
2*	Major	Permanent and beneficial impacts on the environment or population; large impact area.
3*	Moderate	Substantial temporary or minor long term beneficial impacts on the environment or population; moderate impact area
4*	Minor	Minor beneficial impacts on the environment or population; small impact area.
5*	Low	Nil or temporary beneficial impacts on the environment or population; small or isolated impact area.

* Indicates the ranking and criteria for positive consequences.

Table 24-3 Risk Matrix for ERA

		CONSEQUENCES				
		1 Extreme	2 Major	3 Moderate	4 Minor	5 Low
Likelihood	A (Almost Certain)	VH	VH	H	H	M
	B (Likely)	VH	H	H	M	M
	C (Possible)	H	H	M	M	L
	D (Unlikely)	H	M	M	L	L
	E (Rare)	H	M	L	L	L

Risk Matrix is defined as follows: VH = Very High, H = High, M = Medium and L = Low.

Taking into account the Project's design, mitigation measures described in **Chapters 9-21** and the commitments provided in the **Chapter 23 Statement of Commitments**, **Table 24-4** provides an assessment of the residual risks associated with the Project. This has been completed for each environmental aspect assessed within this EIS, based on the likelihood of occurrence and potential environmental consequence. Adverse risks have used the colours in **Table 24-3**. Positive risks have been coloured in blue.

Table 24-4 Residual Risk Analysis

Environmental Issue	Potential Impacts based on unmitigated / inherent risk	Likelihood	Consequence	Potential Risk before Mitigation	Mitigation IPL would implement to address the Potential Risk	Residual Likelihood	Residual Consequence	Residual Risk Post Mitigation
Hazards & Risks	Exposure of surrounding population to hazard or risk.	D	1	H	Use of Best Available Technology (BAT) and appropriate hazard management would limit both the probability and the consequence of risk to the surrounding population. A full list of mitigation measures is available in **Chapter 9 Hazard & Risk**.	E	3	L
	Exposure of IPL staff to hazard or risk.	C	2	H	Design of plant and appropriate occupational health and safety management systems would be developed to limit the risk of exposure.	D	2	M
Air Quality & Odour	Accidental inclusion of particulate matter such as ammonium nitrate in the gaseous output from the plant.	C	3	M	Scrubbers and abatement technology would be used to reduce particulate matter and gaseous emissions from the Project. The use of BAT would ensure that the Project is within accepted air quality criteria and comparable to global standards. A full list of mitigation measures is available in **Chapter 10 Air Quality & Odour** and **Chapter 14 Greenhouse Gas.**	D	4	L
	Emissions of controlled gaseous substances such as Nitrogen Oxides, Sulphur Oxides and ammonia.	C	2	H				
	Increased traffic to the Project Site as a result of the Project increasing traffic emissions.	A	5	M	Traffic to and from the Project Site would be managed through a Transport Management Plan. Traffic would avoid peak hours to reduce increase exhaust emissions related to congestion. Mitigation measures are available in **Chapter 15 Traffic & Transport** and **Chapter 10 Air Quality & Odour.**	C	5	L

Environmental Issue	Potential Impacts based on unmitigated / inherent risk	Likelihood	Consequence	Potential Risk before Mitigation	Mitigation IPL would implement to address the Potential Risk	Residual Likelihood	Residual Consequence	Residual Risk Post Mitigation
Noise & Vibration	Construction noise increasing the acoustic baseline could reduce the amenity of the neighbouring community.	C	3	M	Construction noise is limited to within the hours set out by the interim construction noise guidelines (ICNG), construction practices would be in place to limit the residual probability and consequence of acoustic impacts. A full list of mitigation measures is available in **Chapter 11 Noise and Vibration.**	D	4	L
	Operational noise increasing the acoustic baseline could reduce the amenity of the neighbouring community.	C	2	H	The Project has been designed to meet the most stringent noise levels and would not contribute to or increase existing noise levels. A full list of mitigation measures is available in **Chapter 11 Noise & Vibration.**	D	4	L
Soil & Groundwater	Spread of existing contamination from the Lot into the neighbouring Hunter River.	D	2	M	A number of mitigation measures would be implemented to ensure that any contamination would be identified, contained and managed appropriately. These measures would ensure that contamination and sediment would be unlikely to spread offsite and any potential erosion is limited.	D	4	L
	Erosion and sedimentation during construction.	D	3	M				
	Exposure of Acid Sulphate Soils (ASS).	D	3	M	An ASS Management Plan would be incorporated within the CEMP to reduce the probability and consequence of ASSs. Details are available in **Chapter 12 Soil & Groundwater.**	D	4	L

