Tooheys Brewery, Lidcombe Cogeneration Facility

Part 3A Modification

Environmental Assessment

Prepared for

ESTD 1869
TOOHEYS

ARUP

Tooheys Pty Ltd

Tooheys Brewery, Lidcombe - Cogeneration Facility

Environmental Assessment

September 2009

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Job number 206814/00

Job title	Tooheys Brewery, Lidcombe - Cogeneration Facility		Job number 206814/00
Document title	Environmental Assessment		File reference
Document ref	EA/001		

Revision	Date				
Draft 1	17/08/09	Filename	0001 EA_Draft.doc		
		Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Natasha Connolly	Melanie Koerner, Stuart Hodgson	Stuart Hodgson
		Signature			
Draft 2	17/09/09	Filename	0002 EA_Revised Draft.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Natasha Connolly	Melanie Koerner, Stuart Hodgson	Stuart Hodgson
		Signature			
Issue	25/09/09	Filename	0003 EA_Final for Issue.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Natasha Connolly	Melanie Koerner, Stuart Hodgson	Stuart Hodgson
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

Appendices

Statement of Certification

Environmental Assessment prepared under

Part 3A of the Environmental Planning and Assessment Act 1979

Environmental Assessment prepared by:

Name:	Stuart Hodgson
Company:	Arup
Position:	Senior Associate
Qualifications:	BE (Hons), Engineering Science
	Masters Environmental Law
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Project to which the Environmental Assessment relates:

Project Description:	Cogeneration facility for the Tooheys Brewery
Land to be developed:	29 Nyrang Street, Lidcombe NSW 2141
	Part Lot 10 DP 1008367 Auburn Local Government Area
Applicant's Name:	Tooheys Pty Ltd
Applicant's Address:	29 Nyrang Street, Lidcombe, NSW 2141

Certification:

I certify that I have prepared this Environmental Assessment and to the best of my knowledge:

- It has been prepared in accordance with Part 3A of the EP&A Act 1979 and the Regulations;
- It has been prepared in accordance with the Director-General's requirements dated 29 July 2009; and
- It does not contain information that is either false or misleading.

Signature:

Date: 25 September 2009

Executive Summary

In June 2006 the NSW Department of Planning approved the Project Key upgrade at Tooheys Brewery. The upgrade included the installation of two new natural gas boilers and decommissioning of the existing, 30 year old, natural gas boilers.

Tooheys are now seeking a modification to the existing approval, under Part 75W of the EP&A Act, to install a cogeneration facility at the Lidcombe brewery.

The project involves the installation of a gas fired internal combustion engine with 2MW of electrical energy output. Additional waste heat in the form of 1MW of steam and 1MW of hot water (used to produce chilled water via absorption chiller) will be added to existing site distribution.

As a result of the proposed project, the electricity consumption of the brewery and the resulting greenhouse gas emissions will be reduced.

An environmental risk assessment was undertaken of the proposed cogeneration facility and no impacts of high or moderate significance were identified.

1 Introduction

Tooheys Pty Ltd is part of the Lion Nathan group which operates breweries in Brisbane, Adelaide, Perth and New Zealand.

The Tooheys brewery at Lidcombe has been in operation since the 1960s and was initially used as a packaging facility. Brewing commenced at the site in 1978. The brewery has undergone several small scale upgrades during this time and a major plant upgrade in 2007.

1.1 Overview of project

Tooheys proposes to install a 2MW co-generation facility at the Tooheys brewery site, located at 29 Nyrang Street, in Lidcombe NSW.

The main objective of the project is to reduce consumption of grid based electricity and associated operational costs. A further driver is to reduce greenhouse gas emissions a key performance indicator for brewery operations.

The proposed project involves the installation of a gas fired internal combustion engine with a 2MW electrical energy output and 2MW of mechanical energy output to supplement the thermal energy supplied by the boilers.

1.2 Legislative Context

In July 2006, Tooheys Brewery received single site wide planning approval from the NSW Department of Planning under Part 3A of the Environmental Planning & Assessment Act, 1979 for the recent Project Key upgrade as well as ongoing operations at the brewery.

The Department of Planning has determined that approval for the installation and operation of the cogeneration facility must be sought as a modification to the existing approval under Section 75W of the EP&A Act requiring the preparation of an Environmental Assessment. The Director General's Requirements for the Environmental Assessment were issued on 29 July 2009, and are included as Appendix A.

2 Site Description

This Section describes the physical environment of the brewery site and surrounding areas including natural and built features as well as the existing brewery process operations.

2.1 Location and Context

Tooheys Brewery forms part of an industrial cluster in the suburb of Lidcombe. The industrial premises are amassed within a large rectangular shaped block bound by Parramatta Road to the north, Boorea Street to the south and Nyrang and Percy Streets to the east and west respectively.

The brewery site lies at the easterly end of the industrial area with its largest frontage along Nyrang Street. The site is surrounded by industrial, residential and recreational land uses. Figure 1 shows the location.

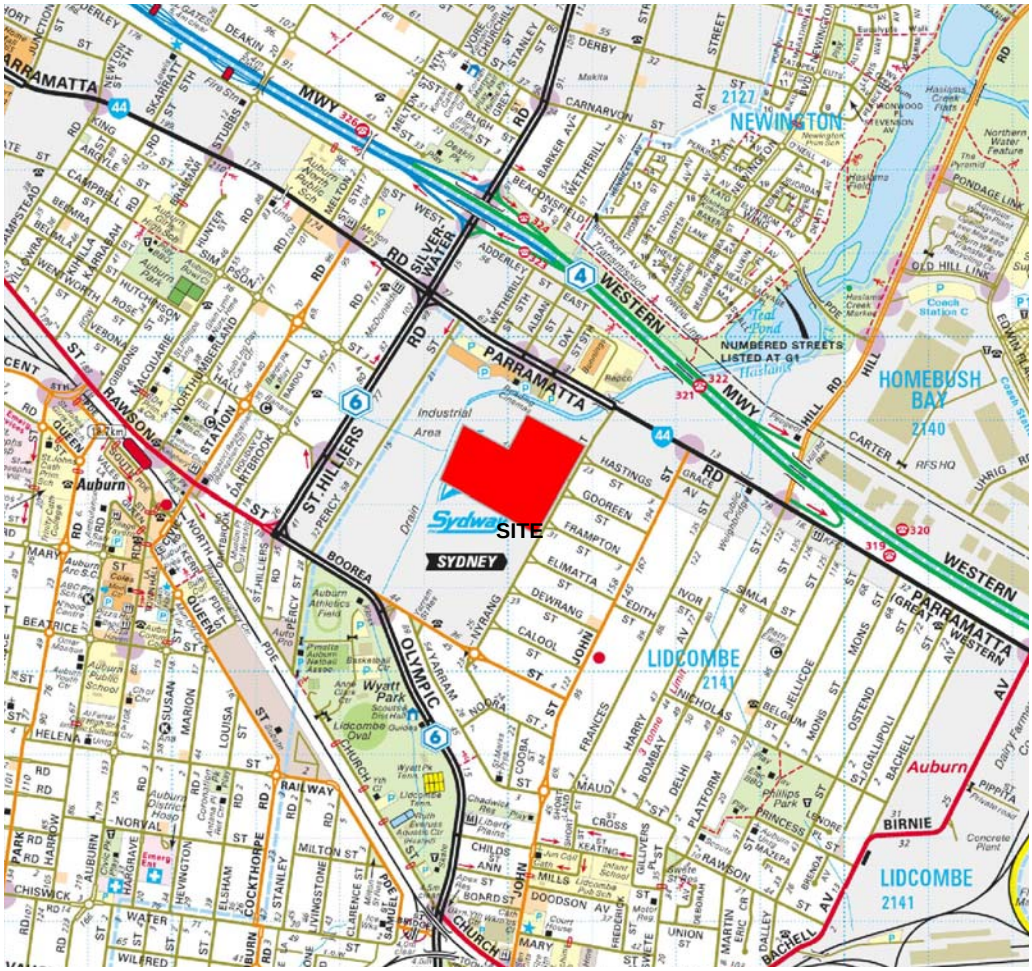


Figure 1 Site Location

The residential area to the east has a distinctive regular grid of streets of blocks containing detached residential dwellings on large allotments from the post-war period. To the south of the industrial area is similar detached housing from the mid 20th century. Redevelopment of some of these allotments has taken place over the last decade with larger double storey dwellings replacing the more austere cottages.

Immediately to the west of the site is a continuance of the industrial area. The majority of these premises contain late 20th century large industrial buildings set back from the street edge which tend to be dominated by hardstand.

Redevelopment in the immediate area has been concentrated along Parramatta Road. The subdivision pattern to the north of the site is largely based on rectangular lots, however the size of each allotment varies. Retail, entertainment and recreation facilities have recently been added to the industrial and commercial streetscape.

Haslams Creek has been canalised where it is adjacent to the brewery site. Northeast of the industrial area, the creek passes through a wetland area, before discharging into Homebush Bay.

2.2 Access

Access to the site is gained via both the Percy Street and Nyrang Street entrances. A manned gatehouse is located at the entrance on Nyrang Street which is the main entrance to site. The secure access on Percy Street is used by most of the heavy vehicles that enter and leave the site.

2.3 Physical Features of Land

2.3.1 Topography and Landform

The site is located in a slightly undulating topographic setting that generally falls to the north and north-west at up to approximately 5° to 10°. The brewery site is generally flat with falls to the north and west at up to approximately 2° to 4°.

2.3.2 Geology and Hydrogeology

Various subsurface investigations have been undertaken on site including geotechnical and environmental assessments. These investigations indicate that the site soil consists of alluvial and residual clay to groundwater level, with underlying shale.

Groundwater at the site is reported at approximately 6 – 7 m below ground level. It is considered likely that groundwater flow would be towards Haslams Creek and/or Homebush Bay in an approximate north to north easterly direction.

2.4 Existing Operations

The current capacity of the facility is 4.0 million hl per annum, however shift working arrangements based on a five day week restrict the production output to 3.3 million hl per annum. The seasonality of demand also influences production rates.

During normal business hours, there are approximately 117 people on site. Outside of normal hours there are approximately 90 people on site.

The key components of the brewing process and the nature of existing operations at the site are described in the following sections, and illustrated in Figure 2.

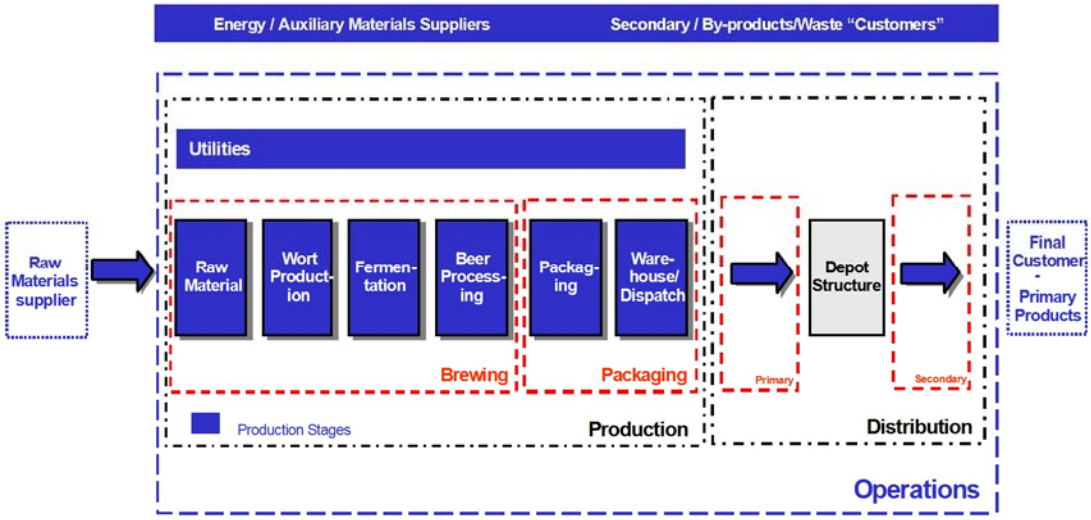


Figure 2 Process Description

3 Project Description

The purpose of the project is to provide a 2MWe co-generation facility at the Tooheys brewery at 29 Nyrang St, Lidcombe.

Cogeneration involves the combustion of natural gas to produce electrical and mechanical energy. The generation of electricity from cogeneration offsets electricity which would otherwise be sourced from the electricity grid.

The project includes the installation of a gas fired internal combustion engine with 2MW of electrical energy output. Additional waste heat in the form of 1MW of steam and an additional 1MW of hot water will also be generated by the plant. The steam will be generated from the exhaust discharge via an exhaust gas heat exchanger and will supplement the existing plant steam system. The hot water will be generated from the engine cooling system and will be used by an absorption chiller to produce chilled water to be supplied to the existing cooling circuit within the brewery.

