Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

NORTHEAST BUSINESS PARK PTY LTD

Hazard and Risk Analysis
Northeast Business Park

October 2007

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EXECUTIVE SUMMARY

INTRODUCTION

Simmonds & Bristow was commissioned by Northeast Business Park Pty Ltd, to prepare a Hazard and Risk Analysis of the proposed Northeast Business Park (NEBP) development at Morayfield. This requirement is specified in the Coordinator General's *Terms of Reference for an Environmental Impact Statement (EIS)* (December 2006).

The project site occupies 793 hectares on the southern banks of the Caboolture River to the east of the Bruce Highway. The proposal seeks to develop the site into a major integrated mixed-use residential, business park, marina (800 berths) and marine industry precinct. The development also incorporates a golf course and 365 hectares of recreation area. The specific industries and businesses that will be located in the NEBP are unknown at this stage of the development.

KEY PROJECT FEATURES

Site Area	• 793 ha
Development Composition	• Marina • Business park, inc industry • Marine industry, inc shipyard • Marina village, inc hotel • Residential precincts • Golf frontage residential • Multistorey residential • Commercial & Retail • Green space • Open space/golf course • Open space • Protected vegetation, inc heritage park
Areas	• 350ha to be developed • 443ha for open space, active and passive recreation and heritage park
Employment	• Construction – ~4000 people • Full operation – ~10000 people
Vehicular Movements (daily)	Unknown
Over Mass Vehicles	One tanker delivery of fuel to marina per month during normal operations. Two to three tankers per month during public holidays.
Hours of Operation	Industry park – standard business hours. Marina fuel dock – 24 hours per day, 7 days per week. The dry stack boat storage will operate from 4:00am to 9:00pm.
Site Access	Bruce Highway and existing roads (Nolan Drive and Trafalgar Drive). Otherwise new roads will be established onsite.
Environmental Features	Retention of extensive riparian (open space) adjacent to the Caboolture River. Retention of protected vegetation and Heritage Park. Stretch of Caboolture River is part of Fish Habitat Area A.
Effluent Disposal	Weier Road WWTP. New pipelines to be establish to link the development and the WWTP to be upgraded to cope with the increased input.
Infrastructure Services to be Developed	Sewerage, water supply, electricity, gas and telecommunications.

RISK ASSESSEMENT APPROACH

The objective of the hazard and risk analysis was to understand the nature of and determine the level of risk associated with the development, so that the development process incorporates risk reduction measures and response planning. The risk assessment process followed in this report was based on AS/NZS 4360:2004 *Risk Management*.

Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur. Consequences and likelihood are combined to produce a level of risk. Where no reliable data are available then subjective estimates are made about the occurrence of a particular outcome or event.

Risk evaluation involves comparing the level of risk found during the analysis process with risk criteria, which describes action priorities for different risk levels or categories. Risk levels may be expressed qualitatively (e.g. low, medium, high and extreme) or quantitatively (e.g. fatality risk of 1 in a million per year). A qualitative approach was used in this report to describe the relative risks associated with a large range of potential site activities. More detailed quantitative assessments should be carried out where high or extreme risks are identified.

This report is specifically concerned with the potential for hazardous events or incidents. That is, events that may cause injuries or fatalities, damage to property or damage to the biophysical environment (i.e. water, land and air). The types of hazardous events that may occur during construction or operation phases of industrial developments are fires, explosions or releases of hazardous substances or other contaminants (e.g. sediment). The risk of a hazardous event is greatest where dangerous goods or hazardous substances are stored and used or where site activities are carried out in sensitive areas (e.g. protected fish reserve or near a school). Natural events such as flooding and bushfire may also impact on a development. Developments near mangrove areas may present risks for mosquito-borne diseases, as well has wildlife hazards, has been addressed.

SITE LOCATION

The proponent for the site is Northeast Business Park Pty Ltd. The site is located on Nolan Drive at Morayfield, which is approximately 4.5km radially east of the Caboolture town centre. The site covers 793ha along the Caboolture River, including 9km of river frontage, and is 8km from the river mouth (and Deception Bay).

Most of the surrounding land is zoned and established Rural Residential, particularly to the south and west of the site. The Bruce Highway forms the western boundary of the site. Land on the opposite (northern) side of the Caboolture River also comprises large rural allotments but with links to forestry and large environmental areas.

CONSTRUCTION PHASE ACTIVITIES

Description

The development of each of the precincts within the NEBP will be staged over a 20 year period in accordance with approvals and commercial requirements. The general sequence of works for each stage includes site establishment, site clearing, earthworks and infrastructure.

There will be 50 000 litres of diesel stored on site during construction works to fuel heavy machinery including bulldozers, scrapers, excavators, trucks and cranes.

The marina basin will be isolated from the Caboolture River for the majority of its construction and then opened to the main river for operational purposes. The construction of the marina will require capital dredging works in the order of 1 500 000m^3.

Each of the precincts within the NEBP will be serviced by water, sewer, power and telecommunications. The potential for the supply of natural gas is also under investigation. Sewage flows from the development will be fed to the South Caboolture wastewater treatment plant, which requires updating of the pipe network.

It is also proposed to use Class A+ recycled water on the site for landscape irrigation (e.g. golf course) and industrial process water. A dual reticulation system servicing residential and commercial property uses would allow other uses of recycled water.

Potential Hazards

A hazard identification analysis was applied to the NEBP development to systematically consider hazards that may result from the proposed activities. The following hazardous events were identified for the dredging phase of the development:

- Breakage or burst of suction hoses during dredging;
- Failure of land disposal sluices and bunds (e.g. during flood conditions);
- Barge collision or capsize; and
- Extreme weather.

Silt runoff controls could also fail under intense rainfall and flood conditions during the excavation and earthworks stages of the development.

Several hazards associated with the operation of community infrastructure were also identified. These hazards were:

- Equipment failure leading to fire in the zone substation (required to supply the anticipated ultimate electrical load of the NEBP); and
- Leaks from gas pipelines (feasibility still under consideration).

OPERATIONAL PHASE ACTIVITIES

The NEBP development will comprise five major precincts:

1. Business and industry;
2. Marina;
3. Golf course;
4. Residential; and
5. Environmental and open space.

Business, Industry and the Marina

The business and industry precinct will comprise general industry, service industry, motor vehicle repairs, fuel depot, storage facility and public utility. A service station may also be located within this precinct.

The marina precinct includes marine industry and shipyard as well as the marina basin and residential developments. The marine industries sector includes ship building, boat repairing and dry stack boat storage as well as suppliers to these activities.

The following marine industries activities are Environmentally Relevant Activities (ERAs)[1] under the *Environmental Protection Act* 1994:

1. Boat maintaining and repairing – ERA 69;
2. Marina or seaplane mooring – ERA 73; and
3. Crude oil or petroleum product storing – ERA 11.

ERAs that may be associated with boat maintaining and repairing included:

- Chemical storage (ERA 7);
- Abrasive blasting (ERA 23); and
- Metal surface coating (ERA 25).

A fuel dock will be located within the marina basin and access area, which will be available to marina vessels 24 hours per day, 7 days per week. The marina will store 55 000L of diesel and 20 000L of unleaded petrol for fuelling of marina vessels.

Residential

The land based residential options include a village residential hotel, multi-level residential development, low-rise medium density and golf course residential. The number of residences was estimated to be 2500 while the residential population was estimated to be around 5300.

[1] ERAs are usually industrial activities with the potential to release contaminants to the environment. Persons carrying out the ERA must obtain approval from either the EPA or local government.

Open Space

This precinct occupies much of the land between the main proposed access road and the Caboolture River. The golf course and golf club are to be located on the southern side of the proposed access road.

Potential Hazards

The major hazards from the proposed business, industry and marina activities are associated with the storage of dangerous goods. Premises are classified into one of four categories as the quantity of dangerous goods stored exceeds specified amounts.

The only activity for which the quantity of dangerous goods to be stored is known is the fuel dock in the marina. The quantity of diesel to be stored at the marina is below the threshold quantity for a large dangerous goods location of 100 000 litres. The quantity of unleaded petrol to be stored at the marina however exceeds the quantity for a large dangerous goods location of 2500 litres.

The types of hazardous events identified in association with the storage of dangerous goods were:

- Loss of containment of flammable and combustible substances;
- Ignition of flammable and combustible substances (i.e. fire and/or explosion);
- Accidental releases of toxic fumes to air;
- Firewaters, leaks and fuel and chemical spills; and
- Gas leak (gas pipeline or bottle).

Several possible hazardous events were identified for the supply of recycled water for industrial processes. These events were:

- Wastewater treatment plant failure (i.e. water contains contamination);
- Pipeline failure (i.e. release of recycled water); and
- Failure of the dual reticulation water which could lead to unintended use of the water (e.g. drinking).

RISK LEVELS

The risk analysis qualitatively evaluates the potential hazards and risks associated with the NEBP development during the construction phase and the operational phase.

The risk analysis was carried out in two stages: (1) without control measures (inherent potential risk), and (2) with control measures as described in the Hazard Identification section (residual risk).

In terms of inherent potential risk, there were no hazardous events that were classified as extreme. There were however, eighteen (18) events that were classified as high risk level:

1. Construction phase – flood effects on dredging (environmental);
2. Community infrastructure – fire or explosion at service station (environmental, human health and property);
3. Business Park – fire in warehouse or office (environmental, human health and property);
4. Business Park – spill and stormwater contamination (environmental);
5. Business Park – supply of untreated recycled water because of treatment plan failure (environmental and human health);
6. Marine Industries – fire or explosion (environmental, human health and property);
7. Marine Industries – spill into stormwater and tidal contamination (environmental);
8. Marina – fire or explosion (environmental, human health and property);
9. Marina – fuel spill (environmental);
10. Marina – sewage release (environmental);
11. Boat entrance channel – collision (human health and property);
12. Boat entrance channel – release of fuel and/or chemicals (environmental);
13. Residential, commercial, retail and education activities – fire (environmental, human health and property);
14. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health);
15. Golf course – supply of untreated recycled water because of treatment plant failure (environmental and human health);
16. Disease vectors – mosquito-borne diseases such as Ross River virus (human health);
17. Flooding – (environmental, human health and property); and
18. Bushfire – (environmental, human health and property).

The risk levels of all activities were reduced when the proposed control measures were included in the analysis. The highest determined risk level was medium and applied to the following cases:

1. Business Park – supply of untreated recycled water because of treatment plan failure (environmental and human health);
2. Marine Industries – fire or explosion (environmental, human health and property);
3. Marine Industries – spill into stormwater and tidal contamination (environmental);
4. Marina – fire or explosion (environmental, human health and property);
5. Marina – sewage release (environmental);
6. Boat entrance channel – collision (human health and property);
7. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health); and
8. Disease vectors – mosquito-borne diseases such as Ross River virus (human health).

RISK ASSESSMENT

The highest risk residual (with control measures) levels were associated with the supply of contaminated recycled water (in the event of treatment plant failure), fire or explosion in the marine industries, fire or explosion in the marina, spill into stormwater from marine industries, collision in the boat entrance channel and mosquito-borne diseases.

These potential events were further evaluated to determine whether the risk level was 'As Low As Reasonably Practical' (ALARP). This analysis concluded that additional control measures could be implemented to reduce the risks from fire and explosion. The proposed recommendations are to:

- Conduct a risk assessment of proposed use of recycled water on site;
- Maintain a central database of the types and quantities of hazardous substances and dangerous goods used and stored on site as new industries are established;
- Ensure site layout incorporates appropriate buffer zones between industry, fuel storage and residential development;
- Prepare an integrated Emergency Response Plan in consultation with each activity and Department of Emergency Services (Fire Safety Studies should also be carried out on Large Dangerous Goods Locations);
- Construct temporary firewater containment and diversion structures that serve the industrial park and/or the marina as a whole to prevent contaminated discharges to the Caboolture River and associated watercourses;
- Install fire alarms that are connected to the Fire Communications Centre (Firecomm) to minimise the risk of fire propagation between adjoining land uses; and
- Develop a plan to minimise public health risks from mosquitoes and biting midges.

Further detailed risk assessment is recommended for the use of recycled water on site and prior to the establishment of new industries. The activities of Large Dangerous Goods Locations in particular should be individually assessed (in accordance with *Dangerous Goods Safety Management* legislation) and the findings of each assessment incorporated in the risk management plan for the site.

The potential for contracting mosquito-borne diseases, such as Ross River virus (RRv) was also considered to be a medium risk. Therefore it is recommended that a plan be developed to minimise public health risks from mosquitoes and biting midges.

SUMMARY OF FINDINGS IN RELATION TO TERMS OF REFERENCE

The purpose of this study was to assist the development approval process by identifying the hazards, prioritising the hazards on the basis of the risk analysis and defining appropriate risk reduction measures. This was a qualitative and conservative assessment because the final mix of land uses within the NEBP was unknown.

The risk assessment covered both environmental and land use safety risks for both the construction and operation phases. In addition it considered both site activities and the potential impacts of natural events (particularly flooding and mosquito-borne disease).

This section specifically addresses the main points listed in the Terms of Reference for this development proposal.

Description of Environmental Values

The environmental values that may be affected by the proposal are primarily those provided by the Caboolture River. These values include aquatic ecosystems comprising significant wetlands and fish habitat areas. The major potential hazard to this value is exposure to toxicants from marine industries or the marina that are released to the aquatic environment by the stormwater system. This includes the release of fire waters produced in an emergency situation (e.g. fire or explosion), which could contain raw chemicals, waste materials and combustion products. The level of risk from these events was assessed qualitatively according to scales described in this report.

The level of residual risk (with proposed control measures) associated with these events was determined to be medium. The likelihood of a fire in the marine industries sector was shown to be higher (classified as likely) than other activities based on frequency data provided by the Fire Engineering Guidelines for industrial occupancies. The consequences of this event vary depending on the types and quantities of hazardous substances stored and used by the activity. For Large Dangerous Goods Locations, the consequences could be major, which indicates the potential for injury to one or more persons or potentially harmful to regional ecosystems (e.g. Deception Bay).

The potential impacts of both natural and emergency situations as a result of the proposal on sensitive areas and resources, community infrastructure, places of residence and work and recreational areas was also qualitatively assessed in this report the highest risks (medium level) were:

1. Business Park – supply of untreated recycled water because of treatment plant failure (environmental and human health);
2. Marine Industries – fire or explosion (environmental, human health and property);
3. Marine Industries – spill into stormwater and tidal contamination (environmental);
4. Marina – fire or explosion (environmental, human health and property);
5. Marina – sewage release (environmental);
6. Boat entrance channel – collision (human health and property);
7. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health); and
8. Disease vectors – mosquito-borne diseases such as Ross River virus (human health).

Potential Impacts and Mitigation Measures

Dangerous Goods

There is limited information on the types of dangerous goods to be stored and used on site at this stage of the development. The types and quantities that are known are summarised below. The marina is classified as a Large Dangerous Goods Location (LDGL) on this basis. A list of all hazardous substances to be used, stored, processed, produced or transported is unknown at this stage of the development because the industry precinct will be rolled out over approximately five years.

Product Name	Proper Shipping Name (if DG)	UN Number (if DG)	Class/Type (note 1)	PG (note 2)	Quantity (kg or L)
Construction phase					
Diesel fuel	Diesel fuel N.O.S	1202	Combustible Liquid C1 (flashpoint not greater than 150°C)	na	50 000
Operational phase					
Marina					
Unleaded petrol	Motor spirit	1203	Class 3 Flammable Liquids	PGII medium danger	20 000
Diesel fuel	Diesel fuel N.O.S	1202	Combustible Liquid C1 (flashpoint not greater than 150°C)	na	55 000

Note 1: If DG, insert class or sub-class;
If cryogenic, aerosol or GTDTBT (goods too dangerous to be transported), insert that word
If combustible liquid, insert C1 or C2.

Note 2: PG = Packing Group. Applies to DG only.

The preventative measures for storage and handling of these goods are described in Section 9 of this report. In the case of the construction phase, it is expected that diesel fuel will be stored in an above ground tank that should be bunded with a containment capacity of 110% of the total fuel volume (i.e. 55 000 litres). In the case of the marina, it is proposed to store the diesel and unleaded petrol in underground fuel storage tanks. These fuels should be managed in accordance with AS 1940: 2004 - *The Storage and Handling of Flammable and Combustible Liquids.*

Fuel will be transported to the site using approved road tankers in accordance with the *Australian Code for the Transportation of Dangerous Goods by Road and Rail.* Tankers would enter the NEBP site by the Buchanan Road/Bruce Highway interchange. The design intent for the internal road is to prevent heavy vehicles from the using local network.

Natural Hazards

No potential wildlife hazards have been identified on the site, with the exception of several species of snakes (information provided by the Client) that may be encountered throughout Brisbane.

Mosquitoes however are likely to be a problem in terms of the spread of diseases such as Ross River virus (RRv) and Barmah Forest virus. There is a very high risk of diseases for residences located within 1.5km of breeding sites and a significant risk of diseases for distances of 1.5 to 5km from breeding sites. It is recommended that a plan be developed to minimise public health risks from mosquitoes and possibly biting midges.

Risk Management

The risk analysis shows the relative risks associated with the proposed activities of the Northeast Business Park. The primary risks were determined to be those associated with fire or explosion in the marine industries and Marina precincts, fire in residential areas (in terms of potential property damage), exposure to contaminated recycled water (e.g. in the case of treatment plant failure), sewage releases in the marina basin and boating collisions.

Proposed control measures to minimise the likelihood of a major accident within the NEBP cover:

- Site design and layout, construction and operation of the facility;
- Preventative measures;
- Proactive maintenance;
- Operator training in relevant industries, particularly the marine industries;
- Organisation and systems measures, safety training, emergency response and evacuation plans, monitoring, incident and safety reporting; and
- Community consultation and information.

The nearest Fire Stations are located at Caboolture and Deception Bay. The standard procedure in the event of an emergency is to contact the Department of Emergency Services by dialling 000. Discussions with the Queensland Fire and Rescue Service indicate the response time to the proposed development location would be within ten minutes. CHEM Services has advised they may be involved in development assessment through referral by the Local Council but their main role is as a concurrence agency for Major Hazard Facilities (does not apply to this development). Further discussions may be held with Queensland Fire and Rescue as information about the types of industries within the development becomes available. The major factors in terms of fire fighting response are:

1. The type and quantity of chemicals present;
2. Storage practices and process activities;
3. Absence of automatic fire detection/suppression systems;
4. Accessibility for the fire service;
5. Containment capability;
6. Proximity to Caboolture River and watercourses and
7. Proximity to other premises storing dangerous goods.

This report presents two additional recommendations for minimising the consequences of fire on the surrounding environment, human health and property:

1. The construction of temporary firewater containment and diversion structures that serve the industrial park and/or the marina as a whole; and
2. The installation of fire alarms that are connected to the Fire Communications Centre (Firecomm) to minimise the risk of fire propagation between adjoining land uses in the industrial precinct.

Hazard and Risk Analysis Northeast Business Park
October 2007

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Simmonds & Bristow was commissioned Northeast Business Park Pty Ltd, to prepare a Hazard and Risk Analysis of the proposed Northeast Business Park (NEBP) development at Morayfield. The requirement for this Hazard and Risk Analysis is specified in the Coordinator General's *Terms of Reference for an Environmental Impact Statement* (EIS) (December 2006).

The project site occupies 793 hectares on the southern banks of the Caboolture River to the east of the Bruce Highway. The proposal seeks to develop the site into a major integrated mixed-use residential, business park and marine precinct comprising 350 hectares of developed area and 443 hectares for open space, recreational areas and a heritage park:

- Business and marine industry precinct;
- Marina and associated commercial/retail/service facilities;
- Mixed density residential development;
- Golf course; and
- Active and passive recreation areas.