Environmental Issue	Potential Impacts based on unmitigated / inherent risk	Likelihood	Consequence	Potential Risk before Mitigation	Mitigation IPL would implement to address the Potential Risk	Residual Likelihood	Residual Consequence	Residual Risk Post Mitigation
Surface Water & Wastewater	Impact of contaminated stormwater on the quality and ecology of the Hunter River during construction	C	3	M	Stormwater runoff during construction would be managed in line with the Blue Book *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004) and other more specific measures. These measures would limit the residual probability and consequence of this impact.	D	4	L
	Impact of contaminated stormwater and wastewater on the quality and ecology of the Hunter River during operation.	C	3	M	Stormwater runoff would be managed through three streams: potentially contaminated stormwater, first flush, and clean stormwater. These management systems alongside a waste water treatment plant would limit the residual probability and consequence of this impact. Wastewater discharges would also be managed through the wastewater treatment plant. The location of the wastewater outfall has been designed to ensure the impacts of the outfall is minimised. A full list of mitigation measures is available in **Chapter 13 Surface Water and Waste Water.**	C	5	L
Greenhouse Gas	Emission of greenhouse gas may increase as a result of the Project.	A	5	M	Greenhouse Gas Emissions have been reduced by utilising BAT at the design phase. Although Greenhouse Gas emissions may occur, the Project represents the lowest possible level of emissions for a Project of this type.	B	5	M

Environmental Issue	Potential Impacts based on unmitigated / inherent risk	Likelihood	Consequence	Potential Risk before Mitigation	Mitigation IPL would implement to address the Potential Risk	Residual Likelihood	Residual Consequence	Residual Risk Post Mitigation
Traffic & Transport	Increase in vehicle movements on Kooragang Island could increase congestion in the area.	A	5	H	Traffic impacts would be mitigated during construction through measures outlined in the TMP. Measures would include provision of a Park & Ride service for construction staff. During operation, traffic movements are unlikely to significantly impact the level of service for the roads on Kooragang Island. A full list of mitigation measures is available in **Chapter 15 Traffic and Transport.**	C	5	L
	Increase in ship movements could increase congestion in the Port of Newcastle.	A	5	M	Ship movements would be pre-planned and scheduled to enter the port in advance with NPC. This would ensure that congestion in the port would not be a concern.	D	5	L
Waste Management	Project waste could be inadequately managed.	D	4	M	A Waste Management Plan (WMP) would be developed as part of the CEMP and OEMP. Provided the measures within this plan are followed the residual probability and consequence of this impact would be limited. A full list of mitigation measures is available in **Chapter 16 Waste Management.**	D	5	L
Visual & Landscape	The visual amenity of nearby areas could be adversely impacted by the Project.	C	5	L	The industrial nature of the surrounding area means that the Project is unlikely to cause any visual or landscape impacts.	D	5	L