The proposed co-generation facility process is illustrated below as Figure 3.

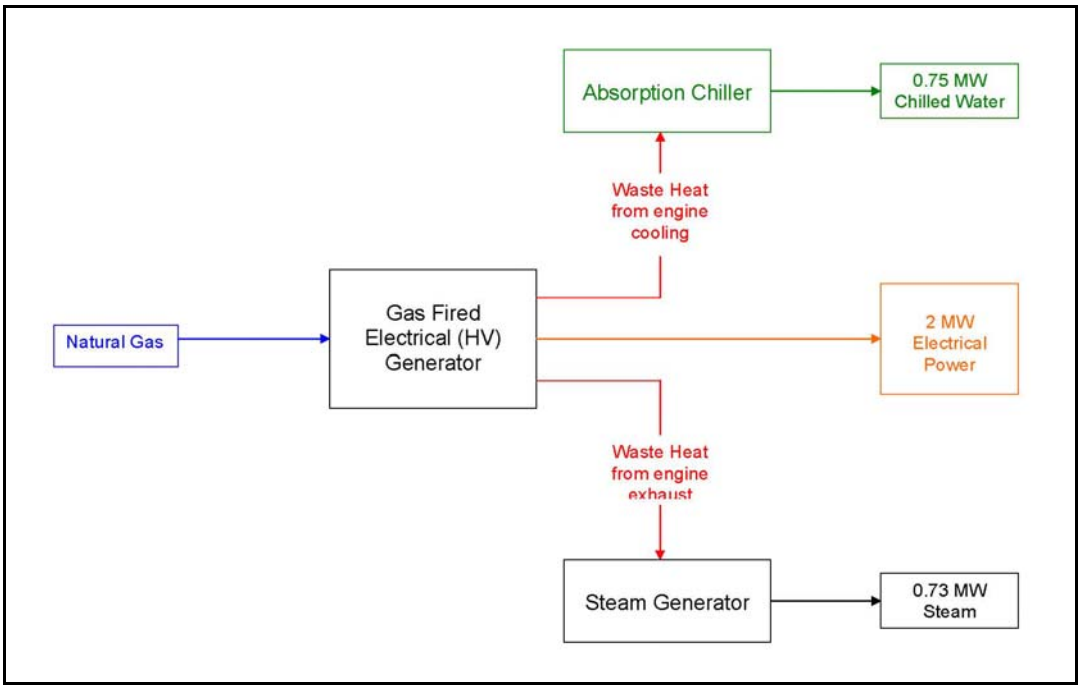


Figure 3 Proposed Co-generation Facility Process

The co-generation project will reduce peak electricity demand on the site by over 2MW - reducing grid electricity annual consumption by approximately 15,000 MWh and associated greenhouse gas emissions by 9,500 tonnes a year.

The upgrade will not increase the total capacity of the brewery or result in any changes to the working arrangements at the brewery.

The total capital investment for the project is $4.5M. Tooheys has received $2M funding for this project from the Department of Environment, Climate Change and Water (DECCWW) as part of the NSW Green Business Programme in recognition of the significant reduction in greenhouse gas emissions and reduced grid demand as a result of the project

3.1 Project Details

The plant will consist of a 2MW (TCG 2020V20 Deutz) generator set with the associated mechanical and electrical systems listed below. This generator is to run parallel to the grid.

- Acoustic Enclosure / Ventilation System
- Cooling tower.
- Waste heat boiler.
- Exhaust Diverter Valve.
- Oil system.
- High temperature and low temperature cooling systems with associated pumps.
- Water Monitoring Units
- Exhaust System / Silencer.
- Gas fuel system.
- Broad BDH 75 Hot Water Absorption Chiller.
- HV RMU.
- Master Control Panel (Incorporating distribution and control).
- HV Electrical Connection.

The new plant is to be substantially installed inside the Engine Room as shown in Figure 4, Site Layout. The equipment will be installed where two redundant steam boilers are currently located which are scheduled to be removed under the current approval for the site. The only items of plant to be installed outside of the existing building will be a cooling tower and an exhaust silencer, both of which will be below the current roofline of the surrounding buildings, as shown on the site elevation diagram Figure 5.

3.2 Schedule

Tooheys are ready to proceed with the installation of the co-generation facility as soon as approval is received from DoP. Pending approval, the co-generation plant equipment would be installed onsite in November 2009.

Filtration Road

Engineering Office

Parking

Hastings Street

Bulk Beer Truck Entry

Bottling Hall (Above)

Administration Building

Office

Central Maintenance Workshop

Empty Can and Bottle Handling

The North Road

Racking Cellar

Underground Carpark

Beer Garden

Tech. Office

Gatehouse Monitor

The Entry

Goreen Street

The Main Road

Water Tower

Tunnel

Water Meter

Spent Grain Silos

Grain Silos

Waste Treatment

Beer Processing Building

Tank Farm Slab No.1

Fabrication

Laboratory Complex

Canteen

Beer Recovery

Packed Stock

Nyrang Street

The Back Road

Beer Recovery Tanks

Yeast Loading

Tank Farm Slab No.2

Brewhouse

Filtration

Filtration Road

Loading

The Front Road

Parking

The Brewhouse Road

Effluent M.S.W. & D.B.

Yeastroom

DAW Tank

Engine Room

The South Road

Haslam's Creek

Carbon Filter

Tank Farm Slab No.3

Sub Station No.1

Frampton Street

Lactic Acid Plant

B'house Liquor Tanks

Hot Liquor Tanks

Old Cellar Road

Unloading Area

Oxygen Tank

Liquid Sugar Tanks

Cooling Tower

Condens.

Maturation

Acid Tanks

Caustic Tank

Cellar

Loading

Holding Tanks

No.1,2 CIP Unit

HorapTanks

Receivers

CO2

Egg Board Road

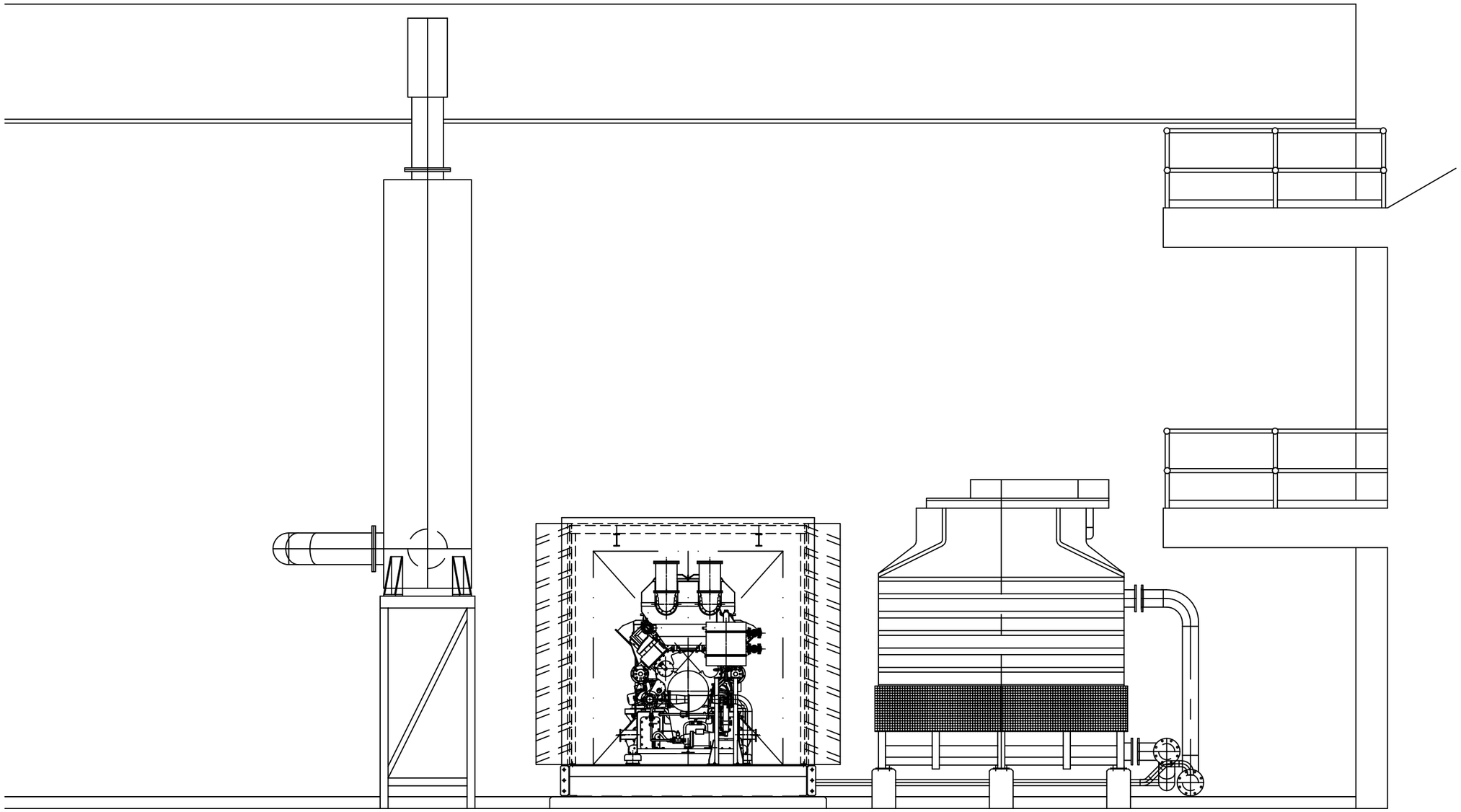
REFERENCE DRAWINGS	
DRAWING No	TITLE

No	DATE	REVISION	DRN	CHK	APP
4	25.3.09	CO-GEN PRELIM PLAN – FOR INFORMATION	AJM		

TOOHEYS LIMITED

EXISTING SITE PLAN
CO-GENERATION PLANT
PRLIMINARY LAYOUT

SCALE	LOCATION	PLOT DATE	DRAWING No	REVISION
1:750	AUBURN BREWERY	30.01.09	A 0101 031	4



FOR COMMENT

		C	LAYOUT REVISED AND UPDATED	12.08.09
		B	ENCLOSURE AIR DISCHARGE MODIFIED	19.06.09
		A	ORIGINAL ISSUE	24.10.08
ASSOC DRGS	DESCRIPTION	REV	DESCRIPTION	DATE

DO NOT SCALE IF IN DOUBT ASK ALL DIM IN MM

PROJECT
TOOHEYS CO-GEN PROJECT

TITLE
PROPOSED SITE ELEVATION
2.0MW ENCLOSED GENERATOR

SDA Engineering Pty Ltd
UNIVERSITY OF ADELAIDE
COMMERCE AND RESEARCH PRECINCT
26 STIRLING STREET, THEBARTON SA 5038
PH:(08) 8238 9404 FAX:(08) 8152 0722
E-MAIL: sda@sdaengineering.com.au

JOB No	E1299
DRAWN	J.PRING
DATE	23.10.2008
CHECKED	
SCALE	1:40

DRAWING No
E1299-01-004

SHT 2 OF 3 REV C A2

4 Project Justification

This Section describes the justification for the co-generation facility, the project benefits and consideration of alternatives.

4.1 Project Drivers

The purpose of the proposed cogeneration facility is to reduce the brewery's consumption of grid electricity reducing utility costs and greenhouse gas emissions.

Tooheys has a commitment to long term environmental improvement and sustainability under the Environmental Policy endorsed by Lion Nathan. Under this policy Tooheys are committed to protection of the environment and meeting the expectations of their people, customers, consumers and stakeholders. In addition, Tooheys monitors its greenhouse gas emissions per hL of beer produced as a key performance indicator.

Tooheys has recognised the cogeneration facility as an opportunity to continue progress towards reduced greenhouse gas emissions following on from the significant reductions achieved by energy efficiency initiatives implemented by Project Key.

4.2 Project Benefits – Energy

Energy requirements for the brewery are supplied by grid electricity, natural gas fired boilers for heating and small amounts of LPG for on site vehicles.

The brewery upgrade, Project Key, commenced in 2007, includes significant works to improve the energy efficiency of the brewery. Key improvements to the plant and equipment that have been made at the brewery in the last 2 years to help achieve this include:

- introduction of an energy management system;
- more efficient flow route of product through the brewery;
- new natural gas fired boilers which are more efficient;
- repair of steam and air leaks;
- repair and increase in insulation;
- improved condensate return rate;
- improved hot water balance;
- increased use of variable speed drives for pumps, motors and fans;
- installation of a new more efficient CO_2 recovery plant;
- installation of a local air compressor for spent grains discharge;
- installation of high efficiency motors for new equipment;
- installation of new and more efficient evaporative condenser plant for the main ammonia refrigeration plant and removal of old condensers; and
- design of utility systems to stand-by capacity to ensure the utility plant does not perform at all times, only when required.