Risk is a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, community and the environment. A hazard is a situation or condition with the potential for loss or harm to the community, property or environment and includes natural hazards such as flood and bushfire. Risk analysis is a systematic process used to understand the nature of and to deduce the level of risk so that the development process incorporates risk mitigation measures and response planning.

A detailed description of the project throughout its lifetime was unavailable at the time of this analysis, particularly in relation to the types of business and industry activities. This analysis therefore has been based on assumptions about industries that may be located in this type of development from reviews of similar existing Business Parks and Marinas. Of particular interest is the marina, which will include the storage and supply of fuel (mainly diesel) in close proximity to a residential development and the Caboolture River estuary. Shipyards are also associated with large marina developments, and may include activities such as ship building, repairs, abrasive blasting and spray painting.

The objective of this report was to identify and evaluate the potential for hazardous incidents to cause injury or fatalities, damage to property or damage to the biophysical environment. The types of hazardous incidents known to occur during any development are fires, explosions and toxic releases. The approach was to qualitatively assess all likely activities but the major hazards associated with the NEBP were considered to be the transport, storage and dispensing of fuels as well as any storage of dangerous goods. In addition, the Caboolture Shire Plan recognises flooding as a natural moderate hazard risk. The potential impacts from natural events therefore have also been included in this report.

2. PURPOSE AND SCOPE

2.1 Purpose

The primary objective of this analysis is to identify and evaluate any hazardous events that may occur as a result of the NEBP development and, the impacts of these events on the environment, infrastructure or property and human health and safety. The analysis addresses interactions between facilities (e.g. different land uses within the development) as well as off-site impacts (e.g. Caboolture River).

The purpose of this study is to assist the development approval process by identifying the hazards, prioritising hazards on the basis of the risk analysis and defining appropriate risk reduction measures. This is a qualitative and conservative assessment because the final mix of land uses within the NEBP is unknown (the Park will be staged over a 20 year period in accordance with approvals and commercial requirements).

Therefore, this approach is used to demonstrate that either:

1. The facilities, or processes that are undertaken on site will not pose an environmental or safety hazard or risk, or
2. In accordance with any hazard or risk identified, the appropriate ameliorative design and environmental management measures have been included in the proposed development.

2.2 Scope

The scope of the study was to assess the hazards and risks associated with the construction and operation of the Northeast Business Park (NEBP) as outlined in the *Northeast Business Park Project - Terms of Reference for an Environmental Impact Statement* (The Coordinator-General December 2006). The terms of reference require:

1. Description of the environmental values likely to be affected by any hazardous materials and actions incorporated in the proposal; and
2. Assessment of potential impacts and mitigation measures for protecting people and places from hazard and risk.

The appropriate level of risk evaluation at this stage of the proposed development is equivalent to a Preliminary Hazard Assessment (PHA). The methodology used is based on AS/NZS 4360:2004 *Risk Management.* The scope of work therefore covers the following aspects of hazard and risk for both the construction and operation phases:

1. Screening of potential land use and natural hazards;
2. Identification of proposed storage, transport and usage of dangerous goods and hazardous materials;
3. Assessment of the risk impacts associated with the storage, transport and use of dangerous goods and hazardous materials;
4. Definition of all potential hazards and contingency plans to deal with the effects of any hazardous events;
5. An appropriately detailed impact assessment of any additional key environmental impacts, if any key environmental impacts are identified through the environmental risk analysis; and
6. Consideration of process inventories and the inherent nature of the development.

The site-specific information on the NEPB development available for this assessment included:

- *Initial Advice Statement (IAS) Northeast Business Park Nolan Driver, Burpengary May 2006* (pmm Group 2006);
- Marina Precinct Plan;
- Infrastructure Plans*;*
- *Northeast Business Park EIS Energy Report* (Lectel 2007);
- *Northeast Business Park – Preliminary Report (traffic)* (Cardno Eppell Olsen 2007); and
- Construction and development staging plans.

The following Australian Standards, Guidelines, Planning Policies and Codes were also considered relevant to this analysis:

- AS/NZS 4360:2004. *Risk Management*.
- HB 436:2004. *Risk Management Guidelines. Companion to AS/NZS 4360:2004*.
- AS/NZS 3931:1998. *Risk analysis of technological systems – Application Guide.*
- SPP 1/03: *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (Queensland State Planning Policy).
- Department of Urban Affairs and Transport Planning (2003). *Major Industrial Hazards Advisory Paper No. 3. Hazard Identification, Risk Assessment and Risk Control.* Consultation Draft. NSW Department of Planning.
- AS 1940:2004. *The Storage and Handling of Flammable and Combustible Liquids.*
- ADG Code. *The Australian Dangerous Goods Code*.
- NSW Department of Urban Affairs and Planning (1997). *Guidelines for Hazard Analysis*. *Hazardous Industry Planning Advisory Paper No. 6.*

3. SITE DESCRIPTION

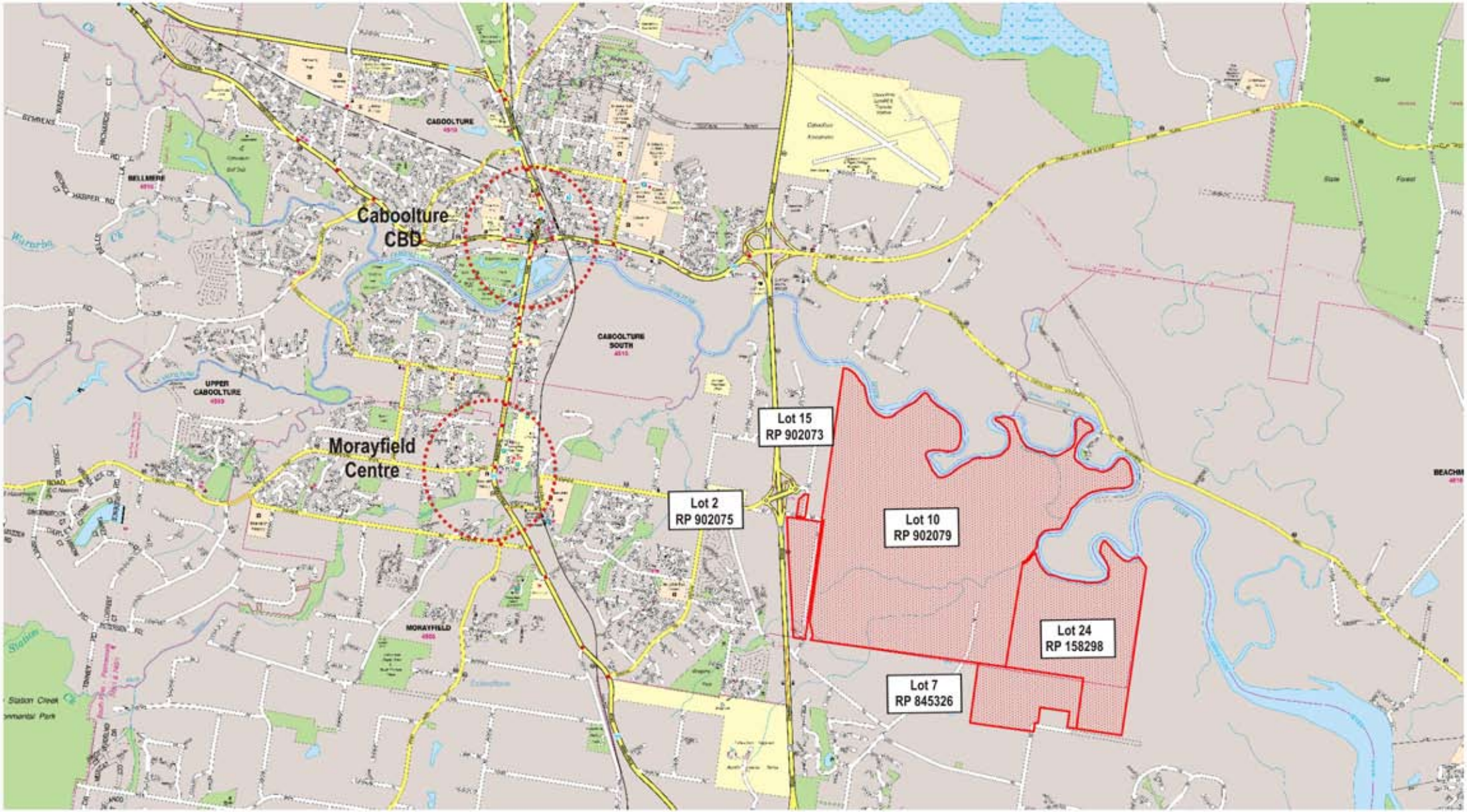
This section does not replicate detailed information on the Site Description, which it is assumed, has been addressed in detail in other sections of the EIS.

3.1 Location

The NEBP site is located on Nolan Drive at Morayfield within the Caboolture Shire, north of Brisbane and adjacent the Bruce Highway. It is approximately 4.5km directly east of the Caboolture town centre. The site covers 793ha along the Caboolture River (including 9km of river frontage) and is 8km from the river mouth (and Deception Bay).

Locality Plan

Figure 1 Northeast Business Park site locality



The site occupies vacant private (freehold) land covering six land parcels in Caboolture Shire Council's central planning zone:

- Lot 10 on RP902079;
- Lot 24 on SP158298;
- Lot 7 on RP845326;
- Lot 2 on RP902075;
- Lot 15 on RP902073; and
- Lot 12 on RP145197.

The site is a mixture of cleared vegetation, regrowth and remnant vegetation. The cleared areas are the result of previous land use, namely cane farming and forestry. Some remnant vegetation exists in the western corner.

The site forms part of the Caboolture River catchment with several sections of the riparian zone along the river nominated as a wetland protection area. Remnant vegetation in the western corner is also nominated as a wetland protection area by the Caboolture Shire Council. The Caboolture River is nominated as a catchment protected major waterway with the onsite small creeks and drainage lines nominated as catchment protected minor waterways. It is not part of the potable water catchment.

3.2 Surrounding Land Uses

The land to the immediate north and south is zoned Rural Residential. Both these northern and southern areas are already partially established with residential development. Development immediately to the south of the subject site consists of rural and rural residential development on lots ranging in size from 1-18 hectares.

Development further to the south east consists of rural residential lots, generally either 3000m^2 or 8000m^2 in area. West of the site is the Bruce Highway, beyond this the land use zoning is a mixture of Residential A, Rural Residential, isolated rural parcels and open space. Further west is the railway and the township of Morayfield.

To the east of the site is the Caboolture River. Beyond the river the land is cleared open space with a mixture of forestry and rural land use. Land on the opposite side of the Caboolture River consists predominantly of large rural allotments that link to forestry and large environmental areas to the north. The site effectively forms the interface of urban development and extensive environmental and open space areas and corridors, particularly to the east and north.

There is an existing marina and slipway (Monty's) located on the Caboolture River in the vicinity of the proposed development.

3.3 Caboolture Shire Demographics

The Caboolture Shire has a population of approximately 135,000 people, with an annual growth rate of approximately 3,000 people (Caboolture Shire Council, 2007). The Shire has experienced an average annual 2.6% population increase since 1996, which is greater than the Queensland average for the same period of 1.7% (Caboolture Shire Council, 2001).

The demographic spread of the Caboolture Shire population is 0-14 age group 24.1% , 15-64 age group 63.6% and >65 age group 12.3%. The age group that has experienced the highest growth rate since 1996 is the >65 age group.

Dwellings within the shire are predominantly houses that are either fully owned or under mortgage. Townhouses are next most popular dwelling type followed by units. The average number of people within houses is 2.9 persons, with 1.8 and 1.7 persons in townhouses or units respectively. The age group growth rates and dwelling occupant numbers indicate that retired couples are the most common family type within the shire.

3.4 Environmental Values

3.4.1 Environmental Designations

The Initial Advice Statement for the Northeast Business Park (pmm Group 2006) lists the following environmental designations for the subject site shown in Table 1.

Table 1: Environmental Designations associated with the Subject Site

Designation	Boundary
Moreton Bay Marine Park	Deception Bay and the lower reaches of the Caboolture River including the length of frontage to the site.
Ramsar Wetlands	Caboolture River for part of the site and downstream.
Deception Bay Fish Habitat Area – Category A	FHA No. 0.13 – beds, banks and water column of Caboolture River along length of frontage to the site and a short way into Raff Creek. Excludes marked channel. Works or activities requiring the disturbance of habitats require a permit under the *Fisheries Act 1994.*
JAMBA[1], CAMBA[2]	No specific boundary defined. Site is adjacent to wetlands that are likely to be used by birds protected under these agreements.
Erosion Prone Areas	As per EPA Plan No. SC3367 (adjacent Caboolture River). Part of the site is within an Erosion Prone Area, being 40 metres landward of Highest Astronomical Tide (HAT).
Areas of Coastal Biodiversity Significance – under the Draft Southeast Queensland Regional Coastal Management Plan	Site is adjacent to Significant Coastal Wetlands.
Remnant Vegetation designations	Site contains some identified communities of concern.
Coastal Management district	No Coastal Management Districts mapped in the locality.

[1] Japan Australia Migratory Birds Agreement.
[2] China Australia Migratory Birds Agreement.

3.4.2 Water Quality Objectives

The stretch of the Caboolture River that forms the eastern boundary of the development is described under the *Environmental Protection (Water) Policy 1997* as a middle estuary. Away from the actual river the tributaries in this area are classed as lowland streams (freshwater at elevations <150m).

The Caboolture River system, through the middle estuary section, is not pristine habitat as it has been degraded by human occupation and land uses in the surrounding area for at least 100 years. It is therefore not considered to be of high ecological value and therefore classified as a 'slightly to moderately disturbed' ecosystem.

As a slightly to moderately disturbed ecosystem the following environmental values for the subject site apply (under the *Environmental Protection (Water) Policy 1997*) as part of Basin No. 142:

- Aquatic Ecosystem;
- Secondary Recreation (e.g. boating, but not swimming);
- Visual Recreation; and
- Industrial Use.

Subject to the above environmental values (EV), water quality objectives (WQO) are designated. Where multiple EVs exist the most stringent WQOs apply. The WQO for the stretch of the Caboolture River adjacent to the development are detailed in Table 2.

Table 2: Water Quality Objectives (WQO) as determined for the Caboolture River

Parameter	WQO
Turbidity (NTU)	<8
Suspended Solids (mg/L)	<6
Chlorophyll a (μg/L)	<4
Total N (μg/L)	<300
Oxidised N (μg/L)	<10
Ammonia N (μg/L)	<10
Organic N (μg/L)	<280
Total P (μg/L)	<25
Filterable reactive phosphorus (FRP) (μg/L)	<6
DO (%)	85-100
pH (stand.)	6.5-8.0
Secchi depth (m)	>1.0

Source: *Environmental Protection (Water) Policy 1997 Caboolture River Caboolture River Environmental Values and Water Quality Objectives Basin No. 142 (part) - Including all tributaries*.

The subject site abuts the Caboolture River, which is part of a declared Fish Habitat Area 'A' by the Department of Primary Industries and Fisheries (DPI&F). The inshore and estuarine areas provide important habitat for sustaining local and regional fish stocks and fisheries. The mangrove communities that line the river's edge in estuarine areas are important as fish nurseries.

Areas classed as a Fish Habitat Area 'A' allow shared community use, which includes community access, boating, commercial and recreational fishing. Oyster farming is not permitted within a Fish Habitat Area 'A'. Classing an area as a fish habitat means that the area will be protected against heavy impact development.

3.4.3 Remnant Vegetation

A mixture of cleared vegetation, regrowth and remnant vegetation exist on the site. The remnant vegetation exists in the western corner and is a mix of remnant endangered (dominant) and remnant not of concern, as classified by the Environmental Protection Agency (EPA).

The endangered vegetation is comprised of *Eucalyptus tindaliae* (Stringybark) and *E. racemosa* (Narrow-leaved Scribbly Gum) communities. The not of concern vegetation refers to *Melaleuca quinquenervia* (Broad-leaved Paperbark) communities.

3.5 Flood, Bushfire and Landslide

Historical records suggest that flooding and fires cause the greatest risk to communities within Caboolture Shire. In addition, exposed coastal areas such as Beachmere, which is located north of the mouth of the Caboolture River, are susceptible to storm surge flooding. There is no evidence to suggest that Caboolture is under major threat from tremors or earthquakes (Caboolture Shire Plan).

3.5.1 Flood

The Caboolture Shire Council Plan (Caboolture Shire Plan) (December 2005) states that flooding in the Caboolture area has resulted in damage to buildings and agriculture, loss of life and disruption to normal services (e.g. mail and rail).

Downstream of Caboolture CBD, the Caboolture River floodplain is very flat and consists of scattered swamps and extensive areas that are floodprone. The major townships are Caboolture, Morayfield and Beachmere. The remainder of the floodplain is characterised by various rural activities including pastures and pine forest plantations.

The Burpengary Creek system, directly south of the Caboolture River catchment and the subject site, also flows in an easterly direction to the northern end of Deception Bay, just south of the Caboolture River mouth. Flooding of the Caboolture River and Burpengary Creek poses a moderate natural hazard risk to Caboolture (Caboolture Shire Plan).

Caboolture has always experienced nuisance flooding affecting properties along the Caboolture River, King John Creek and Lagoon Creek, as well as closing local roads. It should also be noted that all coastal areas may be subject to flooding resulting from storm surge. There has also been some erosion and destabilisation of the river banks along the proposed development site.

Therefore, the riparian area adjacent the Caboolture River is known to be subject to periodical flooding. Minor waterways that are tributaries of the Caboolture River and that may be subject to minor flooding also transect the development area. Those areas of land known to be subject to flooding, from the Caboolture River, have been retained as open space while those that may be subject to minor flooding from the tributaries are well within the golf course/open space area. The development of the site includes a cut and fill plan to ensure the majority of the development will be located above the I in 100 year (Q100) flood level.

3.5.2 Bushfire and Landslide

Bushfires and landslide pose a threat to many areas of the Shire with varying levels of risk involved. The provisions of SPP 1/03 are to be incorporated into the planning scheme. Bushfires are the incontrollable burning of forest or wooded areas, usually occurring over large tracts of land on multiple fronts and as the result of dry and hot weather conditions.

Bushfires can destroy property (including urban property) and result in fatalities. The most notable bushfire events affecting Caboolture Shire in recent years occurred in September and November 1994 (Caboolture Shire Plan). These fires affected more than 4800 hectares of exotic pine plantation and destroyed both urban and rural property within the Caboolture Shire.

Areas at most risk from bushfires are generally on the urban fringe or at the interface between the bush and built up areas. The major threat within the Shire remains in rural and rural fringe areas. In this context, there is visual evidence of recent bushfire in remnant forests along and outside of the southern boundary of the proposed site.

The Rural Fire Service and Queensland Fire and Rescue have produced bushfire risk maps based on the methodology described in State Planning Policy (SPP) 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*. The proposed NEBP site is located in a medium bushfire hazard area.

Landslides are the downslope movement of a soil or rock mass as a result of shear failure at the boundaries of the mass. The most common trigger for a landslide is an episode of intense rainfall. In Caboolture, rainfall events of such magnitude have an average recurrence interval of less than one per year (Caboolture Shire Plan).

Areas at risk of landslides are typically on steep slopes with unstable soils. The State Planning Policy (SPP) 1/03 requires all land with a slope of 15% or greater to be identified in planning schemes. The site is located on a flood plain and is therefore not at risk of landslides occurring.