Environmental Issue	Potential Impacts based on unmitigated / inherent risk	Likelihood	Consequence	Potential Risk before Mitigation	Mitigation IPL would implement to address the Potential Risk	Residual Likelihood	Residual Consequence	Residual Risk Post Mitigation
Flora & Fauna (Ecology)	Loss of critical habitat due to clearing.	E	5	L	Habitat of value has been retained on the Project Site as part of the Project.	E	5	L
	The Project could directly or indirectly impact on threatened species.	D	4	L	Habitat suitability assessments and assessments of significance for relevant threatened species have indicated that no direct or indirect impacts would occur.	E	5	L
Indigenous & European Heritage	Discovery of culturally significant items on the Project Site.	E	5	L	Due to the nature of the Project Site, the likelihood of the discovering culturally significant items is extremely low. Should items be discovered appropriate actions would be outlined within the CEMP.	E	5	L
Resource Implications	Increase in resource use as a result of the Project, namely, natural gas, water and electricity.	A	5	M	Whilst some increase in resource use is likely to occur, the Project has been designed to minimise draw on the electricity grid when in steady state operation.	C	5	L
Socio Economics	Skilled labour demands on the local population.	D	5	L	The Project would not represent a strain on the skilled labour available in the local area	D	5	L
	Increase in jobs and revenue to the local area.	A	2*	VH	The Project would provide jobs to the local population.	A	2*	VH

24.1.1 Summary of Risk Analysis

The Residual Risk Analysis in **Table 24-4** illustrates how the assessments and mitigation measures contained within **Chapters 9 – 21** have helped understand the Project risks and would reduce the environmental risks identified in **Chapter 8 Environmental Scoping Assessment**.

The residual risk posed by the Project would consequently be substantially reduced if IPL implements the mitigation measures outlined during the design, construction and operational stages.

This EIS assessment process has ensured that the potential high risks impacts associated with Hazards & Risk, Air Quality, Noise & Vibration and Traffic & Transport can be confidently reduced to medium or low risks if appropriate mitigation measures are implemented as part of the Project. IPL has no objection to the implementation of those measures to ensure operations are conducted in a safe and responsible manner.

24.2 Ecologically Sustainable Development

This section provides a review of the Project, its impacts and associated safeguards against the principles of Ecologically Sustainable Development (ESD) in accordance with the *Environmental Planning and Assessment Regulation 2000*. The principles, as listed in the Regulation, are as follows:

a) *"The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*

b) *Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;*

c) *conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration; and*

d) *improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services."*

These principles are discussed below.

24.2.1 Precautionary Principle

The precautionary principle deals with certainty in environmental and technical decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

An EIS is a public process which examines the potential effects of the Project. Therefore the EIS process is precautionary in nature. The requirement to assess the impacts of the Project is a form of regulation designed to identify and address uncertainty about the effects of the Project.

For the Project, IPL has commissioned specialists to undertake detailed assessments on a range of environmental aspects identified during the consultation and risk assessment phases. These assessments provide sufficient scientific understanding of the Project and the surrounding environment to enable a decision that is consistent with this principle to be reached.

Project Objectives

The Project has been designed to include a number of internal and external design elements to reduce the risk of any potential impacts, or avoid potential incident scenarios from occurring. The Project is also designed to ensure that compliance with environmental criteria (e.g. ANZECC Guidelines, Industrial Noise Policy, Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW, etc.) as well as all relevant statutory requirements, is achieved through appropriate design and mitigation measures and this is done through a process that has regard to community expectations.

Design Safeguards

A number of design safeguards were incorporated during the initial design stage in response to the Precautionary Principle. These design features and modifications included the following:

- Best Available Technology has been selected at the design phase to ensure that the process is as efficient as possible, thus reducing any residual environmental impact. Technology included in the Project design has included dual pressure NA technology, NOx and N_2O abatement measures, air particulate removal, low noise equipment and noise attenuation screening, process condensate and waste water recycle, waste water treatment, first flush systems, firewater containment, heat recovery and exchange, electricity generation, double integrity tanks, and emissions monitoring.
- Safeguards have been introduced regarding the management of any pre-existing contamination to ensure that it does not spread into the Hunter River or offsite.
- The Project has been designed to avoid any valuable habitat on the Site and to ensure no adverse impacts on any SEPP 14 wetlands or the Hunter Estuary Ramsar Site.