These works when complete are anticipated to reduce the electricity consumption of the brewery to 9 kWh/hl (from 10 kWh/hl) and natural gas consumption of 70 MJ/hl (from 82.7 MJ/hl).

It is estimated that the co-generation project will reduce peak demand on the site by over 2MW - reducing grid electricity annual consumption by approximately 15,000 MWh and reducing greenhouse gas emissions by 9,500 tonnes a year.

Tooheys are striving to further reduce their electricity consumption and greenhouse gas emissions at the Lidcombe brewery through a number of mandatory and voluntary programmes including the Commonwealth Government's Greenhouse Challenge Programme and Energy Efficiency Opportunities Programme. The proposed cogeneration facility will assist in achieving targets under both these programmes

4.3 Consideration of Alternatives

The proposed cogeneration facility is not necessarily required for the operation of the brewery. The new high efficiency boilers, as approved for Project Key, can meet the site's thermal energy requirements and therefore represent a viable alternative.

However, the proposed cogeneration facility is expected to have significant environmental and operational cost benefits into the future and is therefore the preferred option for Tooheys at this point. The proposal represents a significant capital outlay for Tooheys and would not be viable without the additional funding under the NSW Green Business Programme. Tooheys therefore considers that the option of such a facility will only be viable in the short term future while this funding is available.

5 Planning Framework

5.1 Commonwealth Government

5.1.1 Environmental Protection and Biodiversity Conservation Act, 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection to matters of National Environmental Significance (NES) which include:

- world heritage properties;
- Ramsar wetlands of international importance;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- nuclear actions;
- Commonwealth marine environment; and
- any additional matters specified by regulation.

The proposed development will not affect any matters of NES, and therefore referral to Department of Environment and Heritage is not required.

5.2 State Government

5.2.1 Environmental Planning and Assessment Act, 1979

In July 2006, Tooheys Brewery received single site wide planning approval from the NSW Department of Planning under Part 3A of the *Environmental Planning & Assessment Act*, 1979 (EP&A Act) for the recent Project Key upgrade as well as ongoing operations at the brewery.

Any work which is inconsistent with this approval must be assessed as a modification of the Minister's approval under Section 75W of the EP&A Act, requiring the preparation of an Environmental Assessment. The Director General Requirements for the Environmental Assessment were issued on 29 July 2009, and are appended to this EA as Appendix A.

5.2.2 Protection of the Environment and Operations Act 1997

The *Protection of the Environment Operations Act, 1997* (POEO Act) establishes a system of environment protection licensing for 'scheduled' activities with the potential to have a significant impact on the environment. Schedule 1 of the POEO Act lists the activities requiring an EPA licence including:

Breweries or distilleries that produce alcohol or alcoholic products and that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.

Tooheys brewery produces in excess of 20,000 tonnes per annum and therefore qualifies as a scheduled activity and as such is subject to an Environment Protection Licence (EPL number 1167). The Licence however, does not specify any limits for emissions to air at the site.

Schedule 1 of the POEO Act also lists "electricity works" as an activity requiring a license including:

- "general electricity works", meaning the generation of electricity by means of electricity plant that uses, any energy source other than wind power or solar power with the capacity to generate more than 30MW of electrical power; or
- "metropolitan electricity works (internal combustion engines)", meaning the generation of electricity with the capacity to burn more than 3 megajoules of fuel per second.

While the plant generates less than 30MW of electrical power, it has the capacity to burn in excess of 3 MJ of natural gas per second and will therefore require a variation to the existing licence to permit Tooheys to undertake metropolitan electricity works. Further

discussion of the POEO Act and Regulation is presented in Section 8, Air Quality Assessment.

6 Consultation

Consultation was undertaken with DECCW and DoP. A letter was sent to Auburn Council seeking their comment, but no comments were received. Copies of all consultation is presented in Appendix B.

Given the nature of the proposed facility, community consultation was not undertaken as part of this EA process.

Key issues arising from the consultation are presented below in Table 1.

Table 1 Key Issues arising from Consultation

Issue	Stakeholder	How / Where Addressed
Project Description		
Capacity of the cogeneration plant in terms of megajoules of fuel burnt per second	DECCW	Section 8 – Air Quality Assessment
Diagram showing location of the cogeneration plant, including the cogeneration engine and stack	DECCW	Figures 3 and 4
Noise		
Provide information that will demonstrate whether the noise levels from premises will comply with the DECCW's NSW industrial Noise Policy. At this point modelling would not be required – previous information demonstrated compliance, based on previous documents, the engines being housed with noise mitigation. Similar details need to be provided	DECCW	Section 9 – Noise Assessment
Include construction, operational and traffic noise	DoP	Section 2 and Section 9 – Noise Assessment
Air		
Engine emission rates (NOx) compared to relevant standards	DECCW	Section 8 – Air Quality Assessment
"NOx Policy Compliance" Report should be submitted as part of an attachment. The report should also be used to demonstrate that ground level concentration and/or local impacts will not be affected by the installation of the two engines	DECCW	Section 8 – Air Quality Assessment
Include air, odour and greenhouse gas emissions	DoP	Section 2 and Section 8 – Air Quality Assessment
Greenhouse		
Brief statement of the local greenhouse benefits	DECCW	Section 8 – Air Quality Assessment
Hazards		
Include a Preliminary Hazard Analysis (PHA) of the project including a detailed assessment of the off-site risks.	DoP	Appendix C – Preliminary Hazard Assessment

7 Environmental Assessment

The environmental assessment provides an assessment of the potential environmental impacts of the proposed cogeneration facility.

Table 2 presents a summary of the potential environmental impacts associated with all relevant issues associated with the brewery upgrade. The table also assigns a level of significance to the issue based on the extent and likelihood of:

- potential impact with consideration of mitigation or management measures; and
- potential community or regulatory concern.

The three levels of significance are:

High environmental significance:	A high likelihood of adverse environmental impact or the potential environmental impact is of a severe nature. These issues are key decision making factors, and require detailed and specific investigations to adequately characterise the nature of the impact and to determine appropriate mitigation or management measures which may still result in significant residual impact.
Moderate environmental significance:	Some likelihood of adverse environmental impact however the potential environmental impact is predicted to be of a manageable nature. These issues are likely to be important decision making factors, and may require investigations to characterise the nature of the impact. Non-standard mitigation and management measures, or special tailoring of standard measures, are likely to be required to ensure impacts are minimised to acceptable levels.
Low environmental significance:	Low likelihood of adverse environmental impact and the potential environmental impact is negligible or of a manageable nature. These issues are not likely to be key decision making factors, and are unlikely to require investigations. Standard mitigation and management measures may be applied.

No issues of high or moderate environmental significance have been identified. This reflects the fact that the modification has been sought to primarily improve the environmental performance of the site including decreased grid electricity consumption and greenhouse gas emissions.

Table 2 Environmental Risk Analysis

Issue	Potential Environmental Impact	Further Assessment
Contamination	Petroleum hydrocarbon contaminated soil and groundwater has been identified on site. This is consistent with the historical and current industrial use of the site including historical underground fuel storage. The soil contamination identified was limited to hard stand locations which will not be disturbed during the upgrade. No subsurface works will be performed as part of this project - all equipment installed on top of existing slabs and utilites will be connect to existing underground services. **Low environmental significance**	**No Further Assessment.** No management measures proposed.
Local Air Quality	The original air quality assessment for Tooheys Brewery showed that PM_{10} was the critical pollutant in terms of local air quality. The proposed cogeneration facility will result in a net decreased in PM_{10} emissions from the site and hence not likely result in any greater impact than Project Key as approved. For NO_2 and CO, the original assessment showed that ground level concentrations were well below the relevant criteria. The cogeneration proposal is not likely to elevate concentrations above the criteria. **Low environmental significance.**	**More detail provided in Section 8.** Assessment includes consideration of *Protection of the Environment Operations (Clean Air) Regulation 2002.*
Regional Air Quality	The NOx emissions from the site will likely increase compared to the Project Key as approved due to the increased consumption of natural gas as well as the increased NOx generation rate of cogeneration plant compared to boilers. However, due to increased efficiency of the new boilers and the use of the low emission configuration for the cogeneration, the total NOx emissions will be less than Pre-Project Key such that the overall upgrade including cogeneration will be “NOx neutral”. **Low environmental significance.**	**More detail provided in Section 8.** Assessment includes consideration of *Protection of the Environment Operations (Clean Air) Regulation 2002.*
Greenhouse Gas	The natural gas consumption of the brewery will increase as a result of the proposed cogeneration facility. Therefore the greenhouse gas emissions directly produced by Tooheys Brewery (Scope 1 emissions) will increase. However, as a result of the electricity production on site, the electricity sourced from the grid and associated indirect emissions (Scope 2 emissions) will decrease. Overall the project will provide a total net reduction in greenhouse gas emissions	**More detail provided in Section 8.**

	associated with the heating plant. **Low environmental significance.**	
Odour	Odour from the brewhouse will not change as a result of the proposed co-generation facility. **Low environmental significance.**	**No Further Assessment.** No management measures proposed.
Noise	Noise modelling was undertaken of the proposed cogeneration plant and associated equipment to ensure that noise critieria, as set by DECCW under the existing Environmental Protection Licence L1167, is not exceeded at the Tooheys site boundary and nearest sensitive receiver (31 Gooreen St, Lidcombe). The assessment and results are presented in Appendix C. The assessment indicates that operational noise levels from the proposed cogeneration plant under both primary operation modes will comply with the noise criteria at both the site boundary of the Tooheys Brewery and at 31 Gooreen Street. As such, it is predicted that the cogeneration plant will not contribute to causing overall noise levels from Tooheys Brewery to exceed the EPL Licence. However, the noise levels from the cogeneration plant are dependent on the final equipment selection and locations. Provided that the as-installed equipment noise levels comply with the maximum noise levels given in Table 1, the noise impact of the proposed cogeneration plant at Tooheys Brewery, Lidcombe, is assessed to be low. The construction of the facility will require 2-3 standard shipping container deliveries to site. This is considered to have a low impact in terms of construction and traffic noise. **Low environmental significance.**	**More Detail Provided in Section 9.** Noise control measures required in the specification (Rev F) for the generator enclosure to be assured. Noise levels from the cooling tower, generator dump radiator and absorption chiller should be controlled to not exceed the noise criteria levels.

Hazards and Risk	The Preliminary Hazard Analysis (PHA) has found that the operation of the proposed facility meets the criteria laid down in HIPAP No. 4 Risk Criteria for Land Use Safety Planning and would not cause any risk, significant or minor, to the community, with the recommended safeguards in place. Furthermore, the site's proposed operations have not been found to be an offensive or hazardous industry under the DoP guidelines. Through the PHA, it has been determined that the proposed facility meets all the safety requirements stipulated by DoP and hence would not be considered to be an offensive or hazardous development. **Low environmental significance.**	**Further Assessment Provided in Section 10. Full PHA provided in Appendix C.** Management measures including operating procedures and regular inspections are described in Section 10.
Flooding	As the project is within the existing built form, the upgrade will not change or impact on the current overland flow paths regime. **Low environmental significance.**	**No Further Assessment.** No management measures proposed.
Stormwater	The proposed facility does not include structures or buildings that would be expected to significantly alter overland flows or the amount of or quality of stormwater runoff. **Low environmental significance.**	**No Further Assessment.** No management measures proposed.
Traffic	The co-generation facility will not alter the capacity or production of the brewery. No increase in traffic generation is expected. The construction of the facility will require 2-3 standard shipping container deliveries to site. **Low environmental significance**	**No Further Assessment.** No management measures proposed.
Visual Amenity and Landscape	The new plant is to be substantially installed inside the Engine Room as per the site layout (Figure 4). The equipment will be installed in an area where two redundant steam boilers are currently located. These boilers will be removed to make space for the new plant. The only items of plant to be installed outside of the existing building will be a cooling tower and an exhaust silencer, both of which will be below the current roofline of surrounding buildings. **Low environmental significance**	**No Further Assessment** No management measures proposed.