3.6 Mosquito-borne Diseases

Mosquito-borne diseases such as Malaria, Ross River, Barmah Forest, Dengue, Australian Encephalitis, Japanese Encephalitis, Kunjin, Kokobora and Stratford viruses, occur in Queensland (Queensland Health 2002).

Developments in close proximity to wetlands, particularly within the coastal zone, have brought humans into closer contact with these biting insects in their natural habitats. In addition, some developments (e.g. incorporating recreational lakes and artificial wetlands) have created new mosquito or biting midge breeding sites.

The factors that influence the density and dispersal of mosquito and midge populations and therefore the risk of health impacts are meteorological conditions, location of populated areas, availability of shelter and specific habitats of mosquito and biting midge species.

The Caboolture Shire Council reports on the incidence of Ross River and Barmah Forest viruses. Ross River and Barmah Forest are nationally notifiable diseases. That is, they are part of an agreed list of communicable diseases or disease groups that are monitored under the National Notifiable Diseases Surveillance System (NNDSS).

The Caboolture Shire Council has a program for the control of mosquito breeding on Council and Crown land across salt marsh, estuarine and riparian zones. In most cases, spraying is carried out by helicopter following a high tide of 2.4 metres or heavy rain. Treatment must be carried out within approximately five days of a high tide. The mosquito season is mainly from September to May.

4. CONSTRUCTION PHASE ACTIVTIES

4.1 General Site Construction

The roll out of each of the precincts within the development will be staged over a twenty (20) year period in accordance with approvals and commercial requirements. The general sequence of works for each stage will include installation of environmental controls and site establishment, site clearing, earthworks, infrastructure and construction.

The marina development will involve dredging in the Caboolture River as well as at the river mouth to enhance the safety of the navigation channel and to improve flood mitigation. Dredging is an Environmentally Relevant Activity (ERA 19).

The land development, where possible, will be designed around a balanced cut to fill approach which may include the handling of approximately 3.2 million cubic metres (m^3) of material. The type of equipment used would be similar to any major infrastructure and construction project and include the use of bulldozers, scrapers, excavators, trucks, cranes and concrete pumps. There will be 50 000 litres of diesel storage on-site for the construction phase.

Figures of the indicative development phases over the next twelve (12) years (Stages 1 to 11) have been prepared by the pmm Group and summarised in Table 3. It is expected that approximately 4000 people would be employed during the construction phases.

Table 3: Indicative Development Phases (June 2008 to December 2020)

Stage	Dates		Construction	Development
	Construction	Sales		
One	Jun 2008 to Jun 2009	June 2009 to Jun 2011	Temporary road entry upgrade including Trafalgar Road	District Industry Land subdivided 28.9 hectares
			Nolan Road	
			Mains Services	
			Earthworks to prepare flood mitigation measures	
			Earthworks to fill platform	
			Marina Basin excavation	
			River dredging downstream	
Two	Jun 2009 to Jun 2010	Jun 2010 to Dec 2013	Buchannan Road Interchange Upgrade	Heritage Park complete
			Estate Entry Road	District Industry Land subdivided 31.4 hectares
			Boulevard Road Stage 2A – 4 lanes	
			New Nolan Road alignment	
			Boulevard Road Stage 2B – 2 lanes	
			Stage 2B start bridge construction	
			Continued marina construction	
			Earthworks to fill platform	
			Continued river dredging downstream	
Three	June 2010 to Jun 2011	June 2011 to Jun 2015 (Business Park)	Construct 9 holes complete Golf Club construct and complete	District Industry Land subdivided 35 hectares
		Jun 2011 to Jun 2014 (Residential)	Continued bridge construction to completion	Marine industry
			Road and bridge linkage construct and complete	Residential land subdivided 10 hectares
			Continued Marina and lock construction finalised	Shipyard available
			River dredging finalised	Marina Villa Stage 1 operational
			Buckley Road upgrade	Marina berths available
Four	Jun 2011 to Jun 2012	Jun 2012 to Jun 2016 (Business Park)	Construct marina boardwalk	District Industry land subdivided 27.7 hectares
		Jun 2012 to Jun 2014 (Residential)	Construct and complete internal roads	Residential land subdivided 10 hectares
				Medium density development
				Marina Villas Stage 1
Five	Jun 2012 to Dec 2013	Jun 2013 to Dec 2015	Boulevard Road and Bridge – Additional 2 lanes	Residential land Subdivided 10 hectares

Stage	Dates		Construction	Development
	Construction	Sales		
				Marina Village Stage 2 operational
				Marina Villas Stage 2
Six	Jan 2013 to Jun 2014	Jan 2014 to Dec 2019 (Business Park)	Marina boardwalk complete	District Industry land subdivided 32 hectares Business Park completed
		Jun 2014 to Jun 2017 (Residential)	Marina club and construction	Residential land subdivided 10 hectares
				Marina Village Stage 3 operational
				Medium density development
				Marina villas Stage 3
Seven	Jun 2014 to Jun 2015	Jun 2015 to Dec 2018	Construct 9 Holes complete	Marina Village Stage 4 operational
				Marina Villas Stage 4
				Medium Density Development
				Golf Residential Land Phase 1
				Residential Land Subdivided 10 hectares
Eight	Jun 2015 to Jun 2016	Jun 2016 to Jun 2020	-	Residential land subdivided 10 hectares
				Golf residential Phase 2
				High density development
Nine	Jun 2010 to Jun 2011	Jun 2011 to Jun 2015	Roads and bridge linkages construct and complete	Marinas Villas Stage 5
				Resort Development Complete and Operational
				Residential Land Golf Stage 3
				High Density Development
				Residential Land Subdivided 15 hectares
Ten	Jun 2017 to Jun 2018	Jun 2018 to Jun 2023	Construct and complete roads and bridge linkages	Marina Villas Stage 6
				High Density development
				Residential Land subdivided 12 hectares
Eleven	Jun 2019 to Dec 2020	Jun 2020 to Jun 2025		Residential Land subdivided 14 hectares
				High density development 2 buildings

4.2 Marina Construction

The marina basin will be isolated from the Caboolture River for the majority of its construction and then opened to the main river for operational purposes. The construction of the marina will require capital dredging works in the order of 1 500 000m^3 (pmm Group 2006). A proportion of the resultant fill is intended to be used on site, with some required to be exported to other properties in the proponent's portfolio.

Dredging is also required in the navigable section of the lower Caboolture River to:

- Provide a safe entrance and to the river at all tides and facilitate marine traffic to the marina, including large vessels; and
- Increase the outfall of water flows in flood events, providing substantial flood mitigation upstream.

4.3 Community Infrastructure

Infrastructure will consist of stormwater drainage and services and construction of a road network. Each of the precincts will be serviced by water, sewer, power and telecommunications (pmm Group 2006). There is also the potential for extension of gas pipelines to service the development and the route investigation for these pipelines is underway.

There are four wastewater treatment plants (WWTP) within the Caboolture Shire at South Caboolture (Weier Road), Burpengary East (Uhlmann Road), Woodford and Bribie. The South Caboolture and Burpengary East WWTPs have capacities of 9.6ML/day and 9.0ML/day respectively (Caboolture Shire Plan).

Sewage flows from the development would be fed to the South Caboolture WWTP. The pipe network will need to be updated. The pumped rising main would run along Weier Road and beside the treatment plant access road. The South Caboolture WWTP, at Weier Road, will require an upgrade to cope with the increased volume of waste requiring treatment (based on 12700 equivalent persons (EP)).

It is further proposed to use recycled water from the South Caboolture WWTP, which produces Class A^+ water. The reclamation plant produces 9ML/day of tertiary treated recycled water. Class A^+ is treated to a level that meets the microbiological, physical and chemical criteria described in the *Queensland Water Recycling Guidelines* (EPA 2005).

Other possible uses of recycled water include landscape irrigation, industrial process water and wash down. A dual reticulation system servicing residential and commercial property uses would allow other uses of recycled water including toilet flushing, garden watering, car washing, water features and systems and utility washing (e.g. paths and buildings).

An Energy Report has been prepared by Lectel Consulting (June 2007), which assesses the environmental impacts of the proposed electrical and telecommunications network. The electrical network includes the construction of a 33kV zone substation in Nolan Drive (commissioning period of up to two years).

5. OPERATIONAL PHASE ACTIVITIES

The infrastructure plan for the proposed development shows a number of land use precincts (see Figure 2). These precincts are:

- Business park;
- Marine industry;
- Marina village;
- Residential precincts;
- Waterfront townhouses;
- Hotel;
- Shipyard;
- Golf frontage residential;
- Multistorey residential;
- Commercial;
- Retail;
- Education;
- Green space;
- Open space/golf course;
- Open space;
- Protected vegetation; and
- Community node.

The types of activities that may be carried out in each precinct are discussed in the following sections. It is expected that upwards of 10000 people would be permanently employed by the development.

These activities are further evaluated in Section 6 to determine whether the materials stored or processes used constitute hazardous industry as described by Chemical Hazards and Emergency Management Services (CHEM Services) in the Queensland Department of Emergency Services.

LEGEND

- STRUCTURE PLAN BOUNDARY
- PRECINCT BOUNDARY
- 1 MIBA PRECINCTS
- 1(1) MIBA ESPLANADE
- 1(2) MIBA CORE
- 1(3) MIBA HIGHWAY
- 1(4) MIBA MARINE INDUSTRY
- 2 MARINA PRECINCTS
- 2(1) MARINA BASIN
- 2(2) SHIPYARD
- 2(3) MARINA VILLAGE
- 2(4) MARINA RESIDENTIAL
- 2(5) HOTEL
- 2(6) MARINA PAVILION
- 2(7) GOLF RESIDENTIAL
- 3 RESIDENTIAL PRECINCTS
- 3(1) RESIDENTIAL WEST
- 3(2) RESIDENTIAL EAST
- 4 OPEN SPACE PRECINCTS
- 4(1) GOLF CLUB
- 4(2) GOLF COURSE
- 4(3) OPEN SPACE
- 4(4) COMMUNITY MULTI USE
- COMMUNITY NODE
- HERITAGE PARK
- SPORTING FIELDS
- EDUCATION & TRAINING
- ENVIRONMENT CENTRE
- ARTERIAL
- SUB ARTERIAL
- COLLECTOR
- POSSIBLE FUTURE PUBLIC TRANSPORT ROUTE
- LOAD LIMITED THRESHOLD

Note:
Structure Plan is indicative only, intended to convey major land use precincts & development features. Detailed location of all precincts & features is subject to survey, detailed design, sector plans & Council development approvals.

CLIENT
NORTHEAST BUSINESS PARK

PROJECT
NORTHEAST BUSINESS PARK

STRUCTURE PLAN

Level Datum	
Origin	
Date	25 SEPT 2007
Surveyed	
Comp By.	KCH
DWG Name.	20430STRUCTURE
Local Authority	CABOOLTURE SHIRE COUNCIL
Job Reference	20430
Scale	*1:5000@A0*
Plan Reference	***20430-10F***

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Table 4 was presented in the Initial Advice Statement (IAS) (pmm Group 2006) and represents approximate estimates of the area of each land uses precinct.

Table 4: Approximate Area of each Land Use Precinct

Precinct	Approximate area (ha)[1]
Business and Industry Precinct	**160**
Business and Industry Park	153
Residential business	7
Marina Precinct	**70**
Marine Industry + shipyard	19
Commercial and Retail	5
Village residential hotel	5
Multi level residential	8
Low rise medium density residential	6
Marina basin and access	27
Golf course Precinct	**111**
Golf course and golf club	82
Golf course residential	29
Residential	**56**
Environmental and open space	**365**
Open space + stormwater retention	146
Rehabilitated riparian corridor and buffer	138
Wetland reserve	4
Public river access + public esplanade	14
Recreation/Lakeland/environmental	41
Heritage precinct + gardens	22

[1] Some areas may be larger based on a revised total land area of 793ha (October 2007)

5.1 Business Park

The IAS describes the advantages of mixed-use precincts as demonstrated by Norwest Business Park in Sydney and Metroplex on Gateway. These precincts tend to attract clean efficient industries that rely on an increasing knowledge base to gain a competitive advantage. The Norwest Business Park includes a range of Corporate, Multi-user (e.g. warehouses and office space) and Retail and Service Developments. Businesses include IBM, ARV Food Services (preparation of meals), Wyeth Australia (pharmaceuticals – head office), Optus Single (communications operations centre) and Woolworths Limited (Offices). Product manufacture (small to medium scale), processing (small to medium scale) and warehousing (product storage specific to industry type) are activities that are common in Business Parks in Southeast Queensland.

The western sector of the Northeast Business Park site is designated District Industry Zone in the Caboolture Shire Plan (effective from 12 December 2005). One of the outcomes sought for this zone is that District Industry areas provide for uses, that due to their nature and operation, are unlikely to have significant adverse amenity or environmental impacts upon adjacent or nearby land. A list of consistent and inconsistent land uses is shown in Table 5 and provides a further guide to the type of businesses that may occupy this section of the development.

It is likely that a small service station, which is listed as a consistent use, will be established within the NEBP.

Table 5: Consistent and Inconsistent Uses within the District Industry Zone (Caboolture Shire Plan)

Consistent Uses	Inconsistent Uses
Accommodation building for motel	Accommodation building except motel
Aquaculture	Agriculture
Car parking facility	Animal husbandry
Car wash	Caravan park
Caretaker's residence	Cemetery
Educational establishment	Child care centre
Entertainment and recreation	Corrective institution
Fuel depot	Dependent person's accommodation
General industry	Display home
Hotel	Dual occupancy
Landscape supply centre	Dwelling house
Landscape supply production	Estate sales office
Medical centre	Extractive industry
Motor vehicle repair station	Forest practice
Park	Funeral parlour
Public utility	Home based business
Recycling yard	Hospital
Sales or hire yard	Marina
Service industry	Market
Service station	Multiple dwellings
Shop	Office
Storage facility	Place of worship
Take away food outlet	Relocatable home park
Telecommunication facility	Restaurant
Transport depot	Retail showroom
Warehouse	Retirement village
	Roadside stall
	Rural service industry
	Rural worker's dwelling

Source: Caboolture Shire Plan (effective from 12 December 2005)

5.2 Marine Industry and Shipyard

The Queensland Department of State Development defines the marine industries sector as including:

- The building, maintenance and refit of boats and pleasure craft;
- Various suppliers to the sector; and
- Infrastructure such as marinas and marine precincts.

The activities of interest to this study are ship building, boat maintaining and repairing and dry stack boat storage.

The IAS (ppm Group 2006) provides an overview of the environmental management of the proposed shipyard, which will be designed to capture and treat all wastewater and pollutants. A sophisticated drainage network will provide filtration and treatment for wastewater. Waste oil is to be collected and recycled by a licensed waste removalist. Environmental plans will manage surface coating activities, vessel surface cleaning, water quality, dust and particle dispersion, noise and waste.

All containments, including stormwater run-off are to be contained in underground holding tanks. Pollutants and solids will be filtered and separated. Treated clean fluids will then be automatically discharged to sewer under controlled conditions. No contaminated water will be released into the environment. Uncontaminated runoff will discharge the stormwater system (i.e. not diverted to sewer).

5.2.1 Ship Building

The functions and operations for the shipyard activities identified in this report are based on Environment Australia (1999) *Emission Estimation Technique Manual for Shipbuilding, Repair and Maintenance*.

In terms of shipbuilding, the major processes are:

- Foundry operations;
- Metal working; and
- Construction.

The structural framework of most large ships is constructed of various grades of mild and high strength steel. Smaller ships are also constructed of aluminium, wood or fibre composite materials. Other metals such as stainless steel, galvanized steel, and copper and nickel alloys are used in shipbuilding in areas requiring specific corrosion resistance.

Some shipyards build only large ships and also have repair and dry dock facilities. Other shipyards have facilities for building small and medium sized vessels such as patrol boats, fire and rescue boats, water taxis, ferries, tug boats, fishing boats and shallow drafted barges (Environment Australia 1999). The production of recreational boats would also be expected.

A shipyard consists of a number of major production facilities with supporting workshops and services. The steps involved in building a ship include:

- Handling raw materials and fabricating basic parts;
- Joining fabricated parts into assembled parts;
- Joining fabricated and assembled parts into sub-block assemblies which are in turn fitted together to form blocks;
- Fitting and welding blocks together to erect the ship; and
- Outfitting the ship with fabricated parts that are not structural in nature.

5.2.2 Boat Maintaining and Repairing

Boat maintaining and repairing is an Environmentally Relevant Activity (ERA 69). The carrying out of this activity therefore would be subject to development approval conditions that would include air, water and soil emissions. Other ERAs that may apply to these activities are:

- ERA 7 – Chemical storage;
- ERA 23 – Abrasive blasting; and
- ERA 25 – Metal surface coating.

In terms of repair and maintenance, the major processes are:

1. Surface preparation;
2. Surface coating;
3. Fibreglassing; and
4. Engine maintenance.

Surface preparation can include solvent, detergent and steam cleaning; abrasive blasting; wet abrasive blasting and hydro-blasting; metal plating; chemical surface preparation (e.g. paint removers, alkaline cleaning solutions and pickling acids) and mechanical methods (e.g. scraping, sanding or grinding).

Surface coating systems prevent corrosion and deterioration of the structure and components of ships. The nature of shipbuilding and repair requires several types of paints to be used for a variety of applications. Paint types range from water-based coatings to high performance epoxy coatings.

Antifouling paints are used to prevent the growth of marine organisms on the submerged area of a boat. Copper-based and tributyltin (TBT) – based paints are widely used as antifouling paints, although TBT may only be used on vessels longer than 25m and with regulatory approval. The most widely used form of application in the shipbuilding industry is the airless sprayer. Airless sprayers can have up to 90% transfer efficiency and are much cleaner to operate than compressed air systems. Thermal spray is the application of aluminium or zinc coatings to steel for long term corrosion protection.

Many of the medium and small shipyards manufacture and repair fibreglass ships and boats, or construct fibreglass parts for steel ships. The mould based process is the most common for this industry, which involves applying the reinforcing material and catalysed resin to a mould surface. The materials used include glass fibres, accelerators, catalysts, mould release agents, fillers, pigments and cleaning agents e.g. acetone. Resins used in the reinforced plastics industry such as polyesters and vinyl esters may contain styrene, although low styrene emission (LSE) resins are available. Styrene is a volatile organic compound with a characteristic sweet odour.

Polyester resins are usually combined with MEKP (methyl ethyl ketone peroxide) and cobalt solution may also be added. Some associated activities (e.g. production of polyurethane foams) may include the use of isocyanates.

Engine maintenance covers installation, servicing and repairs. These activities would be similar to those for vehicle motor service industries and therefore would include the storage of solvents and disposal of wastes (e.g. waste oil, waste solvents, oil filters and batteries).

5.2.3 Dry Stack Boat Storage

A boat storage facility would comprise boat buildings and a hardstand area (to facilitate the movement of boats). The boat stores typically contain racks positioned on either side of a wide aisle and could accommodate vessel lengths ranging from ≤7m to 12m. Boats would be fed to and from these racks by fork lift trucks (FLTs). Boat feed pontoons and layover berths also form part of the operation of a dry boat store. This activity would operate from 4:00am to 9:00pm.

There are two common types of boat lifting systems:

1. Fork lift trucks with ‘negative lift’ (i.e. allows boats to be lowered several metres into the water); and
2. Boat lift stations that comprise a cradle to support the boat and a hydraulic lift to lower or retrieve boats from the water.