Construction and Operational Principles

Should the Project be approved, the safeguards and mitigation measures included in this EIS, together with the Management and Mitigation Measures would form the basis of a Construction Environmental Management Plan (CEMP). Monitoring programs would also be developed to address the specific content requirements within the Project approval.

24.2.2 Inter-Generational Equity

Inter-generational equity requires that the present generation pass onto the next generation an environment that does not limit the ability of those future generations to attain a quality of life at least equal to that of the current generation.

Through the design of the Project and the implementation of operational safeguards mitigating any short-term or long-term environmental impacts, IPL is confident that inter-generational social equality impacts have been addressed. Examples of Intergenerational Equity consideration that are relevant to the various stages of the Project are described below.

Project Objectives

The objectives of the Project are to ensure a safe, sustainable and secure solution to meet the medium and long term market demand for AN in the Hunter region. A more reliable supply of TGAN to the area would allow the mining industry, one of New South Wales' key industries, to maintain its economic position in the future, providing jobs and revenue to the State.

A key objective was to ensure that both the Project and the supply of AN would be sustainable. This objective has ensured that the Project included a number of measures to safeguard the environment of the local area around the Site for future generations, thereby meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Design Principles

The Project would maintain inter-generational equity by ensuring components of the existing bio-physical, social and economic environment available now would also be maintained in a similar or better condition for future generations. Relevant design considerations include the following:

- maintenance and enhancement of an industrial presence on Kooragang Island, thereby ensuring employment opportunities in a range of areas for future generations;
- ensuring that key areas of habitat or feed vegetation on the Site are preserved;
- reducing potential contamination by managing pollution risks during construction and removing or isolating any contamination that is found as part of the works;
- establishing and implementing noise and air quality controls which are in line with modern global standards;
- reduction of greenhouse gas production and electricity demand from the grid to help combat global warming in the future; and
- a 'whole of life' approach to the Project to benefit future generations (e.g. positive socio economic impacts).

Construction and Operational Principles

IPL would continue to maintain inter-generational equity through the safeguards identified in this EIS, including but not limited to the following:

- ongoing consultation and engagement with the local community to provide an opportunity to ask questions and identify and manage areas of concern; and
- development of appropriate environmental protocols in consultation with relevant State agencies.

24.2.3 Conservation of Biological Diversity and Ecological Integrity

This EIS includes an assessment of the ecological impacts of the Project against the requirements of NSW Legislation. The ecological impact assessment concluded that the Project is unlikely to cause any ecological impacts provided that certain mitigation measures were followed. IPL would be committed to implementing those mitigation measures.

Design Principles

As part of the planning for the Project, the following design features were incorporated to minimise the impact of the proposed activities on the biodiversity and ecological integrity of the locality:

1. key ecological values on the Site, (e.g. notable feed trees) have been identified and retained during the design process to ensure that valuable habitats are retained; and
2. the wastewater outfall for the Project has been located to avoid any potential impacts on water quality affecting the Hunter River or any threatened or protected biota, specifically the SEPP 14 wetlands and the Hunter Estuary Ramsar Site.

Management and Operational Safeguards

In addition to these design features, flora and fauna management plans would be incorporated into the final CEMP to protect specific ecological values on the Site and ensure that any noxious weeds or other ecological impacts are minimised. Relevant measures to manage ecological issues would also be incorporated in any OEMP for the entire Lot.

24.2.4 Improved Valuation and Pricing of Environmental Resources

This ESD principle is premised on an assumption that all resources should be appropriately valued and that the value of environmental resources should be considered alongside any economic or cost benefit analysis for the life of the project.

Project Objectives

The Project would provide value to the local and State economy whilst at the same time not compromising the natural value of the local environment and the various services that it provides.