Heritage	The Wangal clan of the Eora Aboriginal tribe were the original inhabitants of the Auburn area. The site has, however, been significantly modified and it is unlikely for Indigenous artefacts to remain. The brewery site forms part of a site occupied by the Sydney Meat Preserving Company between 1869 and 1955. The *Auburn Heritage Study* (Schwager, 1996) identified the meat preserving works site as being of archaeological significance, however, the buildings and structures have been removed and the ground surface disturbed. The site is not formally identified in Auburn Council's register of archaeological sites and potential archaeological sites. The canalisation of Haslams Creek, running along the western boundary of the site, is a non-Indigenous heritage item of local significance, listed in Schedule 2 of the Auburn LEP. None of the works will physically impact upon the canalisation of Haslams Creek. The proposed facility is not expected to impact any of the heritage items within the vicinity of the site **Low environmental significance.**	**No Further Assessment** No management measures proposed
Flora and Fauna	A search of the NSW Government's BioNet database was carried out in September 2006 as part of the Toohey's Upgrade EA (Arup 2006). There are no previous recordings of any threatened species on the site. The Tooheys brewery is a highly modified site with negligible potential for containing threatened species. The proposed works are contained within the built form of the brewery and would not involve any removal of landscaping **Low environmental significance.**	**No Further Assessment.** No management measures proposed.
Waste Management	The proposed cogeneration facility will not produce an increase in waste volumes or generate any new waste types. The proposal does not involve any demolition or excavation **Low environmental significance.**	**No Further Assessment** No management measures proposed.
Energy Consumption	Energy requirements for the brewery are supplied by grid electricity, natural gas fired boilers for heating and small amounts of LPG for on site vehicles. The proposed cogeneration facility will increase the natural gas consumption of the	**No Further Assessment** – Improving energy efficiency is the objective of the proposal. Natural Gas Consumption is discussed in additional detail in

	heating plant on site compared to Project Key as approved. This is due to the additional natural gas required to deliver the electrical energy in addition to the mechanical energy required from the plant. However, compared to the old inefficient boilers prior to Project Key, natural gas consumption at the site is still decreased. The proposed co-generation facility will reduce peak demand on the site by over 2MW. This will reduce grid electricity consumption by 15,000 MWh per year and save 9,500 tonnes of greenhouse gas emissions a year. **Low environmental significance.**	Section 8. No management measures proposed.
Water Consumption	Water is supplied to the site by a Sydney Water mains connection from Nyrang Street. Water consumption within the brewing process is the predominant use of water onsite (73% of the total water consumption). As part of Project Key, Tooheys implemented a range of water conservation measures to bring the current ratio of water consumption to beer production down to 3.5 kL/kL. Water use for the proposed co-generation facility is expected to be 1l/s, due to the evaporation load on the cooling tower. This represents an increase of approximately 2% based on 300 days production per year. **Low environmental significance.**	**No Further Assessment** No management measures proposed.
Socio-Economic	The site forms part of a larger industrial cluster surrounded by the residential suburbs of Lidcombe and Auburn. The project would increase the resource efficiency of the brewery, making the site more cost effective for Tooheys. The project will not affect employment figures at the brewery. **Low environmental significance.**	**No Further Assessment** No management measures proposed.

8 Air Quality & Greenhouse Gas

8.1 Cogeneration and Air Quality

Cogeneration involves the combustion of natural gas to produce electrical and mechanical energy. The generation of electricity from cogeneration offsets electricity which would otherwise be sourced from the electricity grid.

In NSW, electricity generation for the grid is dominated by centralised coal fired power plants located some distance from the site of end use. Centralised energy generators produce a range of pollutants, but generally away from populated areas and outside of the Sydney Illawarra air shed. When decentralised cogeneration plants are located adjacent to the end user of the energy there are a number of efficiencies which occur in the form of reduced transmission and distribution losses and utilisation of waste heat as mechanical energy. However, the disadvantage is that there are a range of pollutants that are emitted close to populated areas which must be addressed.

For combustion of natural gas in cogeneration plants the main pollutants include nitrogen oxides (NO_x), Nitrogen dioxide (NO_2), carbon monoxide (CO), carbon dioxide (CO2), particulates (TSP and PM_{10}).

8.1.1 Local Air Quality

Of these, NO_2, CO and particulates have the potential to result health impacts at elevated levels when directly inhaled. Therefore the impacts of any NO_2, CO and particulates generated by the brewery will be greatest at sensitive receiver locations closest to the brewery.

8.1.2 Regional Air Quality

In terms of regional air quality, the main concern is the generation of NO_x emissions as the precursor to ozone generation. Ozone is formed in summer by reactions between NO_x and volatile organic compounds (VOCs) produced which may be produced anywhere in the regional air shed. Ozone is a respiratory irritant under high exposure levels. During periods of high ozone concentration, hospital admissions for asthma and respiratory conditions increase.

The Sydney Illawarra air shed has a particular issue with ozone, regularly exceeding health based guidelines for ambient concentration of ozone since 1995. The NSW Department of Environment and Climate Change has raised particular concern with the cumulative impacts of increased numbers of small scale cogeneration plants located within the Sydney Illawarra air shed in producing NO_x and further exacerbating the issue of ozone concentrations.

8.1.3 Greenhouse Gas

In addition carbon dioxide generated by the combustion of natural gas is a greenhouse gas. However, the electricity supplied by the cogeneration plan offsets electricity that would otherwise be sourced from the main electricity grid with associated greenhouse gas impacts which currently occur elsewhere at the site of electricity generation. Greenhouse gas impacts are considered on a global scale and therefore the efficiencies associated with the proposal will result in a net reduction of global greenhouse gas emissions. This is further discussed in Section 8.3.4.

8.2 Legislative Context

8.2.1 Protection of the Environment Operations Act 1997 (POEO Act)

The *Protection of the Environment Operations Act, 1997* (POEO Act) establishes a system of environment protection licensing for 'scheduled' activities with the potential to have a significant impact on the environment. Schedule 1 of the POEO Act lists the activities requiring an EPA licence including:

Breweries or distilleries that produce alcohol or alcoholic products and that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.

Tooheys brewery produces in excess of 20,000 tonnes per annum and therefore qualifies as a scheduled activity and as such is subject to an Environment Protection Licence (EPL number 1167). The Licence however, does not specify any limits for emissions to air at the site.

Schedule 1 of the POEO Act also lists "electricity works" as an activity requiring a license including:

- "general electricity works", meaning the generation of electricity by means of electricity plant that uses, any energy source other than wind power or solar power with the capacity to generate more than 30MW of electrical power; or
- "metropolitan electricity works (internal combustion engines)", meaning the generation of electricity with the capacity to burn more than 3 megajoules of fuel per second.

While the plant generates less than 30MW of electrical power, it has the capacity to burn in excess of 3 MJ of natural gas per second and will therefore require a variation to the existing licence to permit Tooheys to undertake metropolitan electricity works. Details of the natural gas combustion are discussed in Section 8.3.1.

Furthermore, Part 5.4 of the POEO Act deals specifically with air pollution including the obligation that occupiers of non-residential premises:

- do not cause air pollution by failing to operate or maintain plant, carry out work or deal with materials in a proper and efficient manner and comply with any air emission standards prescribed by regulations; and
- take all practicable means to prevent or minimise air pollution (even where standards for a particular pollutant are not prescribed by regulation).

8.2.2 Protection of the Environment Operations Act (Clean Air) Regulation 2002

Part 4 of the *Protection of the Environment Operations Act (Clean Air) Regulation, 2002* deals with emission of air pollutants from industrial activities and plant. In particular, the Regulation sets maximum limits on emissions from activities and plant for a number of substances, including oxides of nitrogen, smoke, solid particles, chlorine, dioxins, furans and heavy metals at the point of discharge. The standards are based on levels that are achievable through the application of reasonably available technology and good environmental practices.

The Regulation requires that when any emission unit operated in the Sydney Greater Metropolitan Area is replaced, the replacement emission unit becomes subject to Group 6 emission standards.

The emission limits for Group 6 emission units are presented in Table 3 below.

Table 3 Applicable POEO (Clean Air) Regulation Standards of Concentration

Pollutant	Emission Unit	Standard of Concentration[2]
Solid particles (Total)	Any activity or plant	50 mg/m^3
Nitrogen dioxide (NO_2) or Nitric oxide (NO) or both, as NO_2 equivalent	Any boiler operating on gas	350 mg/m^3
	Stationary reciprocating internal combustion engines	450 mg/m^3

[1] Type 1 substances: antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements

Type 2 substances: beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements

[2] at standard temperature and pressure, dry basis, 3% O_2

8.2.3 Ambient Air Quality National Environment Protection Measure (NEPM)

In June 1998 the NEPC agreed to set uniform standards for ambient air quality (ambient air does not include indoor air). The standards contained in the NEPM for ambient air quality are listed in Table 4 below.

Table 4 NEPM Standards for Ambient Air Quality

Pollutant	Averaging Period	Maximum Concentration	Goal within 10 years Maximum Allowable Exceedances
Carbon monoxide (CO)	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide (NO_2)	1 hour 1 year	0.12 ppm 0.03 ppm	1 day a year none
Photochemical oxidants (as ozone)	1 hour 4 hours	0.10 ppm 0.08 ppm	1 day a year 1 day a year
Sulfur dioxide (SO_2)	1 hour 1 day 1 year	0.20 ppm 0.08 ppm 0.02 ppm	1 day a year 1 day a year none
Lead	1 year	0.50 $\mu g/m^3$	none
Particles as PM_{10}	1 day	50 $\mu g/m^3$	5 days a year

8.2.4 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

The Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (AMMAAP) lists the methods that are to be used to model and assess emissions of air pollutants from stationary sources in NSW and is referred to in Part 4 of the *Protection of the Environment and Operations (Clean Air) Regulation, 2002*. The assessment criteria prescribed within the AMMAAP refer to ground level concentrations at sensitive receptors and therefore take into account site-specific features such as meteorology and background air quality, and therefore protect against adverse air quality impacts in the areas surrounding he premises. The criteria are presented in Table 5 below.

Table 5 NSW DECCW Impact Assessment Criteria

Pollutant	Averaging Period	Concentration	
		ppm	µg/m^3
Nitrogen dioxide (NO_2)	1 hour	12	246
	Annual	3	62
Photochemical oxidants (as ozone)	1 hour	10	214
	4 hours	8	171
PM_{10}	24 hours	-	50
	Annual	-	30
Total suspended particulates (TSP)	Annual	-	90
		g/m²/month	g/m²/month
		ppm	mg/m^3
Carbon monoxide (CO)	15 minutes	87	100
	1 hour	25	30
	8 hours	9	10

8.2.5 DECCW Interim NOX Policy for Cogeneration in Sydney and the Illawarra

Gas fired cogeneration can be one of the most greenhouse friendly forms of electricity generation using fossil fuels. However, cogeneration has the potential to adversely affect local and regional air quality as it can emit significant amounts of oxides of nitrogen (NO_x). The NO_x Policy for Cogeneration in Sydney and the Illawarra sets out how DECCW is currently dealing with emissions from cogeneration proposals.

Specifically to comply with the policy all new cogeneration must:

- Demonstrate no adverse impact on human health or the environment in accordance with the requirements of the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
- Proposals in Sydney and the Illawarra should either be NOx neutral or required to achieve Best Available Technique (BAT) emission performance.
- Proposals outside of Sydney and the Illawarra are required to meet the Protection of the Environment (Clean Air) Regulation 2002 NO_x emission limits of 450 mg/m³ for internal combustion engines, and 70 mg/m³ for gas turbines.

Proposals can be NO_x neutral by either operating within existing approved capacity for NO_x emissions, and/or achieving an equivalent emission reduction off-site.

8.3 Impact Assessment

The impact assessment presented below discusses air quality impacts for three different scenarios:

Pre-Project Key: Operation of the brewery prior to the implementation of Project Key when the heating plant was comprised of the old inefficient natural gas boilers

Project Key as Approved: Operation of the brewery as approved by the Department of Planning in June 2006 with a heating plant comprised of

Project Key with Cogeneration Modification: Operation of the brewery as approved by the Department of Planning in June 2006 modified by the installation of a 2MW cogeneration facility as part of the heating plant.

8.3.1 Natural Gas Consumption

The Project Key upgrade has improved the efficiency of the entire brewery site such that the average steam requirement is expected to be reduced by 1MW. The new boilers are also much more efficient than the old boilers such that Project Key will result in an approximate 13% reduction in natural gas consumption.

The cogeneration plant will increase the consumption of natural gas compared to Project Key as approved by approximately 15%. This is because a portion of the natural gas will be used to generate electricity. However, the total natural gas consumption will still be less than before Project Key.

A summary of the natural gas consumption predicted is presented in Table 6.

Table 6 Natural Gas Consumption

Plant	$E_{delivered}$	Efficiency	$E_{required}$	Natural Gas Combustion	
	MW		MW	GJ/day	kg/24hrs
Pre-Project Key					
Old Boilers	16	0.72	22.2	1,920	43.2
Project Key as Approved					
New boilers	15	0.78	19.2	1,662	37.4
Project Key with Cogeneration Modification					
New boilers	14[1]	0.78	17.9	1,551	34.9
Cogeneration (mechanical)	2	0.82	4.9	423	9.5
Cogeneration (electrical)	2				
Total Cogen+Boilers System	18	0.82	22.1	1,913	44.4

[1] Cogeneration produces 1MW of steam, thus load on boilers will be reduced.

8.3.2 Local Air Quality

The 2007 Project Key air quality assessment addressed carbon monoxide, nitrogen dioxide and PM_{10} impacts at sensitive receivers through dispersion modelling. The assessment identified the nearest sensitive receptors at 200m to the south east of the site and 450m to the south west west of the site. A summary of the results of the 2007 assessment is presented in **Error! Reference source not found.** below.