5.3 Marina

The marina basin and access covers 27 hectares. The marina basin will be a lock facility that provides approximately 800 wet berths. One of the major benefits of this location is its suitability for access by tall-masted ships because there are no overhead obstructions. The activities within the marina include boat mooring (or wet berths) and fuel dock.

A marina is classed as an Environmentally Relevant Activity (ERA 73) under the *Environmental Protection Act 1994.* ERA 73 refers to marina or seaplane mooring and the activity levels are provided below:

- Level 2 – less than 20 berths or moorings;
- Level 1 - ≥ 20 - <100; and
- Level 1 - ≥ 100.

Therefore the proposed marina operation would be classified as ERA 73 Level 1 (≥100). The operation of the proposed marina will also require periodic maintenance dredging of both the marina basin and the navigation channel. Management considerations for the dredge spoil include disposal locations, testing for acid sulphate materials and spoil treatment if required.

5.3.1 Boat Mooring

Boat mooring (wet berths) at the marina will have the capacity to accommodate up to 800 vessels. Vessels will include powered boats, sail craft (including tall masted vessels) and potentially seaplanes. It is assumed that the majority of vessels within the marina will be private recreational vessels. However it is also likely that some tourist vessels will also operate out of the marina. It is expected that boat berths will be a mixture of privately owned berths, leased berths as well as berths set aside as visitor or layover berths. Estimates are that 300 berths will be utilised for most of time and the numbers will increase during public holiday times.

Boat mooring includes movement of vessels within the marina basin and navigation channel, transfer of goods to and from vessels, boat toilet water (black water) discharges to the marina holding facility and boat fuelling.

5.3.2 Fuel Dock

It is expected that the fuel dock will be located within the marina precinct and basin. The fuel dock will consist of four floating fuel bowsers, which will be available to the marina vessels 24 hours a day, 7 days per week.

Activities associated with the fuel dock include bulk fuel delivery to the site, transfer of fuel to underground storage tanks, fuel supply from the storage tanks to the bowsers and fuel dispensing from the bowser to vessels and other users.

Bulk storage of fuel is classed as an Environmentally Relevant Activity (ERA 11) under the *Environmental Protection Act 1994.* ERA 11 refers to crude oil or petroleum storage and the activity levels are provided below:

ERA 11 – crude oil or petroleum product storing:

- Level 2 ≥ 10 000L and < 500 000L; or
- Level 1 ≥ 500 000L.

Based on estimations provided by Laing O'Rourke, the marina will store 55 000L of diesel and 20 000L of unleaded petrol. Therefore the marina will be classed as an ERA 11 Level 2 (as well as a Large Dangerous Goods Location, see Section 6). Both fuel products will be stored in underground storage tanks (UST) and delivered to the fuel bowsers via underground pipelines.

It is assumed that the bulk fuel will be stored in underground storage tanks (UST) close to the dispensing areas. AS1940 recommends a minimum distance between any two tanks of at least 150mm and protection of underground tanks from potential damage arising from adjacent properties by at least 2m of boundary separation.

UST are constructed using either a double wall tank or an underground bund. The second wall on a double walled tank acts as an in-situ bund. Given the large quantities of diesel to be stored multiple tanks will be installed. All storage tanks should be fitted with monitoring wells to enable regular checks on fuel levels within the tanks.

Land bowsers should be located on a hardstand area and should be surrounded by an on-grade drainage collection system. This ensures that any fuel spills to the ground are collected and won't enter the stormwater system. Floating bowsers will be located on the fuel wharf, which is a jetty arrangement. Land based and floating fuel dispensers will be located and constructed in accordance with AS 1940 (Section 7).

Fuel should be supplied to the land bowsers using lined polyethylene flexible pipe (LPFP) or equivalent. Any joints in the pipeline should be welded. Any buried galvanised fittings must be protected against corrosion. Fuel supplied to the floating bowsers will be via a steel ducted contained pipeline, or equivalent, which is placed on marine grade bracket under the jetty. Pipelines, delivery hoses and nozzles will be located and constructed in accordance with AS1940 (Section 7). Bowsers hoses are to have automatic shut nozzles to prevent overfilling, as per AS1940. Vapour recovery lines are constructed using LPFP.

5.3.3 Boat Movements

This activity refers to the movement of vessels in and around the marina basin as well as through the navigation channel and lock that provide access to the Caboolture River. The lock is intended to function as a flood mitigation measure as well as buffer between high and low tide changes in water level.

5.4 Residential

This category comprises the land based residential options including village residential hotel, multi-level residential development, low-rise medium density, golf course residential and residential. The residential options therefore range from two-bedroom apartments to five-bedroom houses. The proposed area of each of these precincts is provided in Table 4.

The development in total will comprise approximately 2500 residences. The average number of people occupying different residence types in Caboolture Shire is described in Section 3.3. The average number of occupants across all residential types was 2.1. Therefore, the total population of the NEBP is assumed to be approximately 5250.

Medium to high density residential will centre on the marina hub, between the marina and the golf course. The hotel/conference/resort centre will be located at the eastern end of the marina hub, overlooking the marina proper. Low density residential will be on the southern side of the golf course.

Construction of the residences, including the hotel/conference/resort will be a staged release, with construction works expected to commence in 2008. The first residences will be available for sale as Stage 3 of the development release in 2011. The final residential release will occur in 2020 as part of the Stage 11 (final stage) development release.

5.5 Commercial, Retail and Education

Based on similar marina and residential developments, the commercial and retail precincts could include businesses such as:

- Real estate;
- Yacht brokers;
- Boat builders;
- Marine upholstery;
- Electronics and electrics;
- Retail – general store, accommodation, laundromat, hair dressing, bottle shop;
- Hotel;
- Yacht club and other eateries; and
- Charter, cruises and other activities.

Child care facilities could also form part of the commercial mix.

5.6 Green Space, Open Space and Protected Vegetation

The land areas of these precincts are listed in Table 4 and comprise 447 hectares in total, including the golf course and golf club. The green space precinct occupies much of the land between the main proposed access road and the Caboolture River. The proposed location of the golf course is the southern side of the access road. The other specific land uses in this precinct include sporting fields and the Heritage Park.

6. HAZARDOUS SUBSTANCES AND DANGEROUS GOODS

A hazardous material is a material which, in sufficient quantities, has the potential to cause harm to people, property or the environment because of its chemical, physical or biological qualities. Dangerous goods are chemicals that have the potential to present an immediate threat to people, property or the environment if not properly controlled. They are classified according to the nature of the hazard into nine classes, some of which are divided into sub-classes.

The Terms of Reference (TOR) for the EIS requires an inventory for each class of substances listed in the Australian Dangerous Goods Code to be held on-site. The approach here is to consider the potential activities that may operate on the site and the types of dangerous goods or substances that may be used by these activities.

This section therefore provides an overview of the *Dangerous Goods Safety Management Act* 2001, the dangerous goods classes and an assessment of whether the quantities of dangerous goods and combustible liquids stored at a facility exceed the prescribed quantities set out in Schedules 1 or 2 of the *Dangerous Goods Safety Management Regulation* 2001. These schedules set out the prescribed quantities for Dangerous Goods Locations (DGL), Large Dangerous Goods Locations (Large DGL) and Major Hazard Facilities (MHF).

6.1 Dangerous Goods Safety Management Act and Regulation

The *Dangerous Goods Safety Management* (DGSM) *Act* 2001 was developed by the Department of Emergency Services' Chemical Hazards and Emergency Management (CHEM) Services in consultation with stakeholders from industry, State Government departments, the Local Government Association of Queensland and community groups.

The overall objective of the DGSM Act is to protect people, property and the environment from harm caused by hazardous materials, particularly dangerous goods (CHEM Services 2001). The dangerous goods classes are discussed in Section 6.1.2.

The requirements of the DGSM legislation increase as the quantity of dangerous goods stored at any premises exceeds specified amounts. Premises are classified into one of four categories as the quantity of dangerous goods or hazardous materials increases, namely:

- Small quantities – minor storage workplaces (a minor storage workplace refers to 'a workplace that is not a major hazard facility or a dangerous goods location, where stated dangerous goods or combustible liquids are stored or handled');
- Medium quantities – dangerous goods locations (DGLs);
- Large quantities – large dangerous goods locations (Large DGLs); and
- Very large quantities – major hazard facilities (MHFs).

The threshold quantities for DGLs, Large DGLs and MHFs are detailed in Schedules 1 and 2 of the DGSM Regulation. The legislation then describes general safety obligations for everyone involved with the storage or handling of dangerous goods, as well as detailed obligations for each of the four dangerous goods categories. The classification of premises under the DGSM legislation is described in Section 6.3 and applied to the Northeast Business Park in Section 6.4.

6.2 Dangerous Goods Classification

Dangerous goods are divided into nine classes based on their hazardous properties and according to the most significant risk presented by the goods. There are nine classes (numbered 1 – 9). A summary of these classes is provided in Table 6.

When specific Dangerous Goods have more than one significant hazard, they are assigned a Class on the basis of the most significant hazard, and are assigned one or more subsidiary risks ('sub-risks') according to the other hazards.

Fire risk dangerous goods are dangerous goods of Class or sub-risk 2.1, 3, 4.1, 4.2, 4.3, 5.1 or 5.2. These materials may contribute to the risk of fire either by adding to the fuel load or by increasing the ease and rate of combustion.

Table 6: Dangerous Goods Classes

Class	Dangerous Good	Description
1	Explosives	Information on the classification of Class I Explosives is included in the Australian Explosives Code.
2.1	Flammable gas	Gases that can ignite in air on contact with a source of ignition.
2.2	Non-flammable gas	Gases that are non-flammable but may cause suffocation.
2.2 Sub-risk 5.1	Oxidising gases	Gases that are non-flammable and non-toxic but which contribute to combustion, such as oxygen and nitrous oxide.
2.3	Toxic gas	Gases likely to cause death or serious injury if inhaled.
3	Flammable liquid	Liquids, the vapours of which can ignite in air on contact with a source of ignition.
4.1	Flammable solid	Substances that are easily ignited by external sources, such as sparks and flames.
4.2	Spontaneously combustible	Substances likely to heat spontaneously and catch fire.
4.3	Dangerous when wet	Substances that produce dangerous quantities of flammable gas when in contact with water. Heat from this reaction may cause these gases to spontaneously ignite.
5.1	Oxidising agent	Substances that are not necessarily combustible by themselves, but which produce oxygen, which increases the risk and intensity of fire in other materials with which they may come into contact.
5.2	Organic peroxide	Organic substances containing bivalent oxygen that are thermally unstable and likely to react dangerously with other substances.
6.1	Toxic	Substances likely to cause death or serious injury if swallowed, inhaled or brought into contact with the skin.
6.2	Infectious	Substances known or likely to contain micro-organisms which can cause disease.
7	Radioactive	Material for which the specific activity exceeds 70kBq/kg.
8	Corrosive	Solid and liquid substances that can severely damage living tissue or attack other materials such as metals.
9	Miscellaneous	Substances and articles that present a danger, but are not covered by other classes.

Table 7 shows the typical classification of fuels as dangerous goods or combustible liquids. Flammable liquids produce vapours that can ignite in air on contact with a source of ignition. Combustible liquids are liquids that burn, but are more difficult to ignite than flammable liquids. They have a flashpoint greater than 60.5°C and are not classified as dangerous goods (whereas liquids with a lower flashpoint are dangerous goods Class 3 – flammable liquids).

Table 7: Fuel Classifications

Fuel type	Classification
Petrol including grades such as: • Unleaded ULP • Lead Replacement LRP • Super • Premium	Dangerous Good Class 3 Flammable Liquids Packing Group II (PG II) – medium danger
Kerosene	Dangerous Good Class 3 Flammable Liquids Packing Group II (PG II) – medium danger
Diesel fuel	Combustible Liquid C1 – flashpoint not greater than 150°C
Fuel oils and heating oils	Combustible Liquid C1 – flashpoint not greater than 150°C
Motor oil	Combustible Liquid C2 – flashpoint greater than 150°C
Waste oil	Combustible Liquid C2 – flashpoint greater than 150°C
LPG (Liquefied Petroleum Gas)	Dangerous Good Class 2.1 Flammable Gas (PG not applicable)

Source: http://www.emergency.qld.gov.au/chem/dangerousgoods/faqs_dg.asp#q5. Accessed June 2007.

6.3 Approach to Premises Classification

The approach is to determine the quantities of all stated dangerous goods and combustible liquids at the premises by class, type and packing group (PG). The actual quantities are compared with the prescribed quantities listed in the DGSM Regulation to determine which thresholds the premises exceed.

It should be noted that the AS 1940-2004: *Storage and Handling of Flammable and Combustible Liquids* minor storage exemption limits differ from the DGSM thresholds and should not be confused with them (CHEM Services 2005). Premises that store flammable or combustible liquids above the minor storage exemption of Table 2.1 AS 1940: must obtain a licence for this activity from their Local Government.

Also, premises that exceed the thresholds for Environmentally Relevant Activities (ERAs) may need an approval or licence from their Local Government or the Environmental Protection Agency.

CHEM Services (2005) provides detailed guidance for classification, particularly in cases involving a range of classes, types and PGs in packages (or small quantities). The thresholds for MHFs and DGLs are provided in the DGSM Regulation 2001.

6.4 Application of Premises Classification

Information on the quantities of dangerous goods or combustible liquids to be stored on the site was available for the marina development. In this case it is proposed to store diesel and unleaded petrol in underground fuel tanks. Table 8 shows the required information for the storage of fuel as part of the marina development and provides the template for each new activity within the development.

Table 8: Indicative Inventory of Dangerous Goods and Combustible Liquids at the Premises

Product Name	Proper Shipping Name (if DG)	UN Number (if DG)	Class/Type (note 1)	PG (note 2)	Quantity (kg or L)
Unleaded petrol	Motor spirit	1203	Class 3 Flammable Liquids	PGII medium danger	20 000
Diesel fuel	Diesel fuel N.O.S	1202	Combustible Liquid C1 (flashpoint not greater than 150°C)	na	55 000

Note 1: If DG, insert class or sub-class;
If cryogenic, aerosol or GTDTBT (goods too dangerous to be transported), insert that word
If combustible liquid, insert C1 or C2.

Note 2: PG = Packing Group. Applies to DG only.

The quantity of diesel to be stored at the marina is below the threshold quantity for a large dangerous goods location of 100 000 litres. The quantity of unleaded petrol to be stored at the marina however exceeds the quantity for a large dangerous goods location of 2500 litres but does not exceed the prescribed quantity for a Major Hazard Facility (50 000 tonnes). Therefore, the marina development is classified as a large dangerous goods location (LDGL).

There was no available information on the quantities of other dangerous goods or combustible liquids to be stored on site. Inventories of each activity would need to be carried out as the development progresses. It is likely however that marine and other industrial activities will store and use the following dangerous goods:

- Solvents;
- Engine oil;
- Fuel;
- Engine coolants;
- Paints;
- Anti-fouling paints;
- Fibreglass resins;
- Acids and alkalis; and
- Pesticides (e.g. golf course).

6.5 Transportation of Dangerous Goods

Fuel will be transported to the site by an approved road tanker, which would comply with the Australian Code for the Transportation of Dangerous Goods by Road and Rail. It is expected that diesel will comprise 73% of deliveries unleaded petrol (ULP) comprising the remainder (based on storage quantities). It is estimated that there will be one tanker fuel delivery per month with the exception of public holiday times, when the number of deliveries may increase to two per month.

Tankers would enter the NEBP site by the Buchanan Road/Bruce Highway interchange. Buchanan Road currently serves a function of carrying traffic between the Bruce Highway and Morayfield Road. It also serves the growing number of residential lots to the west of the Bruce Highway. East of the Bruce Highway, Nolan Drive and Trafalgar Road serve Buchanan Road with low volumes of traffic from a reasonably undeveloped/low density area. An assessment of the increase in light and heavy vehicle traffic is provided by Cardno Eppell Olsen (2007) *Northeast Business Park – Preliminary Report*.

The design intent for the internal road network is to direct most traffic to the Buchanan Road intersection, limiting the extent of traffic using the local roads to the south of the site and preventing heavy vehicles from using the local network (pmm Group 2006 – Initial Advice Statement).

The Bruce Highway is a National Highway under the control of the Department of Main Roads. Currently, the highway consists of a divided carriageway with two lanes of traffic in each direction. It is understood that current planning proposes progressive upgrading from four to eight lanes (Cardno Eppell Olsen 2007).

7. HAZARD AND RISK ASSESSMENT METHODOLOGY

The hazard and risk assessment methodology used for the Northeast Business Park development was based on AS/NZS 4360:2004 *Risk Management.* The methodology is a multi-staged process, involving:

1. Context establishment;
2. Hazard identification;
3. Consequence analysis;
4. Frequency or likelihood analysis;
5. Risk evaluation; and
6. Risk treatment.

Figure 3 presents a flowchart of this assessment process.

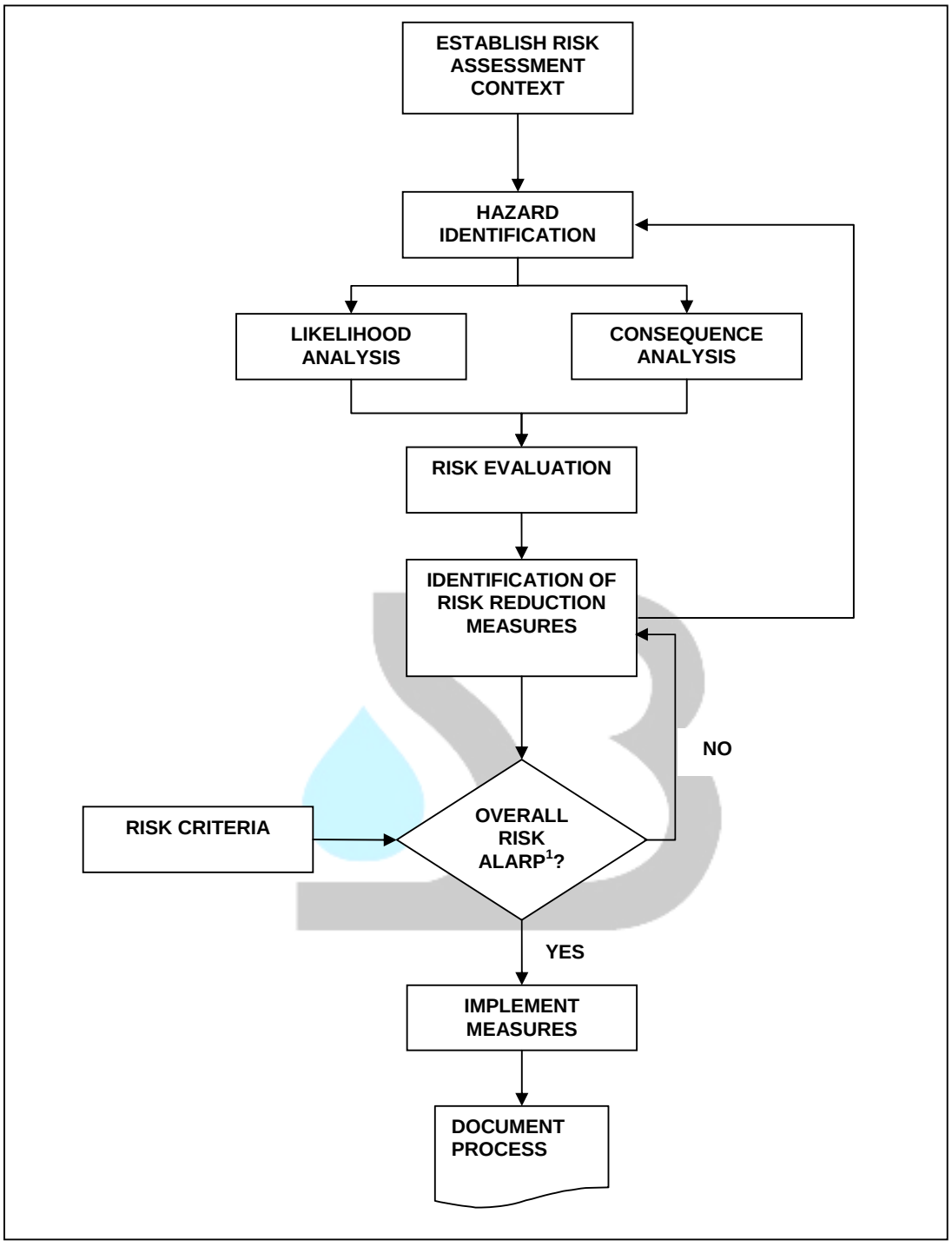

Figure 3: Hazard and Risk Assessment Process

[1] ALARP = As Low as Reasonably Possible

7.1 Context Establishment

Establishing the context is concerned with understanding the background of the organisation and its risk, scoping the risk management activities being undertaken and developing a structure for risk management. In this report, this step is needed to:

- Specify the main scope and objectives for risk management, boundary conditions and the outcomes required;
- Identify a set of consequence criteria against which the risks will be measured; and
- Define a set of key elements for structuring the risk identification and assessment process.