Design Principles and Management and Operational Safeguards

As discussed above the Project design includes a number of measures to ensure that impacts to the biophysical environment are avoided or mitigated. These measures help ensure that the local water, soil and air environments can continue to provide the same level service now and into the future. A number of these measures would also be implemented through the CEMP for the Project and the OEMP for the entire Lot.

Conclusion

The value placed by IPL on environmental resources is evident from the extent of site-specific investigations, planning and environmental safeguards and measures that have been undertaken and which would be implemented to prevent damage to the local environment.

24.2.5 Compatibility with the Principles of ESD

The approach taken in planning the Project has been multi-disciplinary, involving consultation with various stakeholders including government agencies and the community (refer to **Chapter 5 Consultation**). Emphasis has been placed on the avoidance of impacts through careful design as well as management and mitigation measures to minimise potential negative environmental, social and economic impacts, during construction and operation. The principles of ESD have been incorporated into every stage of the Project.

24.3 Objects of the Environmental Planning & Assessment Act 1979

As required by the DGRs issued for this Project, consideration has been given to the consistency of the Project with the objects of the EP&A Act as outlined below.

a) To encourage:

i. The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.

The Project would facilitate the proper management of resources by improving the efficiency of the mining industry in the Hunter Valley by providing a safe and sustainable supply of AN. The Project would allow the mines in the Hunter Valley to remain competitive and operational, safeguarding the various jobs that the industry provides, thereby promoting the social and economic welfare of the local communities. Development of the Project at this location is an appropriate use for the Lot given its industrial nature. Therefore the Project is consistent with and supports the proper management and development of the City of Newcastle, providing social and economic welfare through the delivery of jobs and using brownfield land for new development.

ii. The promotion and coordination of the orderly and economic use and development of land.

The Site is located on Kooragang Island, an industrial area within the Newcastle LGA. As is outlined in **Chapter 6 Planning Policy and Approvals**, the area is identified within the Major Projects SEPP as part of the 'Three Ports' Area. The Site location, adjacent to existing port infrastructure and other industry makes it an appropriate location for the Project. The Project is permissible under the existing land use zoning for the Lot, and therefore is in line with orderly and economic use and development of land.

The Project would not significantly affect the future orderly use or development of land, as it does not compromise any existing LGA Planning Policy.

iv. The provision of land for public purposes.

The Project would not directly impact on the provision of land for public purposes.

v. The provision and coordination of community services and facilities.

The Project would not impact on the provision of existing community services and facilities.

vi. The protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.

The Project would not directly or indirectly have any significant impact on any threatened species, populations and ecological communities, and their habitats. Equally the numerous mitigation measures outlined within this EIS, would ensure that any impact on native plants and animals would be unlikely.

vii. Ecologically sustainable development.

An assessment of the Project against the principles of ecologically sustainable development has been undertaken in **Section 19.2** above. IPL believes the Project aligns with the principles of ecologically sustainable development.

viii. The provision and maintenance of affordable housing.

The Project would not impact on the provision or maintenance of affordable housing.

b) To promote the sharing of the responsibility for environmental planning between the different levels of government in the State.

The Project is to be assessed as State Significant Development under Part 4 of the EP&A Act and the State and Regional Development State Environmental Planning Policy. The Minister for Planning has the power to determine State Significant Project applications. Input into the Director-General's Requirements was obtained from the relevant NSW Government departments, agencies and stakeholders including the Newcastle City Council.

c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.

IPL has undertaken consultation activities to inform and receive feedback from the public and government agencies as the feasibility study for the Project has progressed. This consultation effort has been outlined in **Chapter 7 Consultation** and in **Appendix C Consultation**.

In addition, DP&I will place the EIS on public exhibition for a minimum of 30 days. In accordance with the requirements of the EP&A Act, stakeholders and the public are invited to make submissions. This process provides further opportunity for public involvement and participation in the environmental planning and assessment process for this Project.

24.4 Project Justification

The mining industry in the Hunter Valley represents a significant proportion of the NSW economy. The mining industry in NSW is expected cause the demand for AN to grow at a rate of around seven percent per annum over the next decade.