Table 7 Results of 2007 Air Quality Assessment for PM10, NO2 and CO

Pollutant	Averaging Period	Predicted Max Ground Level Concentration at Sensitive Receiver (µg/m³)	Background Concentration (µg/m³)	Criteria (µg/m³)
PM_{10}	24 hours	0.25	49.72	50
NO_2	1 hour	16.4	135	246
CO	15 minutes	14.7	NA	100,000
	1 hour	13.8	6,300	30,000
	8 hours	5.77	3,000	10,000

From these results it can be seen that PM_{10} was the most critical pollutant and that NO_2 and CO were well below the relevant criteria. NO_2 and CO have therefore not been considered further in this assessment from a local air quality perspective.

Total PM_{10} emissions are likely to decrease as a result of the cogeneration proposal due to the relatively low PM_{10} emission factor for natural gas fired engines. It is therefore considered unlikely that PM_{10} impacts will increase compared to the Project Key as Approved and will likely decrease compared to the Pre-Project Key scenario. This comparison is presented in Table 8 below.

Table 8 PM_{10} Emission Comparison

Plant	PM_{10}	
	Emission Factor (kg/ t gas)	Emission Rate (g/day)
Pre-Project Key		
Old Boilers	0.160[1]	6.95
Pre-Project Key		
New boilers	0.160[2]	6.02
Project Key with Cogeneration Modification		
New boilers	0.160[2]	5.62
Cogen (mech)	0.00185[3]	0.00172
Cogen (elec)		
Total Cogen System	0.131[3]	5.64

[1] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Uncontrolled)

[2] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Low NO_x Burner)

[3] Taken from NPI tables: Uncontrolled 4-stroke natural gas engines

8.3.3 Regional Air Quality

Cogeneration has a relatively high NO_x emission rate compared to boiler technology as a result of the higher temperatures. To address this, the generator to be installed will be configured to run in a low emission mode (250 mg/Nm3). Notwithstanding the overall emissions of NO_x will likely increase compared to Project Key as approved due mostly to the increased natural gas consumption. However, total NO_x will decrease compared to Pre-Project key scenario. In effect, Project Key as modified is considered to be "NO_x Neutral". Tooheys has undertaken consultation with the DECC Air Technical Advisory Services branch responsible for air quality policy to this effect as well as the Sydney Industry group responsible for issuing and amendments to Tooheys EPL. The DECCW has advised that no changes to existing site licenses will be required.

Table 9 NOx Emission Comparison

Plant	NO_x	
	Emission Factor (kg/ kg gas)	Emission Rate (kg/day)
Pre-Project Key		
Old Boilers	2.16[1]	93.3
Project Key as Approved		
New boilers	1.08[2]	40.4
Project Key with Cogeneration Modification		
New boilers	1.08[2]	37.7
Cogen (mech)	5.41[3]	51.5
Cogen (elec)		
Total Cogen System	2.07	89.2

[1] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Uncontrolled)

[2] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Low NOx Burner)

[3] Calculated from supplier specifications for flue gas concentration of 250 mg/m³

8.3.4 Greenhouse Gas Emissions

As presented in Section 8.3.1, the natural gas consumption of the brewery will increase as a result of the proposed cogeneration facility. Therefore the greenhouse gas emissions directly produced by Tooheys Brewery (Scope 1 emissions) will increase as shown in Table 10.

Table 10 GHG Emission Comparison

Plant	GHG	
	Emission Factor (kg/ kg gas)	Emission Rate (kg/day)
Pre-Project Key		
Old Boilers	51.4[1]	98.7
Pre-Project Key		
New boilers	51.4[1]	85.4
Project Key with Cogeneration Modification		
New boilers	51.4[1]	79.7
Cogen (mech)	51.4[1]	9.4
Cogen (elec)		
Total Cogen System	23.5	89.1

[1] Taken from National Greenhouse Accounts (NGA) Factors, June 2009, Natural gas distributed in a pipeline

[2] Offset based on National Greenhouse Accounts (NGA) Factors, June 2009, Indirect (scope 2) emission factors for consumption of purchased electricity from the grid, New South Wales and Australian Capital Territory

However, as a result of the electricity production on site, the electricity sourced from the grid and associated indirect emissions (Scope 2 emissions) will decrease. Assuming the cogeneration plant is run at capacity over a 24 hour period, this will result in an offset of 48 MWh per day. Based on current grid based emission intensity this results in a decrease of 42.7 t CO2-e per day.

Taking into account the emission offset from grid electricity, the overall impact of the proposed facility is a 47% decrease compared with the Project Key approved heating plant and a 55% decrease compared with Pre-Project Key heating plant as presented in Table 10.

8.4 Conclusion

8.4.1 Natural Gas Consumption

The proposed cogeneration facility will increase the natural gas consumption of the heating plant on site compared to Project Key as approved. This is due to the additional natural gas required to deliver the electrical energy in addition to the mechanical energy required from the plant. However, compared to the old inefficient boilers prior to Project Key, natural gas consumption at the site is still decreased.

8.4.2 Local Air Quality

The Air Quality Assessment undertaken for Tooheys Brewery as part of the Environmental Assessment for Project Key showed that PM10 was the critical pollutant in terms of local air quality impacts from the site. The proposed cogeneration facility will result in a net decreased in PM10 emissions from the site and hence not likely result in any greater impact than Project Key as approved.

For NO2 and CO, the original assessment showed that ground level concentrations were well below the relevant criteria. The cogeneration proposal is not likely to elevate concentrations above the criteria.

8.4.3 Regional Air Quality

The NOx emissions from the site will likely increase compared to the Project Key as approved due to the increased consumption of natural gas as well as the increased NOx generation rate of cogeneration plant compared to boilers. However, due to increased efficiency of the new boilers and the use of the low emission configuration for the cogeneration, the total NOx emissions will be less than Pre-Project Key such that the overall upgrade including cogeneration will be "NOx neutral".

8.4.4 Greenhouse Gas Emissions

The total natural gas consumption on site will increase as a result of the modification, increasing direct (Scope 1) greenhouse gas emissions from the site compared to Project Key as approved. However, the cogeneration proposal will also provide electricity to the site, offsetting grid electricity and provide a total net reduction in greenhouse gas emissions associated with the heating plant.

8.5 Summary

A summary of emissions for Pre-Project Key, Project Key as Approved and Project Key with cogeneration is presented below.

Table 11 Emission Summary

Plant	NO_x		GHG		PM_{10}	
	EF (kg/ kg gas)	Rate (kg/day)	EF ($kgCO_2$-e GJ)	Rate (tCO_2-e /day)	EF (kg/ t gas)	Rate (g/day)
Pre-Project Key						
Old Boilers	2.16[1]	93.3	51.4[4]	98.7	0.160[1]	6.95
Project Key as Approved						
New boilers	1.08[2]	40.4	51.4[4]	85.4	0.160[2]	6.02
Project Key with Cogeneration Modification						
New boilers	1.08[2]	37.7	51.4[4]	79.7	0.160[2]	5.62
Cogen (mech)	5.41[3]	51.5	51.4[4]	21.8	0.00185[5]	0.0176
Cogen (elec)						
Total Cogen System	2.01	89.2	23.5	44.9	0.131[6]	5.64

[1] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Uncontrolled)

[2] Taken from NPI tables: Wall fired natural gas, <30MW heat input (Low NOx Burner)

[3] Calculated from supplier specifications for flue gas concentration of 250 mg/m³

[4] Taken from National Greenhouse Accounts (NGA) Factors, June 2009, Natural gas distributed in a pipeline

[5] Taken from NPI tables: Uncontrolled 4-stroke natural gas engines

9 Noise

9.1 Assessment Criteria

The Tooheys Brewery at Lidcombe currently operates under noise criteria set by the Department of Environment and Climate Change (DECC) under Environmental Protection License L1167.

Operational noise limits for Tooheys Brewery are given in Clause L6 of License 1167, and contain limits for noise at the site boundary of Tooheys Brewery and limits for noise at the site boundary of any residential receiver. The criteria at the site boundary of Tooheys Brewery contain separate provisions for the time periods 7 am to 10 pm and 10 pm to 7 am, as detailed below. A glossary of acoustic terminology is provided at the end of this section.

L6.1 Noise from the premises must not exceed:

(a) An LA10 (15-minute) noise emission criterion of 70 dB(A) (7 am to 10 pm); and

(b) At all other times, an LA10 (15-minute) noise emission criterion of 65 dB(A).

5 dB(A) must be added to the measured level if the noise is substantially tonal or impulsive in character.

L6.2 Noise from the premises is to be measured at any point within 1 m of the plant boundary to determine compliance with condition L6.1

L6.3 Noise from the premises must not exceed an LA10 (15-minute) noise emission criterion of 50 dB(A) at all times.

5 dB(A) must be added to the measured level if the noise is substantially tonal or impulsive in character

L6.4 Noise from the premises is to be measured at any point within 1 m of any residential boundary or other noise sensitive areas such as schools, hospitals etc. in the vicinity of the premises to determine compliance with condition L6.3.

The nearest noise-sensitive receiver to the site is the residential property at 31 Gooreen Street, Lidcombe. This receiver will be used to determine compliance with Clauses L6.3 and L6.4.

The criteria in L1167 apply to all noise sources from the premises, i.e. noise from existing Tooheys operations in addition to noise from the proposed cogeneration plant.

The proposed cogeneration plant therefore represents a new noise source. It is therefore necessary to control noise from the cogeneration plant, such that the overall noise criteria are achieved from all noise sources.

This involves controlling noise from the cogeneration plant to be at least 10 dB(A) below the noise criteria given in L1167, so that the cogeneration plant does not contribute to the overall plant noise level from the Tooheys Brewery.

Accordingly, the applicable noise criteria for the cogeneration plant are:

- 60 dB L_{A10} at the site boundary of Tooheys Brewery (7 am to 10 pm)
- 55 dB L_{A10} at the site boundary of Tooheys Brewery (10 pm to 7 am)
- 40 dB L_{A10} at the site boundary of 31 Gooreen Street, Lidcombe (at all times).

Given that the cogeneration plant may operate at any time of the day, the limiting noise criteria are 55 dB(A) at the site boundary of the Tooheys Brewery and 40 dB(A) at the site boundary of 31 Gooreen Street.

9.2 Predicted Noise Levels

9.2.1 Plant and Locations

The proposed cogeneration plant consists of the following noise sources:

- Radiated noise levels from the 2.0 MW generator enclosure and air inlets/outlets
- Noise from the generator exhaust flue
- Noise from the cooling tower (15 kW motor power)
- Noise from the absorption chiller

Some of these sources (generator enclosure, enclosure fresh air inlet, absorption chiller) are to be located within the Engine Room of the Tooheys Brewery, which is located approximately 260 m to the west of the nearest noise sensitive receiver (31 Gooreen Street).

However, some noise sources (generator exhaust flue, generator air exhaust, cooling tower) are shown on the drawings (Revision D, issued by SDA Engineering dated 19 June 2009) to be located externally, in the Filtration Road of the Tooheys Brewery. These sources potentially represent the most significant noise sources with respect to possible noise impacts on surrounding noise-sensitive receivers.

9.2.2 Source Noise Levels

The Revision F specification requires the generator enclosure and exhaust system to reduce noise levels from the generator enclosure to 75 dB(A) at a distance of 7 m. Octave-band noise spectra for the generator noise sources were adopted from Laymon Miller's *Noise Control for Buildings and Manufacturing Plants*, and normalised to result in a noise level of 75 dB(A) at 7 m.

No noise requirements for other items of plant are contained in the specification. For these items of plant, equipment noise levels have been predicted using empirical formulae presented in Laymon Miller's *Noise Control for Buildings and Manufacturing Plants* (cooling tower and absorption chiller).

Noise levels used for predictions are presented in Table 12 below:

Table 12 Equipment Sound Power Levels used for Prediction

Equipment	Octave Band Sound Power Levels, dB re 1 pW								Noise Level at 7 m
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Generator – Enclosure Casing	115	113	104	102	97	95	93	86	75
Generator – Exhaust Flue	99	96	94	90	89	85	77	69	75
Cooling Tower	92	90	88	87	85	86	80	73	63
Absorption Chiller	90	90	90	90	89	86	83	78	66

9.2.3 Prediction Methodology and Propagation Conditions

Noise levels from the proposed cogeneration plant were predicted to the site boundary and to the nearest noise-sensitive receiver, 31 Gooreen Street, using the CONCAWE noise propagation model. CONCAWE was developed to predict noise levels from large industrial sites at long (greater than 100 m) distances from the source, and allows for long-distance propagation effects on noise from the cogeneration plant to be accounted for, such as refraction of sound by meteorological effects and atmospheric absorption.