7.2 Hazard Identification

Hazard analysis is the process of identifying major hazards to determine the types of incidents that can occur. The breakdown in system elements (e.g. plant components such as storage vessels) or the events (e.g. overfilling of a tank) that can lead to hazardous conditions that may result in fire, explosion or release of toxic substances are identified.

A hazard identification analysis has been applied to the NEBP development to systematically consider hazards that may result from the proposed construction stages and operational activities. These activities have been described in Section 6. The nature and quantities of hazardous materials handled, storage requirements and the site structure plan are important factors that also need to be evaluated.

The hazard analysis was carried out using a Word Diagram. The objectives of a hazard identification word diagram are to:

1. Identify hazards associated with natural and human external effects and influences;
2. Provide a framework for conservative risk assessment in the absence of detailed project information; and
3. Gain an understanding of what hazards exist, the range of accidents these hazards could lead to and what outcomes these accidents have the potential of causing.

At this stage of the project development, the hazard identification (and risk assessment) is intended to be conservative and qualitative. More detailed techniques may by used to analyse those hazards identified as having high risk and hazards identified as having low risk generally do not warrant detailed risk assessment.

7.3 Risk Analysis

Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur (AS/NZS 4360:2004). Consequences and likelihood are combined to produce a level of risk. Where no reliable data is available then subjective estimates are made about the occurrence of a particular outcome or event. The criteria used to classify consequences and likelihood are described in the following sections.

7.3.1 Consequence Scale

A consequence is an outcome or impact on a range of stakeholders and assets. Examples of consequences include fatality, injury or environmental damage. The consequence criteria used in this report are described in Table 9.

Table 9: Consequence Table

Level	Descriptor	Example Detailed Description
1	Insignificant	Health - No medical treatment required
		Environment - Insignificant impact or not detectable
2	Minor	Health – Reversible disability requiring hospitalisation
		Environment – Potentially harmful to local ecosystems with local impacts contained to the site
3	Moderate	Health – Moderate irreversible disability or impairment (<30%) to one or more persons
		Environment – Potentially harmful to regional ecosystems with local impacts primarily contained to on-site
4	Major	Health – Single fatality and/or severe irreversible disability (>30%) to one or more persons
		Environment – Potentially lethal to local ecosystem; predominantly local, but potential for off-site impacts
5	Catastrophic	Health – Multiple fatalities, or significant irreversible effects to >50 persons
		Environment – Potentially lethal to regional ecosystems or threatened species; widespread on-site and off-site impacts

Source: AS4360:2004 and NRMMC, EPHC and AHMC (2006).

7.3.2 Likelihood Scale

Likelihood is used as a general description of probability or frequency. It can be expressed qualitatively or quantitatively. The indicative frequencies of the likelihood levels uses in this report are shown in Table 10.

Table 10: Likelihood Table

Level	Descriptor	Detailed Description	Indicative Frequency
A	Almost certain	The event will occur on an annual basis	Once every year or more frequently
B	Likely	The event has occurred several times or more in similar developments	Once every three years
C	Possible	The event might occur once during the development	Once every ten years
D	Unlikely	The event does occur somewhere from time to time	Once every thirty years
E	Rare	Heard of something like this occurring elsewhere	Once every 100 years

Source: AS4360:2004

7.3.3 Level of Risk

The magnitude of the consequences of an event, should it occur, and the likelihood of the event and its associated consequences, are assessed in the context of the effectiveness of the existing strategies and controls. An event may have multiple consequences and affect different objectives. Consequences and likelihood are combined to produce a level of risk (HB 436:2004).

Consequences and likelihood may be estimated using statistical analysis and calculations. Where no reliable or relevant past data is available then subjective estimates may be made. This is the approach used in this report, which categories the level of risk as low, medium, high or extreme (see Table 11).

Table 11: Risk Characterisation Matrix

Likelihood	Consequences				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
A (Almost certain)	Medium	High	High	Extreme	Extreme
B (Likely)	Medium	Medium	High	High	Extreme
C (Possible)	Low	Medium	High	High	High
D (Unlikely)	Low	Low	Medium	Medium	High
E (Rare)	Low	Low	Medium	Medium	High

Source: AS4360:2004

7.4 Risk Evaluation

Risk evaluation involves comparing the level of risk found during the analysis process with the risk criteria established when the context was considered. Risk evaluation therefore uses the risk levels to determine:

- Whether a risk needs treatment;
- Whether an activity should be undertaken; or
- Priorities for treatment (HB 436:2004).

In this case, the different levels of risk determined by the risk characterisation matrix act as risk criteria. In other cases, where the risk levels are quantified, then quantitative risk criteria such as provided by NSW Hazardous Industry Guidelines may be applied.

7.5 Risk Treatment

Risk treatment involves identifying the range of options for treating risks, assessing these options and the preparation and implementation of treatment plans (HB 436:2004). The purpose of treatment plans is to document how the chosen options will be implemented. The treatment plans should include:

- Proposed actions;
- Resource requirements;
- Responsibilities;
- Timing;
- Performance measures, and
- Reporting and monitoring requirements.

Note: standard preventative measures are described in the hazard identification word diagrams in Section 9. Risk treatment therefore ensures these measures are incorporated in treatment plans. Additional risk treatment measures may also be implemented depending on the outcomes of the analysis.

8. CONTEXT OF THE HAZARD AND RISK ANALYSIS

This analysis qualitatively evaluates the potential hazards and risks associated with the NEBP development during the construction phase and operational phase (for each of the land use activities described in Section 5). This analysis has been prepared as part of the Environmental Impact Statement for this development.

The risks associated with the supply of power and water has been included in the assessment. Specifically, this refers to the construction of a zone substation and the supply and use of recycled water from the South Caboolture WWTP.

Detailed information about the site activities was unavailable at the time of this report and therefore full dangerous goods inventories could not be prepared. Only the quantities of fuels to be stored at the marina have been fully evaluated. On this basis of these quantities, the marina development is classified as a Large Dangerous Goods Location (LDGL).

This assessment considers the environmental risks to the Caboolture River and tributaries, which include important wetlands and a designated fish habitat area (see Section 3.5). It does not include impacts on the Moreton Bay Marine Park, except where the park extends into the Caboolture River. The site is located approximately 8km from the river mouth.

The hazards and risks associated with releases to land are considered to be fire or release of vapours/dusts (public health impacts), or stormwater contamination (i.e. environment impacts on the Caboolture River). Air releases such as smoke and fumes from a fuel or chemical fire will primarily impact on public health although deposition of particulates may cause environmental impacts. In addition, firefighting water may contaminate stormwater drains or tributaries (and finally the Caboolture River) if uncontained during emergency response procedures.

The nearest existing residential settlements are the township of Caboolture (the town centre is located approximately 4.5km to the west of the site) and the suburb of Beachmere (located approximately 6km to the northeast on Deception Bay). Rural residential allotments are also located to the south and west of the site.

The indicative development phases of the site have been described in Section 4.1, Table 3. A large portion of the development should be constructed by 2011 (i.e. approximately four years). By this stage, the industrial and marine industry (including marina) precincts should be operating. The temporal boundary of this analysis therefore is five years maximum. It is expected that individual risk assessments may need to be prepared prior to development

approval for dangerous goods locations or other hazardous activity. In addition, there is insufficient information to include any decommissioning phases in this risk assessment because the life span of individual precincts at this stage of the development is unknown.

The risk criteria for this assessment are detailed in Table 12 below.

Table 12: Qualitative Risk Categories and Action Priorities

Assessment of Risk	Priority for Action
Low	Schedule for action after other risks.
Medium	Further improvement required. Proposed risk treatment measures reviewed in consultation with appropriate persons.
High	Immediate action required. Detailed risk analysis and management plan for specific activity or event prepared in consultation with appropriate persons.
Extreme	Suitability of proposed land use reviewed. Quantitative risk analysis or HAZOP prepared in consultation with appropriate persons.

9. HAZARD IDENTIFICATION

9.1 Hazards during Construction Phase

To establish the marina it has been estimated that approximately 1,500,000m^3 of fill will be excavated. Dredging will also occur in the lower Caboolture River and at the mouth of the river. At the mouth of the river the excavation will enlarge an existing defined navigation channel to 3.4km long and 70m wide. Periodical maintenance dredging throughout the life of the marina will need to occur in the marina basin and in the Caboolture River navigation channel. The amount of fill to be removed during the periodical maintenance dredging is unknown.

Dredging to establish the marina is referred to as capital dredging. Capital and maintenance dredging is an environmentally relevant activity (ERA) under the *Environmental Protection Act 1994*. Such an activity requires a dredging management plan to be in place prior to the ERA being approved. Schedule 1 of the accompanying regulation classifies ERA 19 categories as:

Dredging material from the bed of any waters (other than dredging by a port authority of material which a royalty or similar charge is not payable) using plant or equipment having a design capacity of:

1. not more than 5000 tonnes/year;
2. ≥ 5000t and ≤ 100 000 tonnes/year; or
3. > 100 000 tonnes/year.

Therefore the construction dredging will be considered an ERA 19(c). The quantities of material to be excavated as part of maintenance dredging are unknown at this stage.

It is likely that the construction (capital) dredging will use a barge mounted cutter suction dredge (CSD). This equipment has suction pipes at the cutter head which remove and transport the slurry to the disposal location. Where the equipment is working efficiently turbidity is uncommon in normal operations. Environmentally the slurry disposal point can cause concern because of sediment runoff. This is particularly important when the spoil consists of silt or clays. Maintenance dredging will use either a smaller CSD or trailing suction hopper dredges (TSHD). TSHD are a self propelled ship with a hopper and 1 or suction pipes. The captured sediment slurry is pumped to land.

The marina will be located outside the Fish Habitat Area. Dredging of the navigation channel is within a defined navigation channel, which is excluded from the Fish Habitat Area. The majority of hazards associated with dredging are related to aquatic environmental impacts, such as siltation of the water column, release of heavy metals, nutrients, pesticides (or other sediment accumulated toxins) and acid sulphate soil products into the water column. These impacts may be exacerbated during a flooding event.

Dredging is a hazard for major silt spills, breaches of construction ponding and/or bunds during high rainfall events or accidental discharges during operations in the Caboolture River. Other hazards that may occur during construction of the marina include oil or chemical spills or leaks into the tidal creeks and/or the Caboolture River, acidic runoff from acid sulphate soil stockpiles and fire during construction. Firewater containment from a major fire, either during construction or operational phases is also an issue. The potential hazardous events associated with dredging are provided in Table 13.

Other potential hazards during the construction phase include dust generation and soil erosion following clearing of vegetation and acid runoff from excavation of acid sulphate soils. It is expected that these environmental management issues have been addressed in the relevant sections of the EIS and they have not been included in this assessment at this stage.

Table 13: Hazard Identification Word Diagram – Dredging

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Dredging – Caboolture River mouth, navigation channel and marina basin	Breakage/burst of suction hose/s	Release of sediment slurry to watercourse: • Increased turbidity • Acid sulphate release and fish kill • Release of heavy metals to the water column and toxicity effects • Accumulation of heavy metals in sediments • Release of nutrients to water column and algal bloom	Engineered sedimentation ponds and filter systems to treat slurry waters and runoff. Suction pipes and connections to be maintained in good working order. Dredging operator to have a dredging management plan in place to cover preventative measures and emergency response measures. All crew to be trained in implementation of emergency response measures. Dredging to occur preferably in winter when there is lesser likelihood of triggering algal release and when some aquatic biota are more resistant to temporary siltation, e.g. sea grass beds. Monitoring for turbidity, pH and nutrient changes.
		Release of sediment slurry to watercourse: • Navigation hazard to other watercourse users	Barge operator to have onboard marine navigation hazard flags that can be placed around the extent of the released sediment deposition area. This is important if the settled spoil reduces the navigation channel depth less than what was previously available.
	Failure of land disposal sluices and bunds (e.g. under flood conditions)	Release of sediment slurry to land and water: • Siltation of watercourse • Water quality impacts • Acute impacts to aquatic organisms (including benthic organisms)	Bunds and sluices of adequate capacity to cope with expected slurry volume and sediment type (e.g. sand, silt or clay).
	Barge collision or capsize	Release of fuel, oils or silt to aquatic environment, including mangroves and salt marsh.	Dredging barge to be equipped with an aquatic spill kit which contains floating bunds to capture fuel/oil releases.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
			Spill kit also to be available at the sediment slurry release point.
	Extreme weather	Equipment damage and release of fuels, oils or silt to the aquatic environment	Weather forecasts to be monitored. Safe mooring of dredge equipment.

9.2 Hazards Associated with Community Infrastructure

Infrastructure hazards are primarily related to roads, sewerage, (e.g. pipes and pumps), stormwater drainage, electrical systems, telecommunications networks, and also natural gas pipelines. Specific hazards within the scope of this study are a 33kV zone substation (discussed in further detail in Section 9.2.1), natural gas pipelines (under investigation only) and sewage pump stations. Substations may experience explosion or fire from transformers. Gas pipeline leaks and rupture may also result in explosion or fire. Sewage overflows (e.g. flooding events) and localised gas releases are common hazards. These hazards are identified in Table 14.

9.2.1 Zone Substation

An Energex modular 33kV zone substation will be required to supply the anticipated ultimate electrical load of the NEBP. Lectel (2007) provides an assessment of the environmental impacts of the zone substation. A zone substation is a site incorporating equipment that provides control and voltage transformation from the sub-transmission or transmission network to the distribution network.

Substations generally contain one or more transformers, and have switching, protection and control equipment. The input for a zone substation is typically at least two transmission or subtransmission lines. The proposed distribution voltage in this case is 33kV.

Energy Australia has reported three cases of explosion and fire in zone substations in NSW between 1999 and 2003. In two cases, the cause of the explosion was associated with the failure of the link box on a transformer. In December 1999, a link box on a transformer failed, releasing and igniting transformer oil (Energy Australia 2000). In November 2000, the electrical insulation in a link box failed causing an explosion and fire. The incident in 2003 was reported as a bushing failure but further detail was unavailable.

The hazard identification shown in Table 14 is based on two reports prepared by Energy Australia in 2000.

Table 14: Hazard Identification Word Diagram – Community Infrastructure

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Zone substation to supply anticipated electrical load to NEBP	Link box failure Bushing failure	Fire and explosion: • Damage to infrastructure • Loss of power • Release of transformer oil to land • Discharge of oil from the site i.e. failure of oil containment system	Installation of radiant heat and blast barriers between transformers. Fire rated steel roof. Oil/water separators to achieve required discharge limits. Planned maintenance routine including condition of barrier boards and testing of cable-link boxes. Additional fire mitigation measures: • Sprinklers and deluge systems; • Installation of fire barriers; • Removal of flammable material; • Fire stopping of openings; • Oil spread stopping; and • Acceleration of fault clearing times.
Gas pipelines (feasibility still under consideration)	Poor quality control in pipeline fabrication and laying Damage where pipeline crosses obstacles (e.g. stormwater drain) Deviations from normal operating conditions (thermal stress, digging incident, corrosion, subsidence)	Pipeline leak or rupture: • Flash or jet fire • Unconfined vapour cloud explosion	• AS 2855. *Pipelines – Gas and Liquid Petroleum* • Quality control in pipe fabrication and laying • Adequate depth and cover • Clearly marked pipeline route • Corrosion protection • Emergency Response Plan
Sewerage system	Damage to pipeline Flooding	Sewage release and human health impacts Sewage overflow and human health impacts	Planned maintenance and inspection routine. Emergency Response Plan.

9.3 Hazards Associated With Proposed Activities

Potential hazardous events that are likely to be associated with the proposed business park, industrial, shipyard, marina and retail activities are:

- Fire (flammable and combustible goods and materials);
- Firewater runoff;
- Leaks and spills of dangerous goods such as fuels, solvent, liquid chemical formulations and wastewater; and
- Uncontrolled releases of toxic gases, vapours or dusts.

The hazard identification word diagrams for these activities are shown in Tables 15 to 19.

Table 15: Hazard Identification Word Diagram – Business Park

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Business Park with dangerous goods storage	Loss of containment and/or ignition of flammable and combustible substances	Fire and/or explosion: Injuries or fatalities	All businesses that store dangerous goods onsite must display HAZMAT signage outside the building, showing the location, quantity and type of dangerous goods. All businesses must maintain a Hazardous Substances register. Each dangerous goods site to have appropriate spill response kits available and staff trained in their use. Spill response kits are to include fire extinguishers of the number and type required for each business. All premises to have fire alarms installed. All businesses to have emergency evacuation meeting point, with all staff trained on fire response.
		Fire and/or explosion: Damage to property	Businesses that store dangerous goods are to be separated from adjoining businesses by a rated firewall. Each business to have the appropriate type and number of fire extinguishers onsite. Compliance with storage of dangerous goods legislation and practices. Incompatible substances to be separated, as per AS1940 and the Australian Dangerous Goods Code. Where appropriate dangerous goods to be bunded onsite.
	Accidental release of toxic fumes to air	Injuries or fatalities Nuisance	Storage of volatile hazardous substances or gases in approved cabinets or areas that are protected from heat, light and physical impacts (e.g. damage or puncture). Emergency evacuation procedures.
	Firewaters, leaks and fuel and chemical spills	Stormwater contamination Soil contamination	On-site bunding to contain accidental liquid releases, including fire fighting water, to prevent discharges to tidal waters and wetlands.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
			Containment berms across stormwater drainage lines to prevent contaminated fire fighting water entering the stormwater system. Provision of chemical spill kits and training of staff in the use of these kits.
	Gas leak	Fire and/or explosion: Injuries or fatalities	Pipeline leak detection equipment to be attached to all gaseous pipelines. Each business that stores gas products is to have respiratory protection available in the event of a gas leak.
Business Park without dangerous goods storage	Fire	Injuries/fatalities	All premises to have the minimum number of fire alarms installed. All commercial, retail and hospitality premises to have fire extinguishers available and staff trained in their use. All businesses to have emergency evacuation meeting point, with all staff trained on fire response.
		Damage to property	All commercial, retail and hospitality premises to have fire extinguishers available and staff trained in their use.
Recycled water use for industrial process and/or washdown	WWTP process failure	Effects on plumbing such as corrosion, build-up of scale or clogging Human exposure to contaminated water	Monitoring of reuse water quality including microbiological quality. Contaminated water warnings for development users. Use of back-up water supplies for Business Park.
	Pipeline failure	Human and wildlife exposure Release to tidal waters and wetlands	Controls to notify loss of pressure in pipeline. Regular inspections.
	Failure of dual reticulation system	Human ingestion of recycled water Potential for acute illness depending on microbiological quality	Immediate shut-down on system. Implementation of contingency plan including back-up water supplies.