However, the economic operation of the Hunter Valley mines is reliant on a reliable source of AN. Currently AN for the Hunter Valley mines is sourced from one supplier within NSW. This single source leaves the supply vulnerable to supply chain problems. These problems could include:

- the ageing of the existing manufacturing infrastructure;
- the environmental limitations placed upon those ageing operations; and
- the availability of AN from international sources.

IPL has considered a number of alternatives and options in order to assist in meeting the strategic need for a more reliable, safe, sustainable and secure source of AN in the Hunter region. IPL recognised that if this strategic need is not met, there could be an adverse impact on the growth of the mining operations in the Hunter Valley, which in turn would have direct and indirect economic detriment to all sectors of the NSW economy that are supported by this industry.

In response to this strategic need, IPL examined three alternatives, namely, take no action, increase AN imports or to construct a new AN plant.

An examination of these three alternatives against the Project objectives concluded that the most appropriate option for the Hunter region and NSW would be construction of a new AN plant.

Options regarding the location of that new AN plant were also examined. A number of specific environmental, social, economic and infrastructure constraints were identified and three potential locations for the AN plant were then identified and evaluated. The result of this evaluation concluded that Kooragang Island was the most appropriate location for a new AN plant to service the strategic need in the Hunter region in a safe, sustainable and secure manner.

The evolution of the Project design for IPL's proposed AN plant at Kooragang Island has been driven by IPL's desire to put forward a 'world class' safe and efficient AN plant. Wherever possible IPL has used input from stakeholder and community consultation, alongside the results of various technical studies, to help finalise the Project design, Project layout and construction methodology. The conclusions of a number of the technical studies have helped identify additional measures that would be implemented to ensure that any risks or impacts are mitigated so that they are within an acceptable level.

After consideration of the alternatives and options above, the Project is considered to be the only safe, viable and sustainable option to secure the Hunter region mining industry's medium and long term AN requirements.

The environmental impacts related to the Project have been found not to be significant and capable of being managed through the implementation of various mitigation measures. Those mitigation measures relevant to the Project are outlined in **Chapter 23 Statement of Commitments**.

24.5 Conclusion

This EIS document provides a comprehensive assessment of the Project and includes investigations regarding all relevant technical, social, planning and environmental issues.

Potential adverse impacts arising from the Project have been identified in a variety of ways, including through the community consultation program, and then assessed. Arising from that assessment the identification of strategies to ensure that IPL can avoid, minimise and mitigate those identified impacts is a key part of the EIS process. Those strategies are identified throughout the EIS document and then collected in the Statement of Commitments so that, if approved, IPL has a register of all of the measures undertaken to limit the impact of the Project.

The Project has, to the extent feasible, also been designed to address the issues of concern to the community and Government. IPL has recognised that this Project is being proposed at a time when the local community is sensitive to industrial operations of any kind, following the recent incidents on Kooragang Island. IPL has endeavoured to engage with the community to understand their concerns and questions and then has sought to address those concerns in this EIS document. Similarly IPL has been, and is, mindful of the recommendations of the O'Reilly Report (2011) and the more stringent pollution laws implemented following that report, and has committed to measures which comply with the legislative changes made following the Report as part of any OEMP.

The Project has, to the extent feasible, been designed to address the issues of concern to the community and Government. This EIS has identified the Project can proceed safely because it would:

1. be a new plant built to international standards;
2. result in no material long term adverse impacts on the environment or local community;
3. provide a safe, secure and sustainable supply of AN to Hunter Valley mines;
4. provide local employment opportunities and result in positive economic impacts; and
5. satisfy ecologically sustainable development principles.

This EIS has highlighted a range of issues which would be addressed through the careful design and operation of the Project. On the basis of the studies detailed within the EIS, and with the implementation of the recommended mitigation measures, the Project is considered to be justified and should proceed.

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