These effects are generally only present at distances greater than 100 m, and may cause significant variation in noise levels e.g. between “upwind” or “downwind” sound propagation, the difference in noise levels may be 5-10 dB(A).

Noise levels from the cogeneration plant were predicted for two operational modes:

- “Trigeneration Mode” (generator, cooling tower and absorption chiller operational)
- “Cogeneration Mode” (generator only operational)

These modes account for variation in the noise generation from the cogeneration plant depending on the demands of the Tooheys Brewery for heat, power or chilled water.

The source-receiver distance between the proposed cogeneration plant and 31 Gooreen Street is approximately 260 m, with 31 Gooreen Street being approximately due east of the cogeneration plant.

The intervening terrain is generally concrete or road surfaces and is therefore acoustically “hard”, but is obstructed by the buildings of the Tooheys site such that there is no direct line of sight between the cogeneration plant and noise-sensitive receivers.

This will result in screening of the noise levels from the cogeneration plant, which has been taken into account in the noise prediction model, as well as reflections of sound from the cogeneration plant from the façades of adjacent buildings on the Tooheys site.

Wind roses for Sydney Olympic Park, at Homebush Bay to the north-east of Tooheys Brewery, were used to determine the prevailing wind conditions for meteorological effects. The worst-case wind condition for noise propagation was found to be a wind of approximately 7.5 m/s from the west (i.e. blowing from source to receiver, so-called “downwind” conditions), which occurs frequently during winter months.

This results in a “Category 6” CONCAWE meteorological propagation condition, which corresponds to the greatest increase in noise levels from the source to the receiver compared to “neutral” (e.g. still) conditions.

Accordingly, the predicted noise levels from the cogeneration plant are expected to be the “worst-case” noise levels, and noise levels under other meteorological conditions are expected to be lower than in these predictions.

Predicted noise levels at the site boundary of Tooheys Brewery and at the site boundary of 31 Gooreen Street are presented in Table 13 below:

Table 13 Predicted Noise Levels at Noise Sensitive-Receivers, dB re 20 µPa

Operational Mode	Receiver Location	Predicted Noise Level, dB(A)	Limiting Noise Criterion (Section Error! Reference source not found.)	Complies with Criterion?
Trigeneration	Site Boundary of Tooheys Brewery	41 dB(A)	55 dB(A)	Yes
	31 Gooreen Street, Lidcombe	40 dB(A)	40 dB(A)	Yes
Cogeneration	Site Boundary of Tooheys Brewery	40 dB(A)	55 dB(A)	Yes
	31 Gooreen Street, Lidcombe	39 dB(A)	40 dB(A)	Yes

9.3 Assessment of Effects

Operational noise levels from the proposed cogeneration plant under both primary operation modes are predicted to comply with the noise criteria at both the site boundary of the Tooheys Brewery and at the site boundary of the nearest noise-sensitive receiver, 31 Gooreen Street, Lidcombe.

Therefore, it is predicted that the cogeneration plant will not contribute to causing overall noise levels from Tooheys Brewery to exceed the Licence L1167 criteria at either the site boundary of the Tooheys Brewery or at 31 Gooreen Street.

However, the noise levels from the cogeneration plant are dependent on the final equipment selection and locations. As per the design specification (Rev F), the generator set and control room are to be enclosed within an acoustic enclosure designed to reduce emitted noise levels from the generator set and associated equipment. The total noise emissions of the new cogeneration plant, including generator enclosure and exhaust, are not to exceed 75dB(A) at 7m.

In addition, noise emissions from the co-generation plant shall be such that, when combined with existing noise levels at the brewery site, they do not exceed government regulated noise levels at the property boundaries, or within nearby working environments within the brewery itself.

Tooheys are required to conduct annual monitoring in accordance with their EPL to ensure that these levels are not exceeded.

Provided that the as-installed equipment noise levels comply with the maximum noise levels given in Table 11, the noise impact of the proposed cogeneration plant at Tooheys Brewery, Lidcombe, is assessed to be **low**.

9.4 Acoustic Terminology

'A'-Weighted Sound Level dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

Decibel

The ratio of sound pressures which we can hear is a ratio of 106:1 (one million : one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

Some typical noise levels are given below:

Noise Level dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside disco
90	Heavy lorries at 5 m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

Equivalent Continuous Sound Level (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Frequency

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

Sound Power and Sound Pressure

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

Statistical Noise Levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, eg. dBL_{A10}, 5min or dBL_{A90}, 8hr.

$L_{A90(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 90% of the time interval (T) –i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

$L_{A10(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

$L_{A1(T)}$

Refers to the sound pressure level measured in dB(A), exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.

10 Preliminary Hazard Analysis

A Preliminary Hazard Analysis (PHA) for the installation of the proposed cogeneration facility has been undertaken by Benbow Environmental and is summarised in the following sections. The full PHA report is presented as Appendix C.

10.1 Scope of the PHA

The purpose of the PHA was to assess whether the proposed development and the associated quantities of dangerous goods stored are offensive or hazardous, thereby posing an unacceptable risk to the surrounding community.

The PHA has been prepared in accordance with the Multi-Level Risk Assessment Guidelines and the *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (HIPAP No. 6) as stipulated by the Department of Planning in conducting such studies.

Safeguard measures have been considered and included in the design and operation of the facility to ensure that the safety and amenity of the neighbouring premises would not be affected by the proposed development.

10.2 Dangerous Goods Storage

The additional Dangerous goods that will be stored in conjunction with the cogeneration facility do not exceed the SEPP 33 threshold and were found to be not significant.

As such, the proposed cogeneration facility does not require any additional dangerous good storage areas. The capacity of an existing storage area, Depot D, would increase to increase the storage of engine oil by 800L.There would be an addition of 300 L of engine oil capacity in the gas generator engine itself.

The depot, currently operational on the Tooheys site, has been designed to conform to the *Occupational Health and Safety Amendment (Dangerous Goods) Regulation 2005* and relevant Australian Standards.

10.3 Hazard Identification

The PHA identified and examined a number of potential events/consequence scenarios that could occur at the site.

The prevention and protection measures designed into the operations of each of the activities associated with each event were listed and discussed in a series of Hazard Identification Charts. The functional / operational areas assessed were:

- Natural Gas Pipelines
- Gas Generator Engine
- Exhaust Steam Generator

From the Hazard Identification Charts, a list of potentially hazardous events was prepared which was then examined in greater detail to determine which events would be credible and may have significant off-site impacts.

Natural gas will be supplied from the mains to fuel the generator. Leak from the supply pipeline was considered to be a credible event and hence was analysed further due to its potential to cause fire inside the engine room. The predicted impacts to surrounding dangerous goods storage areas and sensitive receptors from this fire scenario were assessed. The PHA concluded that the impact of heat radiation due to fire in the engine room was negligible.

10.4 Management Measures / Safeguards

The PHA recommended that the following management measures are implemented to control any fire risks associated with the proposed cogeneration facility:

- Regular inspection, maintenance and testing of the natural gas pipeline and cogeneration plant equipment;
- Standard operating procedures to be developed and appropriate training to be completed by the cogeneration plant operators to ensure a full understanding of the control system via the Master Control Panel. The monitoring and alert features would enable early detection of a leak from the natural gas pipe;
- Ensure adequate ventilation in the engine room; and
- In the event of fire and the accumulation of fire water, an emergency system of allowing the capture of fire water shall be activated and re-routed to the equalisation tank.

10.5 Summary

The Preliminary Hazard Analysis concluded that the operation of the proposed cogeneration facility meets the criteria laid down in HIPAP No. 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community, with the recommended safeguards in place.

Furthermore, the proposed cogeneration facility has not been found to be an offensive or hazardous industry under the DoP guidelines.

The proposed facility meets all the safety requirements stipulated by DoP and hence would not be considered to be an offensive or hazardous development.

11 Cumulative Impacts

An assessment of cumulative environmental impacts considers the potential impact of a proposal in the context of existing developments and future developments to ensure that any potential environmental impacts are not considered in isolation. The extent of cumulative impacts to be considered depends upon the nature of the environmental issue.

The cogeneration facility is not considered to make a significant contribution to cumulative impacts associated with wider strategic policy such as greenhouse, resource consumption and waste disposal. The improved efficiencies that will occur as a result of the upgrade will reduce the brewery's load on natural resource consumption resulting in a reduction in cumulative impact to wider environmental systems.

In the context of local cumulative impacts, including noise, odour, air quality, visual and traffic, the impact of the brewery upgrade is to be considered in combination with:

- the surrounding industrial developments;
- future developments including the proposed distribution centre to the west of the site;
- the nearby Parramatta Road and M4 Freeway; and
- the existing brewery operations.

For the most part, the impacts of these developments have already been incorporated as baseline conditions in the environmental risk assessment presented in Section 7.

The Preliminary Hazard Assessment, presented in Appendix C, considered and assessed potential cumulative hazards and risks associated with the proposed cogeneration facility, existing operations on the Tooheys site and the surrounding industrial areas.

12 Environmental Management and Commitments

Environmental management of the proposed cogeneration facility will be undertaken in accordance with the existing approved Construction Management Plan and Operational Management Plans for Project Key.

Tooheys are required to conduct annual monitoring in accordance with their Environmental Protection Licence to ensure that noise levels are not exceeded.

No additional management measures with the exception of noise and hazard as outlined in Sections 9 and 10, and below, are proposed.

Noise Management Measures

- As per the design specification (Rev F), the generator set and control room are to be enclosed within an acoustic enclosure designed to reduce emitted noise levels from the generator set and associated equipment. The total noise emissions of the new cogeneration plant, including generator enclosure and exhaust, are not to exceed 75dB(A) at 7m.
- Noise emissions from the co-generation plant shall be such that, when combined with existing noise levels at the brewery site, they do not exceed government regulated noise levels at the property boundaries, or within nearby working environments within the brewery itself.
- Tooheys are required to conduct annual monitoring in accordance with their EPL to ensure that these levels are not exceeded.

Hazard Management Measures

- Regular inspection, maintenance and testing of the natural gas pipeline and cogeneration plant equipment;
- Standard operating procedures to be developed and appropriate training to be completed by the cogeneration plant operators to ensure a full understanding of the control system via the Master Control Panel. The monitoring and alert features would enable early detection of a leak from the natural gas pipe;
- Ensure adequate ventilation in the engine room; and
- In the event of fire and the accumulation of fire water, an emergency system of allowing the capture of fire water shall be activated and re-routed to the equalisation tank.

13 Conclusion

The objectives of the proposed cogeneration facility are to improve energy efficiency, reduce greenhouse gas emissions and improve the environmental performance of the brewery.

No issues of high or moderate environmental significance have been identified. This reflects the fact that the project is an upgrade to an existing development and the project is will improve the energy efficiency of the brewery.

Appendix A

Director General's Requirements

Director-General's Requirements

Section 75W of the *Environmental Planning and Assessment Act 1979*

Modification	To include an internal 2MW Co-generation Facility at the brewery including external cooling tower and exhaust silencer.
Site	Pt Lot 10 DP 1008367 29 Nyrang Street, Lidcombe NSW 2154
Proponent	Tooheys Pty Ltd
Date of Issue	29 July 2009
General Requirements	The Environmental Assessment (EA) must include: • an executive summary; • a detailed description of the proposal including the: - need for the proposed modification; - alternatives considered; • consideration of the proposal against any relevant statutory provisions, including whether it is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; • a general overview of the environmental impacts of the proposal, identifying any additional impacts from that approved and the key issues for further assessment; • a detailed assessment of the key issues specified below, and any other significant issues identified in the general overview of environmental impacts of the modification (see above), which includes: - a description of the existing environment; - an assessment of the potential impacts of the proposal; - a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the impacts of the proposal; • a Statement of Commitments, outlining the proposed environmental management, mitigation and monitoring measures; and • a signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading.
Key Issues	• **Hazards** - including a Preliminary Hazard Analysis (PHA) of the project including a detailed assessment of the potential off-site risks; • **Noise** - including construction, operational, and traffic noise; • **Air** - including air, odour and greenhouse gas emissions.
References	The Environmental Assessment should take into account the relevant State Government policies, guidelines and plans.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners. In particular you must consult with the: • Department of Environment and Climate Change; and • Auburn Council. The consultation process, and the issues raised during this process, must be described in the Environmental Assessment.
Deemed Refusal Period	60 days

Appendix B

Consultation

Our ref 206814/NMC

Date 18 August 2009

BY EMAIL

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ARUP

Dear Anna

Upgrade of Tooheys Brewery, Lidcombe
Cogeneration Plant

In July 2006, the Tooheys Brewery in Lidcombe received single site wide planning approval from the NSW Department of Planning under Part 3A of the Environmental Planning & Assessment Act, 1979 for the recent Project Key upgrade as well as ongoing operations at the brewery.