Table 16: Hazard Identification Word Diagram – Marine Industry and Shipyard

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Shipyard • Ship building • Boat maintaining • Boat repairing	Ignition of flammable substances (e.g. solvents) Potential ignition sources include welding.	Fire and release of smoke and gases: • Injury or fatality • Damage to property • Release of contaminated firewater	Flammable substances stored in accordance with AS 1940. Maintenance of a Hazardous Substances Register and appropriate signage for Emergency Services. Emergency Response Plan including access for Emergency Services and supply of fire fighting water.
	Fuel and chemical spills, including waste products (e.g. contaminated washdown waters)	• Contamination of stormwater, waterways (Caboolture River and tributaries) and sediments. • Toxic effects on aquatic organisms.	Hazardous substances stored in accordance with Dangerous Goods Safety Management (DGSM) legislation and guidelines. Provision of chemical spill kits and training in their use.
	Release of contaminated fire fighting waters	• Contamination of stormwater, waterways (Caboolture River and tributaries) and sediments. • Toxic effects on aquatic organisms.	Emergency Response Plan to address containment of contaminated fire fighting water.
Dry stack boat store	Failure of boat lift forklift or lift station	Injury to people and/or damage to property	Restricted access to authorised personnel only. Trained personnel operating machinery. Maintenance of equipment in accordance with manufacturer's specifications. Standard workplace procedures including Emergency Response Plan.
		Release of fuel to aquatic environment	Fuel spill response plan including MSDS for fuel type and provision of spill kit.
	Boat storage - ignition of flammable substances (i.e. petrol not diesel)	Fire and/or explosion • Heat radiation or blast effects • Release of smoke particles and toxic gases	Preparation of a Fire Safety Study. Adequate buffer distance or protective barrier between storage location and nearest residences.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
		• Aquatic pollution via fire fighting water and stormwater system • Possible propagation to other buildings	Implementation of site emergency procedures in accordance with Queensland Department of Emergency Services guidelines. Emergency plan includes prevention of fire fighting waters from entering stormwater system. Stormwater drain covers. Building constructed of suitably fire resistant materials.

Table 17: Hazard Identification Word Diagram - Marina

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Boat Mooring	Onboard fire	Injury to people onboard	An emergency services phone can be installed on the marina deck that connects directly to the emergency services help desk.
	Fire propagation	Damage to property (adjacent boats) and marina infrastructure	The marina emergency response plan to include provision for fire fighting. Fire extinguishers and hoses to be situated on the marina deck, accessible to marina users. Approved on site fire water containment system and emergency pressure pumps for marina. Each boat to have an onboard fire extinguisher.
	Transfer of boat 'black water' (onboard toilet) waste to the marina's holding system	Release of raw sewage (small quantities) to the aquatic environment • Water pollution • Odour • Aesthetics	Marina black water pump out transfer systems (e.g. fittings, hoses and pump) to be kept in good working order. Containment and treatment of contaminated water within marina.
Fuel Dock			
Bulk fuel deliveries to site, including transfer to bulk storage tanks	Tanker overturn within NEBP	Spill to ground and injury to people • Fire • Heat radiation • Smoke emissions Spill to ground causing soil contamination	Tankers to access the site via the Bruce Highway then via route chosen to reduce risks to residences. All tankers to have onboard a land spill kit and fire extinguishers for the fuel type they are carrying. Tanker drivers to observe road traffic signage and stick to speed limits.
	Fuel transfer from tanker to storage tanks	Spill to ground and pool fire • Heat radiation • Smoke emissions	Fill lines are automatically earth on connection to tank fill point. Tanker has emergency shut-down valves. Fill point incorporates a spill containment system that drains into the tank.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
			All tanks have overfill protection, as per AS1940. Fire extinguishers are located close to the fill point and operators are trained in their use. Fill lines have vapour recovery for Class 3 PGII fuels (ULP).
	Fuel spill from land bowsers Underground Storage Tank failure	Vapour release and injury to people: • Fire	Tank integrity tests for underground tanks and pipes. Installation of fire protection systems as per AS 1940. All dispenser hoses to be fitted with dry couplings. Signage as per AS1940 for the exclusion of ignition sources at and near fill points. Emergency stop system to be located within close proximity of the bowsers. Access of fire fighting vehicles to fuel berths. Security against vandalism and unauthorised use. Design and implementation of preventative maintenance schedule. Underground piping should include access for operating, testing, maintenance, replacement or drainage. Any above ground storage tanks must be bunded to contain 110% of the volume of the tank.
		Spill to ground causing soil and stormwater contamination	Land and water spill kits available near the bowser, available to users. Dispensing area stormwater runoff to be directed to a separator sump.
	Fuel spill from floating bowsers	Release of fuel (contaminant) to aquatic environment • Water and sediment pollution • Toxicity effects on estuarine	Dispensing units to be constructed as per AS1940, section 7.5. All fuel dispenser equipment to be kept in good working order. Where equipment is faulty it is to be fixed as soon as practicable and signage placed on the equipment to ensure it is not used while

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
		flora & fauna	awaiting repair. Fuel spill kits to be readily available at the fuel wharf. Bowser pumps to have auto lock off and dry break couplings on all fuel delivery hoses as per AS1940. Bowser nozzles to have auto shut nozzles to prevent tank overfilling. Floating bowsers to be installed with stainless steel bollards to prevent boat collision & damage. Impact shear valves on floating bowser base that immediately stops the pump in the event of a vessel collision (AS1940). Containment within marina to allow clean up and remediation work.
		Vapour explosion: • Odour • Toxic vapours • Fire and smoke	Boat operators to ensure they have vented the fuel within the boat tank prior to starting the engine after fuelling their boat. Evacuation procedures for marina, retail and residential areas.
		Fire: • Damage to marina infrastructure • Damage to fuel supply pipelines	Signage at the bowser location to exclude all naked flames and other ignition points at the bowser. Fire extinguishers to be located near the floating bowsers. Extinguishers should be foam, dry powder or water fog – not water to be effective in fuel fire control. Pipelines fitted with tank isolators that automatically prevent burning fuel travelling up the pipeline to the tank. Access of fire fighting vehicles to fuel berth. Security against vandalism and unauthorised use.
Boat Movements • Within the marina • Navigation channel	Collision with marina infrastructure/boats	Injury to persons	Persons in control of vessels to be experienced and licensed to operate the class of vessel for which they are controlling. An emergency services phone can be installed on the marina deck that connects directly to the emergency services help desk.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
		Impact damage to marina infrastructure and property	Persons in control of vessels to be experienced and licensed to operate the class of vessel for which they are controlling. Navigation signs to be clearly visible in all weather conditions. An after hours marina emergency contact to be available in the event of extensive damage to marina infrastructure.
		Fire • Damage to marina infrastructure	The marina emergency response plan to include provision for fire fighting. Fire extinguishers to be situated on the marina deck, accessible to marina users. Each boat to have an onboard fire extinguisher.
		Release of fuel and other hazardous substances (contaminant) to aquatic environment • Water pollution • Toxicity effects on aquatic flora & fauna	The marina is to have aquatic spill kits available for marina users. The spill kit will include floating bunds to contain surface floating contaminants (e.g. fuel). Each boat is to have aquatic spill kits onboard suitable for the type of contaminant they carry, i.e. fuel or other hazardous substances.
Marina Lock	• Mechanical and electrical failure • Damage and collision • Jamming	• Escape of contaminated waters from marina • Influx of contaminated waters from an external event e.g. oil spill, algal bloom, poorly treated sewage or major silt plume	Back up equipment. Emergency spill boom or gate mechanism.
Marina berths	Extreme weather event	• Property damage and release of contaminants	The marina lock should protect the watercraft from extreme weather events causing tidal surges or flooding. The marina should be designed so to ensure secure and protected berths. The marina should prepare a plan for procedures to follow in the event of a severe storm warning (e.g. tie down procedures).

Table 18: Hazard Identification Word Diagram – Residential, Commercial, Retail and Education

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Normal operation	Fire • Accidental • Deliberately started (e.g. schools)	Injury to people • Heat radiation • Vapours and smoke	Installation of fire and smoke alarms in accordance with Department of Emergency Services' guidelines. Emergency Response and Evacuation Plan prepared in consultation with Queensland Department of Emergency Services and Rural Fire Brigade. Emergency Response Plan to address all types of residential developments including multi-storey apartments. All residential, commercial, retail and education buildings should be easily accessed by Emergency Services.
		Damage to property including propagation to other buildings	Emergency Response Plan. Fire rated walls between adjoining buildings to minimise the risk of propagation.
	Release of firewater	Release of toxic chemicals to Caboolture River and tributaries	Emergency Response Plan to address containment of fire waters, including prevention from entering the stormwater system.
Water supply			
Dual reticulation • Toilet flushing • Garden watering • Vehicle washing	WWTP failure	Residential use of contaminated water Plumbing damage and/or blockages	Continual monitoring of re-use waters. Implementation of contingency plan if water does not meet required criteria. Shut-down of system at WWTP and development site e.g. buffer tanks).
	Major pipeline failure	Overflow or runoff into stormwater drain and estuarine environment	Stormwater drains to tidal waters and wetland to be contained and water quality monitored. Contaminated water warnings.

Table 19: Hazard Identification Word Diagram – Golf Course

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Recycled water for landscape irrigation	Failure of WWTP	Microbiological contamination • Human and wildlife exposure and illness Nutrient overload • Landscape vegetation impacts • Wildlife impacts • Algal blooms in river Toxic chemical overload • Landscape vegetation impacts • Toxicity to terrestrial organisms • Toxicity to aquatic organisms • Human health impacts	Monitor quality of recycled water. Preparation of a management plan including contingency plan if water does not meet required criteria. Control of stormwater runoff to prevent input of nutrients to estuarine environment.
	Pipe failures	Human and wildlife exposure	Emergency Management Plan.
	Humans drinking recycled water	Human exposure Potential for acute illness depending on microbiological quality	Restricted access to water supply. Recycled water taps clearly labelled.
Fertiliser use on golf course	Release of fertilisers to stormwater system and aquatic environment	Nutrient overload • Landscape vegetation impacts • Wildlife impacts • Algal blooms in river	Reduced use of fertilisers. Use of designed wetlands and ponding in drainage from golf course. Stormwater management plan to prevent nutrients entering the Caboolture River and tributaries.
Pesticide use on golf course	Release of pesticides to stormwater system and aquatic environment	Toxic chemical overload • Landscape vegetation impacts • Toxicity to terrestrial organisms • Toxicity to aquatic organisms • Human health impacts	Pesticide use register including Material Safety Data Sheets (MSDS) Restricted use of pesticides. Alternative pest control methods e.g. Integrated Pest Management approaches.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
			Use of designed wetlands and ponding (level of contamination in these wetlands would need to be monitored). Stormwater management plan to prevent pesticide contamination of Caboolture River and tributaries.

9.4 Hazards Associated With Natural Events

The hazards associated with flooding, bushfire and vector-borne diseases are identified in Table 20, Table 21 and Table 22.

Table 20: Hazard Identification Word Diagram - Flooding

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Construction phase	Failure of sediment bunding	Large quantities of sediment released to Caboolture River and/or tributaries	Soil and Erosion control plan to include flood events.
	Inundation of property by floodwaters	Destruction of property and equipment	Early implementation of flood mitigation measures during construction phase.
Residential, industrial, commercial, retail, education	Inundation of property by floodwaters	Release of toxic substances	Stormwater management plans for land uses to include diversion from hazardous substance storage areas. Hazardous substances to be stored in accordance with relevant Australian Standards (e.g. AS 1940, AS 3780, AS 4326 and AS/NZS 3833). Emergency Response Plan to include flood events.
		Destruction of property and equipment	Flood mitigation measures to be incorporated in site design and management plan. Adequate stormwater management system.
		Pooling of stagnant water • Increased incident of water-borne disease or disease vectors (e.g. Ross River virus)	Adequate stormwater management system. Public warning and/or notification system.
	Sewage overflow or damage to sewerage system	Sewage release • Increased incidence of water-borne disease	Site management plans for WWTP to include mitigation measures for a flood event. Stormwater management plan for WWTP to include diversion of flood waters from sewage ponds. On-site flood mitigation measures to include consideration of sewage release during a flood event. Emergency Response Plan to include notification procedures in the event of sewage release or increased incidence of water-borne diseases.

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Marina	Pontoon damage	Property and boat damage or destruction	Marina Lock release system for waters above defined level. Emergency evacuation procedures implemented by Marina Management.

Table 21: Hazard Identification Word Diagram – Bushfire

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Construction phase	Deliberately lit bushfire on site Fire propagation from bushfire started off-site	Impacts on construction workers: • Injury e.g. smoke inhalation or burns • Fatality	Fire response training and emergency evacuation plan. Supply of firefighting water. Establish fire breaks. Emergency Services able to access the site.
		Damage to or destruction of property and equipment Delays to construction timeline	Adequate insurance.
Residential, industrial, commercial, retail, education	Deliberately lit bushfire on site Fire propagation from bushfire started off-site	Impacts on residents and workers: • Injury e.g. smoke inhalation or burns • Fatality	Emergency Response Plan for each precinct. Emergency Evacuation Plan for each precinct. Supply of firefighting water. Establish fire breaks that: • Provide adequate set back between buildings and hazardous vegetation; and • Provide adequate road access for fire fighting/other emergency vehicles and safe evacuation.
		Damage to or destruction of property and equipment Ignition of flammable substances and on-site fire propagation	Emergency Response Plan. Flammable and combustible liquids stored in accordance with AS 1940.
Marina	Fire propagation	Injury or fatality of marina employees Ignition of flammable substances and fire propagation among water craft Destruction of marina infrastructure and private property	Emergency Response and Evacuation Plan. Adequate insurance.

Table 22: Hazard Identification Word Diagram – Vector-borne diseases

Function/Operation	Possible Initiating Events	Possible Consequences	Preventative/Protective Measures
Construction phase	Broken water main Accidental water release	Water stagnation and mosquito and/or midge breeding	Any water pooled water drained as soon as possible. Water should be disposed appropriately based on the source of the water.
	Excessive wet weather	Water stagnation and bacterial or viral growths	Stormwater management plan. Flood management plan.
Residential, industrial, commercial, retail, education	Mosquito breeding in natural estuarine habitat	Residents and employees impacted by mosquito-borne diseases such as Ross River and Barmah Forest viruses.	Monitoring of mosquito types and populations. Council spraying of mangrove areas as necessary. Use of low impact insecticides to minimise impacts on non-target species.
Marina	Mosquito breeding in natural estuarine habitat	Boat owners and marina employees impacted by mosquito-borne diseases such as Ross River and Barmah River viruses.	Monitoring of mosquito types and populations. Evaluation of habitat modification techniques to avoid direct spraying of insecticides over fish habitat areas and the marina. Use of low impact insecticides if necessary.
	Release of sewage from boats	Stagnation and concentration of pollutions from the marina facility and boats, including microbiological contamination.	Provision of sewage pump out facilities. Provision of adequate toilet blocks (toilets, wash basins, showers and sinks). Toilet blocks should be accessible by disabled persons. Pump out and public facilities should preferably be connected to a sewerage treatment system. Adequate flushing of marina to maintain the water quality of the marina basin and adjacent waterway. Fines for release of sewage to the marina basin.

10. LIKELIHOOD OF HAZARDOUS EVENTS

In this section, probability or frequency data for possible adverse events are reviewed to provide a basis for the qualitative analysis of risks from the events identified in the hazard identification section. The chance or possibility of these events occurring is reviewed in the context of process activities, equipment failure and accidents that may lead to adverse effects such as fire and release of toxic substances.

10.1 Probability of Events

10.1.1 Equipment Failure and Fire

The assessment of land use risks posed by the fuel storage and supply at the marina depends on the chance of frequency of adverse events occurring. In this case, the potential adverse events relate to the failure rates of equipment leading to the release of diesel or unleaded petrol, which are described in Table 23.

Table 23: Probability of Equipment Failure and Fire – Flammable and Combustible Substances

Item	Failure probability (per year per item)		Fire probability (per year per item)	
	per year per item	one failure per item	per year per item	one fire per item
Storage vessel	600×10^{-6}	1 in 1670 yrs	1000×10^{-6}	1 in 10 000 yrs
Bund	0.1×10^{-6}	1 in 10 000 000 yrs	10×10^{-6}	1 in 100 000 yrs
Pumps				
• Seal	5000×10^{-6}	1 in 200 yrs	50×10^{-6} (0.00005)	1 in 20 000 yrs
• Shaft	200×10^{-6}	1 in 5000 yrs	4×10^{-6}	1 in 250 000 yrs
• Casing	20×10^{-6}	1 in 50 000 yrs	1×10^{-6}	1 in 1 000 000 yrs
Pipeline	$6 – 12 \times 10^{-6}$	1 in 167 000 yrs 83 300 yrs	$0.20 – 0.50 \times 10^{-6}$	1 in 5 000 000 to 2 000 000 yrs
Road tanker	10×10^{-6}	1 in 10 000 yrs	2×10^{-6}	1 in 500 000 yrs

Source: Department of Environment and Planning, Sydney (1985)

10.1.2 Buildings and Fire

In most situations (ignoring bush fires), fire originates from human activities within the building or the malfunction of equipment placed within the building to provide a serviceable environment. This section provides incidence data for fires in buildings, such as factories and warehouses, where hazardous substances or dangerous goods may be stored.

The Fire Engineering Guidelines (Fire Code Reform Centre Limited 1996) provides data on the probability of fires starting in various types of occupancies. This data is recommended for use where detailed information is unavailable and is shown in Table 24.

Table 24: Overall Probability of Fire Starting in Various Types of Occupancies

Occupancy	Probability of starts per occupancy (starts/year)	Probability of one fire start
Industrial	4.4×10^{-2}	1 in 23 years
Storage	1.3×10^{-2}	1 in 77 years
Offices	6.2×10^{-3}	1 in 161 years
Assembly entertainment	1.2×10^{-1}	1 in 83 years
Assembly non-residential	2.0×10^{-2}	1 in 50 years
Hospitals	3.0×10^{-1}	1 in 3 years
Schools	4.0×10^{-2}	1 in 25 years
Dwellings	3.0×10^{-3}	1 in 330 years

The above rate of fire start values are comparable with figures quoted in the National Fire Safety Systems Codes for offices of $8.9 \times 10^{-6}/m^2$/annum (Fire Code Reform Centre Limited 1996). The incidence of fires for different office areas are shown in Table 25. If we assume an average office area of $1000m^2$, then the probability of a fire start using Table 24 is 1 in 161 years and using Table 25 is 1 in 110 years.

Table 25: Calculated Probability of Fire Starts in Factory Offices based on Area

Building area (m^2)	Probability of fire starts per year	Probability of one fire start
50	0.00045	1 in 2250 years
100	0.00089	1 in 1120 years
500	0.0045	1 in 225 years
1000	0.0089	1 in 110 years
1500	0.0134	1 in 75 years
2000	0.0178	1 in 56 years

This study provides an analysis of a fire start in an industrial building leading a fire of sufficient intensity to release of smoke or toxic fumes. The probability of a fire start in an industrial building is assumed to be 1 in 23 years (Table 24). The analysis further assumes the building contains hazardous substances and dangerous goods.

10.1.3 Flooding and Bushfire

There was no information available at the time of writing on the frequency of flooding at this site. However, the NEBP has been designed such that most of the development, with the exception of the marina, is located above the 1 in 100 (Q100) year flood level.

The Rural Fire Service and Queensland Fire and Rescue have produced bushfire risk maps based on the methodology described in State Planning Policy (SPP) 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*. The proposed NEBP site is located in a medium bushfire hazard area. This classification is based on hazard scores for vegetation communities, slope and aspect (i.e. exposure to direct sunlight or low humidity winds).

10.2 Incident Reporting

10.2.1 Zone Substations

Information on zone substation incidents reported by Energy Australia was provided in Section 9.2.1. Additional information was available from TransGrid (2005), who operate 82 substations in NSW. Transformer incidents given in their 2004/2005 Annual Report indicate that transformer explosion and fire could be expected in a substation at about 1-2% on a yearly basis, in the absence of better industry information. This rate refers to substation incidents and not individual transformers but indicates a higher expected chance of explosion and/or fire for a substation.

However, specific failure rate statistics on instrument transformers appear to be unavailable. TransGrid list 6147 units among their assets. The capacities of these units range from 11 kV to 500kV (3961 current transformers and 1478 capacitor voltage transformers). If a failure rate of 0.005 per transformer year is applied, this would be equivalent to 30 units. Across all of TransGrid's facilities throughout NSW, in any year, three or less units are expected to suffer fire depending upon oil or gas filled if a frequency of 1 in 10 failures is adopted.

10.2.2 Boating Accidents

The Maritime Safety Queensland website was researched for information on the type of incidents that have occurred in the past 10 years for the activities likely to be a part of the NEBP.

The majority of marine incidents were associated with activities occurring while vessels were traversing calm, clear and open water. Very few incidents were reported where the vessels were in the marina. The occasional collision has been known to happen when navigating a vessel into port. Sixty percent of all Queensland marine incidents occur in Brisbane or Gold Coast waters (Maritime Safety Queensland 2007).

In Queensland the majority of marine vessels registered are for recreational use (97%), with 2.8% registered as commercial fishing or commercial passenger vessels. The majority of incidents reported involved recreational vessels (Maritime Safety Queensland). Motorboats, sail boats and speedboats were the top three vessel types involved in incidents with 600-650 incidents occurring, on average, each year (2000-2005).

10.2.3 Mosquito-borne Diseases

The likelihood of contracting a mosquito-borne disease is related to the distance from mosquito and biting midge breeding sites. The pest problem and risk from mosquito-borne disease is increased if community areas are located within the range of mosquitoes and biting midges (Queensland Health 2002). The impact that mosquitoes and biting midges will have on the community at different distances is summarised in Table 26.

Table 26: Distance from Mosquito/Biting midge Breeding Sites and its Impact

Distance from breeding site	Risk from diseases	Pest impact	Control measures needed
Up to 1.5km	Very high	Intense from both mosquitoes and biting midges.	Regular monitoring and control measures for mosquitoes and biting midges at breeding sites and development sites.
>1.5 to 5km (without continuous corridor of dense vegetation between breeding site and populated areas)	Significant, especially at the lower distance of this range	Unaffected from most biting midges. Noticeable from mosquito species such as *Ochelerotatus vigilax, Verralina funereal, Culex sitiens, Cx annulirostris, Coquillettidia spp* and *Mansonia spp.*	Regular mosquito monitoring and control at breeding sites and development sites.
>5 – 10km	Moderate	Unlikely by brackish and fresh water mosquitoes and most biting midges. Discomfort by a moderate number of *Oc. Vigilax* adults.	Monitoring of mosquito population. Control may be required to minimise the risk of mosquito-borne disease.
>10 – 15km	Low	Not severe and sporadic. A small proportion of mosquitoes may be carried by wind into development sites.	Unlikely to be needed.

Source: Queensland Health (2002)

The Caboolture Shire Council also reports on the incidence of Ross River and Barmah Forest viruses on a monthly basis. The most recent monthly report was prepared in June 2007 and the results are summarised in Table 27. There appears to be an increase in Barmah Forest notifications compared to last years total.

Table 27: Ross River and Barmah Forest Notifications, 2007 and 2006

Type	2007 Notifications to date	2006 Total
Ross River notifications	33	87
Barmah Forest notifications	28	33

11. CONSEQUENCES OF HAZARDOUS EVENTS

11.1 Fires

The types of fires of greatest concern are pool fires, jet fires, flash fires and fireballs (DUAP 1997). Pool fires occur if a flammable or combustible liquid accumulates in a pool on the ground and is subsequently ignited. Jet fires occur when a flammable liquid or gas, under some degree of pressure, is ignited after release, resulting in a long stable flame. A flash fire occurs when a cloud of flammable gas mixed with air is ignited and fireballs can occur when large quantities of flammable gases are released violently and ignited, resulting in a rising ball of flame. The most likely scenario for the NEBP development is a pool fire from fuel spills or leaks or a building fire.

Fires can give rise to high levels of thermal radiation as well as the evolution of toxic combustion products or toxic fumes. Thermal radiation intensity is determined by factors such as the rate and efficiency of burning, the heat of combustion, the size and orientation of the flame and the fraction of radiation transmitted through the atmosphere (NSW DUAP 1997). The effects of heat radiation are shown in Table 28.

Table 28: Effects of Heat Radiation

Heat Radiation (kW/m^2)	Effect
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)
12.6	• Significant chance of fatality for extended exposure. High chance of injury. • 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	• Cellulosic material will pilot ignite within one minute exposure • Significant chance of fatality for people exposed instantaneously

Source: NSW DUAP (1997)

Explosions can occur through a variety of mechanisms, but in each case damage or injury is caused by a pressure wave, which in turn is created by the rapid expansion of gases. The magnitude of pressure waves is usually expressed in terms of blast overpressure. Explosions of flammable gases are of particular concern in industrial facilities but they may also occur as a result of ignition of dust clouds, thermal decompositions and runaway reactions (NSW DUAP 1997).

11.2 Toxicant Releases

11.2.1 Impacts on the Aquatic Environment

Pollution from industrial and urban sources can cause biological changes in aquatic ecosystems. Environmental concerns include:

- Toxic effects;
- Nuisance aquatic plant growth;
- Maintenance of dissolve oxygen levels; and
- Effects due to changes in salinity.

'Toxicants' is a term used for chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment (ANZECC & ARMCANZ 2000). Toxic effects may be either acute (short-term) or chronic (long-term). Acute toxicity in an ecological sense generally refers to lethal effects while chronic toxicity refers to sub-lethal effects (i.e. a reduction in growth, reproduction and/or development, or the mutation of an exposed organism).

The types of toxicants that might be released from the NEBP depend on the types of hazardous substances and dangerous goods to be used and stored on site. Known hazardous substances at this stage include:

- Unleaded petrol (e.g. petroleum hydrocarbons, aromatic hydrocarbons, polycyclic aromatic hydrocarbons and trace elements); and
- Diesel fuel (petroleum hydrocarbons, polycyclic aromatic hydrocarbons and trace elements).

Other releases may arise from the storage and handling of liquid waste products (e.g. solvents used in shipyard activities, washdown waters) and solid wastes (e.g. abrasive blasting materials or paint residues). Fire fighting water is also likely to contain toxic compounds depending on the materials involved as well as by-products such as polycyclic aromatic hydrocarbons, which are formed during combustion processes.

11.2.2 Impacts from Smoke, Vapours and Gases

The release and dispersion of toxic material to the atmosphere can adversely affect exposed persons and the environment. Toxic concentrations of airborne contaminants can result from:

- The evolution of toxic combustion products during fire;
- Vapours from toxic liquids;
- Reactions of materials giving off toxic vapours or gases;
- Liquid spills entering watercourses or contaminating land or groundwater; and
- Spills of solid materials and dispersion of dusts by the wind.

The effects from exposure to toxic fumes can range from fatality or injury (e.g. damage to respiratory or nervous system) to irritation of eyes, throat or skin.

The Queensland Fire and Rescue Authority (1998) prepared a report on *Fire Fatalities: Who's at Risk? Research Report*. This report investigated 550 fire fatalities in 451 structure (e.g. building) fires in Australia between 1 July 1991 and 30 June 1996. This report found that the major cause of death was smoke inhalation, that the absence of smoke alarms appear to

contribute to the increased risk of death in the event of a fire and that most fire death victims die before the fire brigade is notified. Smoke inhalation leads to poisoning by carbon monoxide and other toxic products of structural fires.

The Queensland fire death rates (structure fires – e.g. houses and mobile houses) for the period from 1991 to 1996 are summarised in Table 29.

Table 29: Queensland Fire Deaths (1991 to 1996)

Financial year	1992/92	1992/93	1993/94	1994/95	1995/96
Number of victims	13	10	22	33	23
Deaths per 100 000	0.43	0.32	0.69	1.00	0.68

11.3 Natural Hazards

11.3.1 Flooding and Bushfire

Natural disasters are a significant and rising cost to the community (State Planning Policy 1/03). They are estimated to cost Queensland an average of $239 million per year (in 1999 prices) in direct and indirect tangible costs between 1967 and 1999. In addition, there are significant intangible costs associated with loss of life, injury, human suffering, loss of productivity and environmental degradation.

The consequences of flooding include:

- Injury or fatality;
- Loss of community infrastructure e.g. sewerage systems;
- Water-borne disease; and
- Property loss.

The dangers faced from bushfires include threats to people, property, community assets, the landscape and wildlife. The consequences include injury or fatality from smoke inhalation and/or heat radiation as well as property damage or destruction from heat radiation (see Table 28).

11.3.3 Mosquito-borne Diseases

High numbers of mosquito vectors in a developmental site increase the risk of the community contracting mosquito borne disease resulting in loss of productivity and high costs of treatment (Queensland Health 2002). Ross River virus (RRv) is the most prevalent disease comprising 90 per cent oft total notification of mosquito-borne diseases.

During epidemics of RRv in Queensland in 1992 and 1996, a total of 4154 and 4935 cases respectively were serologically confirmed. Queensland Health estimated that the cost of the 1992 epidemic to the economy would have been approximately $14 to $15 million. Costs include consultation fees for doctors, blood tests, drugs, absence from the workforce and domestic duties and vector control.

12. RISK EVALUATION

The following tables provide the outcomes of the risk analysis process. These tables show the relative level of risk for both the potential (or inherent) case (i.e. no control measures) and residual case (i.e. with control measures).

As described in Section 7.4, risk evaluation uses the risk levels to determine whether a risk needs treatment, whether an activity should be undertaken and the priorities for treatment. The risk criteria against which the relative risks have been assessed are described in Table 12. The risk profiles for the different phases of the development are discussed further in Section 13.

Table 30: Risk Analysis of Construction Phase

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Dredging				
Rupture or breakage of suction hose	Unlikely	Minor	Low	Low
Failure of land disposal sluices and bunds	Likely	Minor	Medium	Low to medium
Barge collision/capsize and loss of fuel or silt	Rare	Moderate	Medium	Low
Fire	Unlikely	Moderate	Medium	Low
Leaks and spills	Likely	Minor	Medium	Low
Toxic gas, vapour, smoke and nuisance dust releases	Likely	Minor	Medium	Low to medium
Flooding	Possible to likely	Moderate to major	High	Low to medium

Table 31: Risk Analysis of Community Infrastructure

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Substation fire	Unlikely	Moderate	Medium	Low to medium
Gas pipelines				
Leak or rupture	Unlikely	Major	Medium	Low to medium
Sewage leak	Possible	Minor to moderate	Medium	Low to medium
Failure of dual reticulation system	Unlikely	Major	Medium	Low
Service station				
Fire (or explosion)	Rare	Catastrophic	High	Low
Release of vapours	Possible	Minor	Medium	Low to medium

Table 32: Risk Analysis of Business Park Activities

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Fire (or explosion)	Likely	Minor to major	Medium to high	Low – health Medium – property damage
Spill and stormwater contamination	Likely	Insignificant to moderate	Medium to high	Low
Toxic gas or vapour release	Possible	Minor	Medium	Low to medium
Recycled water				
• Failure at treatment plant	Possible	Minor to major	Medium to high	Medium[1]
• Failure of dual reticulation system	Unlikely	Major	Medium	Low

[1] Depending on monitoring program implemented by Caboolture South WWTP

Table 33: Risk Analysis of Marine Industries and Marina Activities

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Marine Industries				
Fire (or explosion)	Likely	Minor to major	Medium to high	Medium
Spill into stormwater and tidal contamination	Possible	Insignificant to moderate	Low to high	Medium
Toxic gas or vapour release	Possible	Minor	Medium	Low to medium
Boat lift accident	Possible	Minor	Medium	Low
Marina Basin				
Fire (or explosion)	Possible	Moderate	High	Medium
Fuel spill	Likely to almost certain	Moderate	High	Low to medium
Sewage release	Likely to almost certain	Minor to moderate	High	Medium
Boat Entrance Channel				
Collision	Likely	Minor to moderate	Medium to high	Medium
Release of fuel and/or chemicals	Possible	Minor to moderate	Medium to high	Low to medium

Table 34: Risk Analysis of Residential, Commercial, Retail and Education Activities

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Fire	Likely	Moderate	High	Low – health Medium – property damage
Spills and leaks	Possible to likely	Insignificant to minor	Low to medium	Low to medium
Toxic releases	Unlikely	Insignificant to minor	Low	Low
Recycled water				
• Failure at treatment plant	Possible	Minor to major	Medium to high	Medium[1]
• Failure of dual reticulation system	Unlikely	Major	Medium	Low
Golf Course				
Recycled water treatment failure	Possible	Minor to major	Medium to high	Low to medium
Chemical use e.g. fertilisers and pesticides	Likely	Minor	Medium	Low to medium

[1] Depending on monitoring program implemented by Caboolture South WWTP

Table 35: Risk Analysis of Natural Events

Hazardous event	Likelihood	Consequence	Relative Level of Risk	
			Potential	Proposed controls
Disease vectors - mosquitoes	Almost certain	Moderate	High	Medium
Flooding	Possible to likely	Moderate to major	High	Low to medium
Bushfire	Possible	Minor to major	Medium to high	Low to medium

13. RISK PROFILE AND SAFEGUARDS

13.1 Risk Profile of Incident Scenarios

The relative risk levels ranged from low to high in the absence of control measures. The events determined to have high risk levels were:

1. Construction phase – flood effects on dredging (environmental);
2. Community infrastructure – fire or explosion at service station (environmental, human health and property);
3. Business Park – fire in warehouse or office (environmental, human health and property);
4. Business Park – spill and stormwater contamination (environmental);
5. Business Park – supply of untreated recycled water because of treatment plan failure (environmental and human health);
6. Marine Industries – fire or explosion (environmental, human health and property);
7. Marine Industries – spill into stormwater and tidal contamination (environmental);
8. Marina – fire or explosion (environmental, human health and property);
9. Marina – fuel spill (environmental);
10. Marina – sewage release (environmental);
11. Boat entrance channel – collision (human health and property);
12. Boat entrance channel – release of fuel and/or chemicals (environmental);
13. Residential, commercial, retail and education activities – fire (environmental, human health and property);
14. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health);
15. Golf course – supply of untreated recycled water because of treatment plant failure (environmental and human health);
16. Disease vectors – mosquito-borne diseases such as Ross River virus (human health);
17. Flooding – (environmental, human health and property); and
18. Bushfire – (environmental, human health and property).

The action criteria specified for this level of risk requires immediate action and the preparation of a detailed risk management plan for the specific activity or event including consultation with relevant persons.

The proposed control measures for these events have been described in the Hazard Identification Word Diagrams provided in Section 9.0. The implementation of these control measures (i.e. residual risk) is expected to reduce the risk level to low, low to medium or medium.

The hazardous events with residual medium risk levels were:

1. Business Park – supply of untreated recycled water because of treatment plan failure (environmental and human health);
2. Marine Industries – fire or explosion (environmental, human health and property);
3. Marine Industries – spill into stormwater and tidal contamination (environmental);
4. Marina – fire or explosion (environmental, human health and property);
5. Marina – sewage release (environmental);
6. Boat entrance channel – collision (human health and property);
7. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health); and
8. Disease vectors – mosquito-borne diseases such as Ross River virus (human health).

The action criteria for medium risk levels is requires further improvement and proposed risk treatment measures reviewed in consultation with appropriate persons. The supply of recycled water to businesses, residential, commercial, retail and education activities for example, has only been reduced to a medium risk level because the level of monitoring undertaken by the Caboolture South WWTP was unknown and the use of recycled water from this source for the above activities is untested.

The remainder of the potential risks were determined to be either low or low to medium, with the implementation of control measures. These activities should be scheduled for action after those listed above and are summarised below:

- Construction phase;
- Community infrastructure;
- Business Park activities – fire, spill or toxic gas release;
- Marine industries – toxic gas release; boat lift accident;
- Marina precinct – fuel spill in basin; and
- Boat entrance channel – release of fuel and/or chemicals.

13.2 Evaluation of Risk Reduction Measures against ALARP

The 'As Low As Reasonably Practical' (ALARP) concept contains within it ideas of practicality (i.e. can something be done) as well as the costs and benefits of action or inaction (i.e. is it worth doing something in the circumstances). In practice it equates to the tolerable region of risk bounded by a Basic Safety Objective (lower risk end) and Basic Safety Limit (higher risk end).

Risks above the Basic Safety Limit fall into the intolerable region and cannot be justified save in extraordinary circumstances. Risks in the ALARP or tolerable region are acceptable if further risk reduction is impracticable. Risks below the Basic Safety Objective are in the broadly acceptable region. This region means that risk reduction is not likely to be required as resources likely to be disproportionate to the reduction achieved.

The objective of the qualitative analysis undertaken in this report was to set priorities or treatment based on the level of risk. The outcome of this analysis was the identification of eight hazardous events with a residual risk level of medium (there were no events with high risk levels following the inclusion of proposed control measures). In terms of the ALARP concept, this level is in the tolerable risk region but implies that further improvements can be made. Table 36 therefore evaluates whether further improvement and risk treatment measures can be practically incorporated to further reduce the risks (i.e. to low). The approach may be to reduce the likelihood of the event (i.e. increased preventative measures) or the consequences of the event (e.g. improved Emergency Response procedures).