Tooheys now proposes to install a 2MW co-generation facility and absorption chiller at the site of the engine room within the brewery.

The Department of Planning has determined that approval for the installation and operation of the facility must be sought as a modification to the existing approval under Section 75W of the EP&A Act requiring the preparation of an Environmental Assessment. The Director General's Requirements for the Environmental Assessment were issued on 29 July 2009.

The proposed natural gas-fired cogeneration project will generate electricity, as well as thermal heat for use in the beer-making process. The co-generation project will reduce peak demand on the site by over 2MW. The project will save approximately 15,000 MWh of grid electricity and 9,500 tonnes of greenhouse gas emissions a year. Due to the overall environmental benefits of the proposed facility, Tooheys has received funding from the DECC's Green Business programme.

Arup has been commissioned by Tooheys to undertake the Environmental Assessment for the proposal and are seeking comments from Auburn Council.

Please send any comments or questions to Melanie Koerner by 26 August, 2009 so that these can be addressed in the Environmental Assessment process.

Yours sincerely

Melanie Koerner
Senior Sustainability Consultant

Our reference : DOC08/43893
Contact : Stuart Clark, 9995 6835

Mr Ben Watkiss
Process Services Engineer
Tooheys Pty Ltd
Locked Bag 58
Silverwater NSW 1811

Dear Mr Watkiss

ENVIRONMENT PROTECTION LICENCE 1167

I refer to the correspondence submitted by Tooheys to Department of Environment and Climate Change (DECC) on 9 April 2009 and the discussions with Tooheys on 7 July 2009.

New Boilers

The stack testing data provided on the boilers demonstrates compliance with the *Protection of the Environment (Clean Air) Regulation* 2002.

Co-Generation Engines

1. The capacity of the plant in terms of megajoules of fuel burnt per second appears below the plant threshold for *Electricity Generation (Metropolitan Electricity Works (Internal Combustion Engines)* in Schedule 1 of the POEO Act and there is no requirement to change the licence.

2. Noise levels from the co-generation engine are expected to be acceptable.

Please do not hesitate to contact Mr Stuart Clark on 9995 6835 if you wish to discuss this matter further.

Yours sincerely

15/07/09.

DAVID GATHERCOLE
A/Unit Head Sydney Industry
Climate Change and Environment Protection.

The Department of Environment and Conservation NSW is now known as the Department of Environment and Climate Change NSW

PO Box 668, Parramatta NSW 2124
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Appendix C

Preliminary Hazard Assessment

PRELIMINARY HAZARD ASSESSMENT FOR PROPOSED COGENERATION PLANT AT TOOHEYS PTY LTD 29 NYRANG STREET LIDCOMBE

Prepared for: Andrew Meagher, Tooheys Pty Ltd
Fred Sadie, Tooheys Pty Ltd
Department of Planning

Prepared by: Filbert Hidayat, Environmental Engineer
Gusni Melington, Senior Environmental Engineer
R T Benbow, Principal Consultant
Benbow Environmental North Parramatta, NSW

Report No: 109128_Final _PHA_Rep
September 2009
(Released: 22 September 2009)

Benbow
ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

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EXECUTIVE SUMMARY

Benbow Environmental (BE) has been commissioned by Tooheys Pty Ltd to prepare a Preliminary Hazard Analysis for the installation of a new cogeneration plant at the existing brewery site located at 29 Nyrang Street, Lidcombe, NSW, 2141. This proposal is part of the Tooheys Brewery Upgrade project currently reviewed by the Department of Planning.

This Preliminary Hazard Analysis (PHA) has been prepared in accordance with the Multi-Level Risk Assessment Guidelines stipulated by the Department of Planning, NSW. The purpose of the PHA is to assess whether the proposed development and the associated quantities of dangerous goods stored are offensive or hazardous, thereby posing an unacceptable risk to the surrounding community.

Safeguard measures have been considered and included in the design and operation of the facility to ensure that the safety and amenity of the neighbouring premises would not be affected by the proposed development.

Section 4 of the report identified and examined a number of potential events/consequence scenarios that could occur at the site. The prevention and protection measures designed into the operations of each of the activities associated with each event were listed and discussed in a series of Hazard Identification Charts.

From the Hazard Identification Charts, a list of potentially hazardous events was prepared which was then examined in greater detail to determine which events would be credible and may have significant off-site impacts. The additional Dangerous goods or Hazardous materials that will be stored in conjunction with the cogeneration plant were found not to be significant nor have exceeded the SEPP 33 threshold, which therefore suggests that the risk associated with this activity was not considered to be significant. Natural gas will be supplied from the mains to fuel the generator. Leak from the supply pipeline was considered to be a credible event and hence was analysed further due to its potential to cause fire inside the engine room. The predicted impacts to surrounding dangerous goods storage areas and sensitive receptors from this fire scenario are discussed in Section 5.2.

The Preliminary Hazard Analysis has found that the operation of the proposed development meets the criteria laid down in HIPAP No. 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community, with the recommended safeguards in place. Furthermore, the site's proposed operations have not been found to be an offensive or hazardous industry under the DIPNR guidelines.

Through the following PHA, it has been determined that the proposed development meets all the safety requirements stipulated by DIPNR and hence would not be considered to be an offensive or hazardous development.

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TABLES PAGE

FIGURES PAGE

ATTACHMENTS

1. INTRODUCTION

Benbow Environmental (BE) has been commissioned by Tooheys Pty Ltd to prepare a Preliminary Hazard Analysis for the installation of a new cogeneration plant at the existing brewery site located at 29 Nyrang Street, Lidcombe, NSW, 2141. This proposal is part of the Tooheys Brewery Upgrade project currently reviewed by the Department of Planning.

This document presents a Preliminary Hazard Analysis (PHA) required to fulfil the requirements of the Department of Planning in accordance with the Multi-Level Risk Assessment Guidelines stipulated in conducting such an analysis. The purpose of the PHA is to assess whether or not the proposed development is offensive or hazardous, thereby preventing an unacceptable level of risk to the surrounding community.

The report is structured as follows:

- Section 1 presents the purpose and report structure;
- Section 2 provides a background introduction to the site and its operations;
- Section 3 discusses the relevant documents and guidelines that have been followed and referenced for this assessment;
- Section 4 assesses the proposed operations according to the relevant guidelines;
- Section 5 assess the Dangerous Goods and Storage handling;
- Section 6 identifies possible hazards;
- Section 7 provides environmental safeguards procedures; and
- Section 8 states the concluding remarks.

1.1 SCOPE OF REPORT

This PHA has been carried out in accordance with the *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (HIPAP No. 6) as stipulated by the Department of Planning in conducting such studies.

This study includes the following key items:

- Evaluation of any potential hazards imposed by the proposed site operations on the surrounding environment and communities while making recommendations on the relevant prevention/protection strategies necessary to minimise the impact and risk of human fatalities, property damage and environmental pollution; and
- Review of the associated risks from the surrounding industrial areas that are considered as potential sources of risks in order to identify any possible cumulative hazards and risk impacts that can occur.

This study evaluates potential hazards imposed by the proposed operation of the site on the surrounding environment and communities.

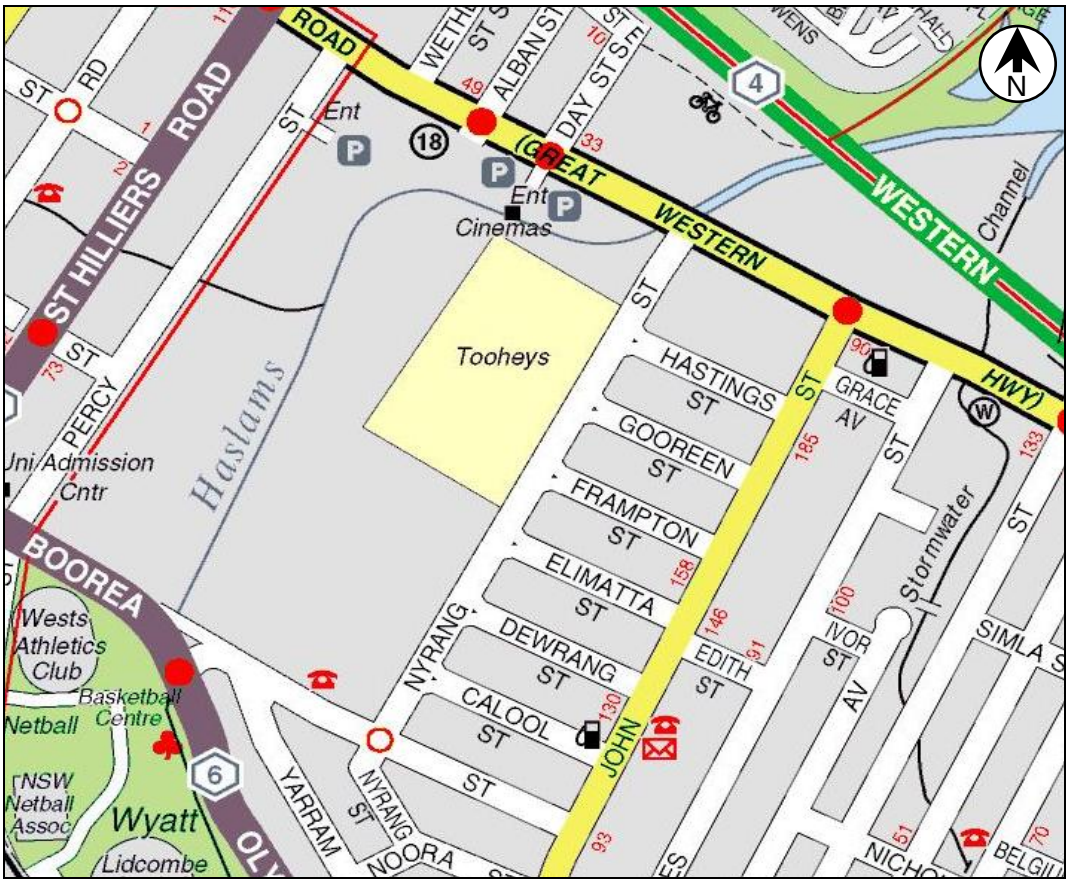
2. DESCRIPTION OF THE FACILITY

2.1 SITE LOCATION

The Tooheys site is located at 29 Nyrang Street, Lidcombe, NSW. The site location (in its local context) has been provided as Figure 2-1. The site is bounded by Parramatta Road to the north, Boorea Street to the south, Percy Street to the east and Nyrang Street to the west. Industrial premises surround the brewery, with residential areas located to the east and south beyond the industrial zone areas. A recreational area exists to the south of Boorea Street, Haslams Creek sits adjacent to the brewery, and formulates the discharge point for stormwater run-off from both the brewery and other industrial sites located within this industrial area.

The subject site is located within land zoned 4(a) General Industrial under the Auburn Local Environment Plan 2000. A site locality plan is provided as Figure 2-1 below.