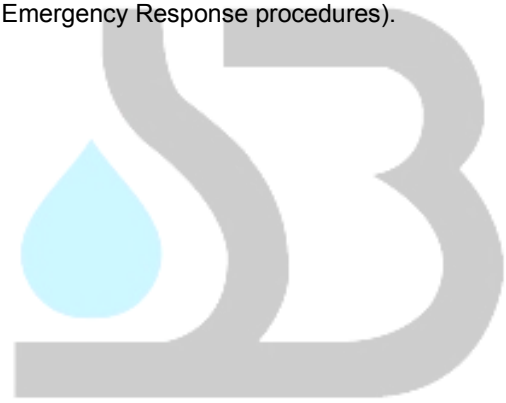

Table 36: Evaluation of Opportunities for Reduction to ALARP

Hazardous incident scenario	Additional control measures
Supply of contaminated recycled water in the event of plant failure • Business Park • Residential • Commercial • Retail • Education	To be evaluated in greater detail. Requires information on the treatment process and the current water quality and monitoring program to adequately assess the risk of plant failure. Assessment to be prepared in accordance with NRMMC, EPHC and AHMC (2006) *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1).*
Fire or explosion in the marine industries	To be evaluated in greater detail. Requires information on the types and quantities of hazardous substances and dangerous goods to be stored and handled within each site activity. Site layout to incorporate buffer zone between industry, fuel storage and residential development. Preparation of integrated Emergency Response Plan in consultation with each activity and Department of Emergency Services. Construction of temporary firewater containment and diversion structures that serve the industrial park and/or the marina as a whole should be evaluated. Installation of fire alarms that are connected to the Fire Communications Centre (Firecomm) to minimise the risk of fire propagation between adjoining land uses.
Fire or explosion in the marina	The marina, and fuel depot, should be designed in accordance with AS 3962: 2001*Guidelines for design of marinas*. The fuel storage should be designed in accordance with AS 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids*. These standards provide Basic Safety Objectives and are considered to be ALARP. Further evaluation could include: • Provisions for a large dangerous goods location under *Dangerous Goods Safety Management* legislation; and • Assessment of separation distances between fuel storage and residential areas.
Sewage release	Sewage releases to the estuarine environment can be controlled under normal operating conditions. The recommended control measures are considered to be Basic Safety Objectives and therefore ALARP.
Spill into stormwater from marine industries	To be evaluated in greater detail. Additional controls may be required for specific activities depending on the nature of the activity, site layout and stormwater system. Recommended control measures are considered to be Basic Safety Limits and therefore ALARP. A whole of site containment system should be evaluated.

Hazardous incident scenario	Additional control measures
Collision in the boat entrance channel	It is assumed that standard marine safety requirements (e.g. Marine Safety Queensland) will be incorporated in this section of the development. The recommended control measures are considered to be Basic Safety Objectives and therefore ALARP.
Mosquito-borne diseases	Develop a plan to minimise public health risks from mosquitoes and, potentially, biting midges, in accordance with Queensland Health 2002[1]. This plan should include: • Information on local mosquitoes and biting midges; • Evaluation of the significance of mosquito and biting midge breeding sites; • Minimisation of mosquito and biting midge problems (land use planning and site layout); and • Mosquito control management. It should be noted that the use of larvacides may not be permitted in Fish Habitat areas and the use of habitat modification should be encouraged.

[1] *Guidelines to minimise mosquito and biting midge problems in new development areas*

14. RISK MANAGEMENT PLAN

14.1 General

The risk analysis shows the relative risks associated with the proposed activities of the Northeast Business Park. The primary risks were determined to be those associated with fire or explosion in the marine industries and Marina precincts, fire in residential areas (in terms of potential property damage), exposure to contaminated recycled water (e.g. in the case of treatment plant failure), sewage releases in the marina basin and boating collisions.

The nearest Fire Stations are located at Caboolture and Deception Bay. The standard procedure in the event of an emergency is to contact the Department of Emergency Services by dialling 000. Discussions with the Queensland Fire and Rescue Service indicate the response time to the proposed development location would be within ten minutes. CHEM Services has advised they may be involved in development assessment through referral by the Local Council but their main role is as a concurrence agency for Major Hazard Facilities (does not apply to this development). Further discussions may be held with Queensland Fire and Rescue as information about the types of industries within the development becomes available.

Proposed control measures to minimise the likelihood of a major accident within the NEBP cover:

- Site design and layout, construction and operation of the facility;
- Preventative measures;
- Proactive maintenance;
- Operator training in relevant industries, particularly the marine industries;
- Organisation and systems measures, safety training, emergency response and evacuation plans, monitoring, incident and safety reporting; and
- Community consultation and information.

14.2 Siting and Design of Facilities

The siting and design of the major land use precincts is shown in Figure 2. Detailed information on the siting and design of individual facilities is unavailable at this stage of the development.

The development provides a good buffer area for a large proportion of the Caboolture River frontage, on the southern side of the river. Approximately 48% (365 hectares) of the site has been designated environmental and open space.

The siting and design of the marina has not been assessed in great detail in this report. A major objective should be to ensure appropriate buffer areas between industrial activities and residential areas. This includes the transportation, unloading and storage of bulk fuels. The proposed road access route should minimise the risks associated with tanker fuel deliveries (described in Section 6.5 Transportation of dangerous goods).

A similar approach should be taken to ensure suitable buffer distances between community infrastructure, such as services stations and zone substations, Large Dangerous Goods Locations and sensitive land uses, such as residences and education facilities. A buffer area should be designated between the industrial park and the Bruce Highway to reduce the risks of interaction or propagation of hazardous events between the two land uses. Examples of hazardous events include a fire in the industrial park or, conversely, a tanker fire on the Bruce Highway.

14.3 Preventative and Control Measures

The standard preventative measures for each of the site activities have been detailed in the Hazard Identification Word Diagrams in Section 9.

The general approach is to ensure appropriate design of facilities in accordance with relevant legislation (e.g. *Dangerous Goods Safety Management Act*), Australian Standards (e.g. AS1940) or other Codes of Practice (e.g. Brisbane City Council *Operator's Environmental Guides for Environmentally Relevant Activities*).

These measures were further evaluated against ALARP in Section 13.2. Additional preventative measures that were recommended are summarised below:

- Conduct a risk assessment of proposed use of recycled water on site;
- Maintain a central database of the types and quantities of hazardous substances and dangerous goods used and stored on site as new industries are established;
- Ensure site layout incorporates appropriate buffer zones between industry, fuel storage and residential development;
- Prepare an integrated Emergency Response Plan in consultation with each activity and Department of Emergency Services (Fire Safety Studies should also be carried out on Large Dangerous Goods Locations);
- Construct temporary firewater containment and diversion structures that serve the industrial park and/or the marina as a whole to prevent contaminated discharges to the Caboolture River and associated watercourses;
- Install fire alarms that are connected to the Fire Communications Centre (Firecomm) to minimise the risk of fire propagation between adjoining land uses; and
- Develop a plan to minimise public health risks from mosquitoes and biting midges.

14.4 Safety Management System (SMS)

Might need to be prepared for individual precincts as a first stage activity and slowly integrated into one plan for the whole development. Could this be managed by the Body Corporate?

The SMS should be the primary means of ensuring risk from activities conducted at a facility is maintained at an acceptable level.

The main components of a SMS are:

1. Commitment and leadership;
2. Planning;
3. Implementation;
4. Monitoring, measurement and evaluation; and
5. Auditing and review.

The sub-components of each stage are summarised in Table 37.

Table 37: Major components of a Safety Management System (SMS)

Commitment and leadership	Planning	Implementation	Monitoring, measurement and evaluation	Auditing and review
Safety Policy	Objectives and targets	Hazard identification and risk assessment[1]	Performance criteria	Formal auditing arrangement
Provision of sufficient resources	Information requirements	Safety assurance	Inspection, monitoring and testing	Review of performance and effectiveness
Responsibility and accountability	Safety Plans	Systems of work i.e. Work Procedures	Incident reporting and investigation	
Communication		Training		
		Emergency Preparedness		
		Change Management		

[1] Completed in this report but may be more detailed for specific activities

14.5 Emergency Planning

On-site and off-site emergency plans are to be prepared according to AS 3780-1994, AS 4326-1995 and AS/NZS 3833-2007 and Queensland Fire and Rescue Service (QFRS) *Fire and Evacuation Guidelines.*

The QFRS Guidelines cover general considerations as well as specific guidelines for different land uses relevant to this development:

- Public Assembly Buildings;
- Commercial Premises (high-rise and large low-rise); and
- Factories and Warehouses.

Emergency plans are to coordinate the alarm, notification, response, management and rehabilitation requirements in the events of a major accident. Key components in the formulation of Emergency Plans are:

1. Ensuring that all persons on-site have appropriate training in the implementation of the emergency plans;
2. Consultation with emergency services to formulate and agree to on-site and off-site emergency plan for action; and
3. Public consultation with local residents and community during preparation of off-site emergency plans.

Details on information to be included in on-site and off-site emergency plans are given in the Australian Standards, along with updates and reporting requirements for major accidents and near misses.

The operator of the facility is to evaluate and implement appropriate measures to limit the consequences of a major accident. Such measures should take into account the likely warning periods that will be available on –site and off-site. Measures may include:

1. Early detection and alarm systems;
2. Communication systems;
3. Shutdown systems for gas release;
4. Fire protection systems including automatic control of tank or bund fires;
5. Containment for spills and firewater runoff;
6. Personal protective equipment;
7. Safety refuges for site personnel;
8. First aid equipment and trained personnel; and
9. Clean-up procedures.

14.6 Training and Education

The operation of the facilities within the NEBP will depend on a preventative and quality assurance approach to reduce and maintain low risks. Key training components for all staff and operators are:

- Induction Training for all staff;
- Quality assurance training;
- Safety and emergency response;
- Site management and supervision training is emphasised to ensure risk management and quality standards are met.

Supervisors and process operators should hold appropriate qualifications and specialist training in automated and manual procedures needed to ensure efficient and safe operation of all plant and equipment (this is particularly relevant to the construction phase, the marine industries precinct and the marina). Any maintenance work should be performed by qualified persons with specialist training and knowledge of process hazards.

The operators of each facility are also to ensure adequate staff training in occupational health and safety, environmental and public safety. Competency training shall address the hazards and risks presented by the warehouse operation including odours, dusts, toxic fumes and gases, fire and explosion.

14.7 Off-site Emergency Response

Emergency response from off-site is to be provided primarily by the Queensland Fire and Rescue Service and Chemical Hazards and Emergency Management Services (CHEM Services) for hazardous chemicals and materials (Queensland Department of Emergency Services). Coordination is to be maintained by the site operators (e.g. marina) with the nearest Fire Service.

The Fire Service provides 24 hour emergency response services to any hazardous materials incident within the state in co-operation with CHEM Services. Through training and experience, the firefighters attached to the units are able to provide expert advice and operate specialised hazardous materials equipment.

Emergency response time to the site would be relatively rapid from the nearest Fire Service. Specialised CHEM Services response could be delayed but adequate hazard knowledge and containment could be readily co-ordinated by the site operators.

The major factors in terms of fire fighting response are:

1. The type and quantity of chemicals present;
2. Storage practices and process activities;
3. Absence of automatic fire detection/suppression systems;
4. Accessibility for the fire service;
5. Containment capability;
6. Proximity to Caboolture River and watercourses and
7. Proximity to other premises storing dangerous goods.

(Department of Emergency Services 2007).

14.8 Security

Any site incorporating the use and storage of hazardous substances and dangerous goods (particularly external storage) should be enclosed by a security fence. All buildings and gates should be securely locked and windows fitted with security locks. A security firm should be contracted to monitor any intruder alarm systems.

14.9 Drainage

Uncontaminated or clean stormwaters will gradually drain or flow off-site to the Caboolture River and associated watercourses.

Any contaminated stormwaters (e.g. chemical spills and fire fighting water) should be controlled in drains, pits or bunded areas in an emergency and re-used on site or disposed off-site by a licensed waste contractor.

The site design should provide for the containment of firewater to prevent environmental impacts on the Caboolture River in the event of an emergency. To be useful for firewater retention, containment systems need to be fed by gravity flow from across the site and, if in separate sections, the sections need to be appropriately interconnected to maximise capacity. Containment systems that depend on the operation of pumps are ineffective when the power supply is cut.

The possibility of providing structures that serve the development as a whole (or at least the marine industries and marina precinct) should be evaluated.

14.10 Related Occupational Health and Safety Matters

14.10.1 Available Hazard Information and Records

Information that should be kept on site as part of the safety management systems include:

- Hazardous Substances Register;
- MSDS copies for all stored products;
- Relevant Codes of Practice and Australian Standards;
- Training records;
- Manifest of stored chemicals and quantities;
- Incidents record; and
- Emergency plans and response procedures including site maps.

14.10.2 Personal Protection and Emergency Safety Equipment

Active and spare protective clothing, including self-contained breathing apparatus, respirators for dusts, toxic gases and fumes should be available at each industrial site. Staff should be trained in the use of protective equipment to meet Australian Standards.

On-site emergency facilities where dangerous goods are stored or handled should include respiratory equipment, emergency showers, eyewash stations, hygiene and first-aid facilities.

14.10.3 Staff Training – Occupational Health and Safety

Staff safety training including inductions should be prepared in consultation with a specialist occupational hygienist, where necessary, and delivered by a person competent in that training.

Appropriate procedures will ensure all staff be sufficiently trained and aware of the requirements in the case of an emergency to protect human health and property and the environment.

Records of all training undertaken by staff should be kept on site.

14.10.4 Fire Prevention, Firefighting and Training

Reduction of fire risk should be managed through placarding and warning signs, enforcement of No Smoking or ignition sources in operational/storage areas and restricted to access by staff only. A Fire Safety Study should be carried out.

Fire fighting facilities (location, number and type) should be approved by the local fire service. Fire extinguishers should be available near storage facilities. Training in the use of firefighting equipment and emergency drills should be held for any new staff and maintained regularly. Regular contact with the local fire service should be maintained.

14.10.5 Audits

Safety and environmental audits of the management system(s), hazard information and records, shift processes, safety measures and staff PPE should be conducted in-house (for individual industrial activities) on a six-monthly basis and externally by a specialist consultant.

The external audits should be conducted on an annual basis while the development continues to grow and new industries are established within the business park and marina precincts. Major equipment or process changes should be audited promptly. Records of all audits should be maintained for review purposes.

15. CONCLUSIONS

The potential impacts of both natural and emergency situations as a result of the proposal on sensitive areas and resources, community infrastructure, places of residence and work and recreational areas were qualitatively assessed in this report.

There were no high or extreme residual risks identified within the NEBP proposal when the proposed control measures were included in the analysis. The highest risks (i.e. medium level of risk) were determined to be associated with the following activities:

1. Business Park – supply of untreated recycled water because of treatment plan failure (environmental and human health);
2. Marine Industries – fire or explosion (environmental, human health and property);
3. Marine Industries – spill into stormwater and tidal contamination (environmental);
4. Marina – fire or explosion (environmental, human health and property);
5. Marina – sewage release (environmental);
6. Boat entrance channel – collision (human health and property);
7. Residential, commercial, retail and education activities – supply of untreated recycled water because of treatment plant failure (environmental and human health); and
8. Disease vectors – mosquito-borne diseases such as Ross River virus (human health).

The ALARP analysis indicates these risks can be further reduced. These recommendations are provided in the following section.

16. RECOMMENDATIONS

The highest risk residual (with control measures) levels were associated with the supply of contaminated recycled water (in the event of treatment plant failure), fire or explosion in the marine industries, fire or explosion in the marina, spill into stormwater from marine industries, collision in the boat entrance channel and mosquito-borne diseases.

These potential events were further evaluated to determine whether the risk level was 'As Low As Reasonably Practical' (ALARP). This analysis concluded that additional control measures could be implemented to reduce the risks from fire and explosion. The proposed recommendations are to:

- Conduct a risk assessment of proposed use of recycled water on site;
- Maintain a central database of the types and quantities of hazardous substances and dangerous goods used and stored on site as new industries are established;
- Ensure site layout incorporates appropriate buffer zones between industry, fuel storage and residential development;
- Prepare an integrated Emergency Response Plan in consultation with each activity and Department of Emergency Services (Fire Safety Studies should also be carried out on Large Dangerous Goods Locations);
- Construct temporary firewater containment and diversion structures that serve the industrial park and/or the marina as a whole to prevent contaminated discharges to the Caboolture River and associated watercourses;
- Install fire alarms that are connected to the Fire Communications Centre (Firecomm) to minimise the risk of fire propagation between adjoining land uses; and
- Develop a plan to minimise public health risks from mosquitoes and biting midges.

The potential for fire is related to the storage and use of flammable and combustible liquids as well as human activities and/or malfunction of equipment within building environments (e.g. factories, warehouses, offices and residences).

The following factors should be evaluated as part of the Emergency Response Plan for the site:

1. The type and quantity of chemicals present;
2. Storage practices and process activities;
3. Absence of automatic fire detection/suppression systems;
4. Accessibility for the fire service;
5. Containment capability;
6. Proximity to Caboolture River and watercourses and
7. Proximity to other premises storing dangerous goods.

Further detailed risk assessment is recommended for the use of recycled water on site and prior to the establishment of new industries. The activities of Large Dangerous Goods Locations in particular should be individually assessed (in accordance with *Dangerous Goods Safety Management* legislation) and the findings of each assessment incorporated in the risk management plan for the site.

The potential for contracting mosquito-borne diseases, such as Ross River virus (RRv) was also considered to be a medium risk. Therefore it is recommended that a plan be developed to minimise public health risks from mosquitoes and biting midges.

17. REFERENCES

AS 1940:2004. *The Storage and Handling of Flammable and Combustible Liquids.*

AS 3962:2001. *Guidelines for design of marinas*.

AS/NZS 3931:1998. *Risk analysis of technological systems – Application Guide.*

AS/NZS 4360:2004. *Risk Management*.

Caboolture Shire Council (2001). *Demographic Profile – incorporating first release data from the 2001 Consensus*. Caboolture Shire Council (CSC).

Caboolture Shire Council (2005). *Caboolture ShirePlan.*

Cardno Eppell Olsen (2007). *Northeast Business Park – Preliminary Report.* Traffic.

CSC (2003). *Community Facilities Infrastructure Guidelines*. Caboolture Shire Council.

CHEM Services (2001). *A guide to the Dangerous Goods Safety Management Act 2001*. Chemical Hazards and Emergency Management Services 2001.

CHEM Services (2005). *Premises Classification for the Storage and Handling of Dangerous Goods.* DGSM Information Paper No. 5. Chemical Hazards and Emergency Management Services.

Department of Emergency Services (2007). *Narangba Industrial Estate: Multi-Agency Fire and Firewater Risk Minimisation Inspection Program.* Department of Emergency Services, Environmental Protection Agency, Department of Employment and Industrial Relations and Caboolture Shire Council.

Department of Urban Affairs and Transport Planning (2003). *Major Industrial Hazards Advisory Paper No. 3. Hazard Identification, Risk Assessment and Risk Control.* Consultation Draft. NSW Department of Planning.

Energy Australia (2000). *Chatswood Zone Substation Transformer Explosion and Fire.* Report and Findings. February 2000.

Energy Australia (2000). *Paddington Zone Substation Transformer Explosion and Fire.* Report and Findings. December 2000.

Environmental Protection Agency [EPA] (2007). *Environmental Protection (Water) Policy 1997 Caboolture River Caboolture River Environmental Values and Water Quality Objectives Basin No. 142 (part) Including all tributaries of the Caboolture River.* EPA Brisbane.

HB 436:2004. *Risk Management Guidelines. Companion to AS/NZS 4360:2004*.

Lectel (2007). *Northeast Business park EIS Energy Report.*

NRMMC, EPHC and AHMC (2006). *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)*. Natural Resource Management Ministerial Council, Environment Protection and Heritage Council and Australian Health Ministers Conference.

NSW Department of Urban Affairs and Planning (1997). *Guidelines for Hazard Analysis*. *Hazardous Industry Planning Advisory Paper No. 6.*

pmm Group (2006). *Initial Advice Statement (IAS) Northeast Business Park Nolan Driver, Burpengary May 2006.*

Queensland Health (2002). *Guidelines to minimise mosquito or biting midge problems in development areas.*

SPP 1/03: *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (Queensland State Planning Policy).

TransGrid (2005). *Electricity Network Performance Report, 2004-2005, New South Wales.*