Figure 2-1: Site Locality Plan



Source: UBD CityLink 2003 Copyright © Universal Press Pty Ltd

2.2 NEAREST RECEPTORS

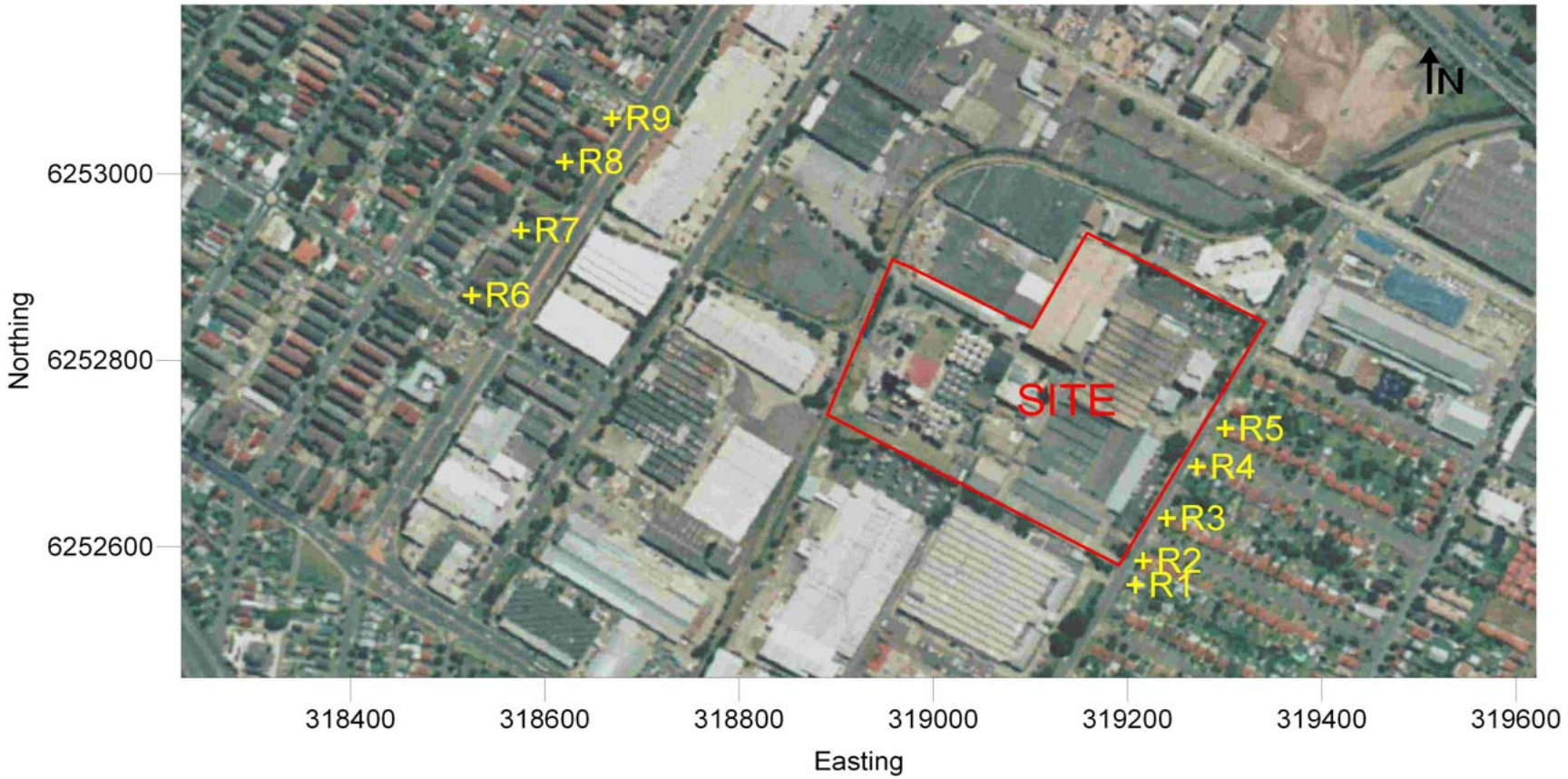
Residential areas located to the east and south are considered as sensitive receptors, as listed in Table 2-1.

Their locations are indicated as R1 to R9 in Figure 2-2. R10 to R12 have not been shown in Figure 2-2 as they are located further away from the site.

Table 2-1: Sensitive Receptors Around the Site

Receptor	Address	Bearings	Distance from the centre of the site (m)	Status
R1	32 Elimatta St, Lidcombe	E	262	Residential
R2	31 Frampton St, Lidcombe	E	246	Residential
R3	32 Frampton St, Lidcombe	E	243	Residential
R4	31 Gooren St, Lidcombe	E	254	Residential
R5	24 Gooren St, Lidcombe	E	261	Residential
R6	Lot 1, DP 1136599, Auburn	W	466	Residential
R7	64 St Hilliers Rd, Auburn	W	449	Residential
R8	74-78 St Hilliers Rd, Auburn	W	445	Residential
R9	4 Simpson St, Auburn	W	423	Residential
R10	151 John St, Lidcombe	S-E	535	Lidcombe Pre-School
R11	Norval St, Auburn	N-W	1440	Auburn Hospital
R12	Normanby St, Auburn	W	1380	St Joseph Hospital

Figure 2-2: Aerial Photograph of the Site and Sensitive Receptors



Source: SIX Viewer - Department of Lands © 2008

2.3 PROPOSED DEVELOPMENT

The new cogeneration plant would be installed inside the existing engine room with a cooling tower and exhaust silencer located below the roofline area outside this room. The cogeneration plant would include installation of a natural gas fired internal combustion engine (Deutz TCG 2020 V20 Gas Generator Set) capable of producing 2 MW of electrical energy and 1,300 kg/hr of steam at 900 kPa. The new plant would be installed inside the existing engine room with a cooling tower and exhaust silencer located below the roofline area outside this room.

Tooheys brewery would operate 24 hours per day, 5 days per week for 10 months of the year, from 10.00pm on Sunday until 10.00pm on Friday. Consequently, Tooheys would operate 24 hours per day and 7 days per week for 2 months during November and December. The generator would operate in conjunction with the operating hours of the brewery and would consume approximately 126 m^3 of natural gas per hour. All electricity and steam generated would be utilised in the brewery operation. Overall, the proposed cogeneration plant is expected to improve the site's energy efficiency by 34 % or equivalent to 113,000 GJ in energy.

The detailed layout of the cogeneration plant has been provided in the Attachments. The cogeneration plant consists of the following mechanical equipments:

- Deutz TCG 2020 V20 Gas Generator Set;
- Acoustic Enclosure/Ventilation System;
- Cooling Tower;
- Waste Heat Boiler;
- Exhaust Diverter Valve;
- Oil System;
- High Temperature Cooling System;
- Low Temperature Cooling System;
- Pumps;
- Water Monitoring Group;
- Muffler;
- Gas Valve Train; and
- Absorption Chiller.

The supply and commissioning of the cogeneration plant will be carried out by SDA Engineering. Operations of the cogeneration plan will be driven via a Master Control Panel with built-in monitoring and safety alert features including:

- Monitoring of ventilation, gas supply, fire/gas detection and various alarms;
- Control of automatic start/stop sequence;
- Monitoring of safety parameters such as lube oil pressure, fuel pressure, coolant temperature and exhaust temperature; and
- Control of generator output including temperature and pressure sensor.

In addition to this, a relief valve will also be installed to prevent overpressure in the combustion cylinders. A gas sniffer is installed to alert the presence of combustible gas in the exhaust pipe due to incomplete combustion of natural gas.

The supply of electricity generated will be via the existing sub station high voltage main switchboard. A number of electrical protection measures will also be implemented to ensure a safe electricity distribution from the generator to the sub station.

2.4 UTILITIES SERVICES

The following section describes the utilities services available for the operations of Tooheys Brewery.

2.4.1 Heating Plant

Two (2) 15 MW gas fired steam boilers and 12 MW gas fired steam boiler equipped with a 50m flue stack are utilised in the existing heating plant.

2.4.2 Refrigeration Plant

The ammonia refrigeration plant, which includes 5 screw compressors and 2 evaporative condensers, are used to provide the refrigeration requirements of the entire site.

An additional 3 screw compressors were installed in the newly built glycol chiller plant to provide support for the site's cooling requirements. The liquid used for refrigeration is based on a propylene glycol solution, which is cooled in the ammonia refrigeration plant, and is then reticulated around the site. This plant has been established to purposely reduce the amount of ammonia stored on site.

2.4.3 CO_2 Recovery and Supply

CO_2 produced from the fermentation processed is collected, treated, and re-used for the carbonation of beer. The old CO_2 liquefaction plant has been recently replaced by a new CO_2 recovery plant to make the brewery self-sufficient with CO_2. This plant is located in the engine room.

2.4.4 Compressed Air Plant

The compressed air plant supplies compressed dried air to provide pneumatic transport of grain materials and to provide air to instrumentation and pneumatic valves. This plant contains 2 oil-free screw compressors and is located within the engine room.

2.4.5 Electrical Power Supply

Electricity is supplied to the site by three 11kV power lines, which are in turn, connected to a main substation. The main substation is connected to the brewery high voltage (HV) main distribution board.

3. DANGEROUS GOODS STORAGE AND HANDLING

The dangerous goods currently stored and handled on-site consist of the following classes and classifications:

- Class 2.1 – Flammable gases;
- Class 2.2 – Inert gases;
- Class 2.2 (5.1) – Oxidising gases;
- Class 2.3 – Toxic gases;
- Class 3 – Flammable liquids;
- Class 5.1 – Oxidising substances; and
- Class 8 – Corrosive substances.

The Dangerous Good depots are outlined in Table 3-1 below. Note that highlighted chemicals are stored within 20 meters from the engine room, which houses the new cogeneration plant. A site map showing the location of each Depot is provided as Figure 3-1.

Table 3-1: Dangerous Goods Depots on Site

Depot	Class	Chemicals Stored	Maximum Capacity
C	8	Sodium Hydroxide Solution	50,000 L
D	3	Various	2,300 L
E	2.2	Liquid Carbon Dioxide (cryogenic)	150,000 kg
F1	2.3	Ammonia Anhydrous	1,840 kg
F2	2.3	Ammonia Anhydrous	1,840 kg
F3	2.3	Ammonia Anhydrous	2,240 kg
F4	2.3	Ammonia Anhydrous	3,760 kg
F5	2.3	Ammonia Anhydrous	1,000 kg
H1	2.2	Liquid Carbon Dioxide (cryogenic)	45,000 kg
H	8	Aqua Slide (Ultra Glide Aqua Slide)	4,500 L
I	8	Cellar Wash	1,000 L
J	8	Bru-Solv	9,000 L
K	8	Bru-Solv	7,500 L
L	8 and 9	Biocide E75	1,000 L
		CWT 381	
		CWT 752	
		CWT BT 154	
M	5.1	Proxitane (Sterilant)	3,000 L
O	2.1	LPG	7,000 L
P	8	Predator	3,000 L
P2	8	Predator	3,000 L
P3	5.1	CWT BT T30 (Sterilant)	400 kg
Q1	8	Cellar Wash	23,000 L
Q3	8	Phosphoric Acid (81 %)	5,000 L
R	2.2 (5.1)	Liquid Oxygen	2,100 L
S1	8	BWT 35 (Caustic)	4,000 L
S3	5.1	Proxitane (Sterilant)	2,000 L
W1	8	Meteor	400 L
W2	5.1	Proxitane (Sterilant)	5,000 L
W6	8	Cellar Wash (Acids)	6,000 L
X	8	Sodium Hydroxide Solution	2,000 L
Y7	5.1	Proxitane (Sterilant)	1,000 L
Y8	8	Cellar Wash	2,000 L
Y9	5.1	Proxitane (Sterilant)	1,000 L
Y10	8	Cellar Wash	1,000 L

In addition, there is a caged store for forklift gas cylinders in front of the warehouse. A total capacity of 500L (water capacity) of LPG is stored here.

The new cogeneration plant would only increase the storage of engine oil in depot 3 by 800 L (formerly 1,500 L). There would be an addition of 300 L of engine oil capacity in the gas generator engine itself.

Material Safety Data Sheets (MSDS's) for the chemicals listed above shall be stored on site. All dangerous goods storage areas are placarded with appropriate HAZCHEM signage.

3.1 HAZARDOUS AREA ZONING

This section outlines the hazardous area zones to be implemented at the proposed facility.

The hazardous area zones are required to enable the protection for electrical equipment to be determined. Specific protection techniques can be one or more of the following:

- Separation distances;
- Enclosures according to relevant Australian Standards;
- Flame proof rated electrical equipment;
- Intrinsically safe electrical equipment;
- Encapsulation of electrical devices;
- Vapour barriers;
- Ventilation; and
- Safety interlocks.

Hazardous areas are classified into one of three zones – Zone 0, Zone 1, and Zone 2. The type of protection required to prevent electrical equipment from being an ignition source depends on the Zone the electrical apparatus is contained within.

The definition of each Zone classification is provided below, as sourced from AS/NZS 60079.10:2004 – Electrical apparatus for explosive gas atmospheres – Classification of hazardous areas.

Zone 0 – A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.

Zone 1 – A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

Zone 2 – A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

3.1.1 Hazardous Zones Applicable to the Cogeneration Plant

Amendment to the existing hazardous zones would be applicable to the proposed cogeneration plant due to the following activities:

- Storage of additional engine oil classified as flammable liquids;
- Supply of natural gas via pipelines; and
- Gas exhaust from the generator may contain small amount of combustible natural gas.

3.1.2 Areas Requiring Hazardous Zones

The engine room currently house two natural gas fuelled boilers which would remain there after the cogeneration plant is commissioned. Therefore, hazardous zones currently established for this area would need to be reviewed if a detailed hazardous area zoning is required for the entire engine room. Due to the nature and complexity of the flammable gas and ignition sources within the engine room, it would be safe to conservatively establish a Zone 2 classification hazardous area for the entire engine room.

However, it is critical to note that 1 m away from any equipment (such as boilers and compressors) that handle natural gas needs to be classified as Zone 2. In addition, any areas of the natural gas pipelines which are considered to potentially leak such as flanges, pipe bends or any exposed/unprotected parts would have a Zone 2 classification of up to 0.5 m away from the identified potential leak area.

3.2 DANGEROUS GOODS SCREENING AGAINST SEPP33 THRESHOLDS

As previously explained, the site involves the storage and handling of different class of dangerous goods. This PHA focused on risks associated with the new cogeneration plant and not the cumulative risk associated with the Tooheys Brewery site. If the estimated risks are found significantly lower than the criteria, then their contribution to the cumulative site risk would be low. Based on the scope, only the total quantity of class 3 flammable liquids is screened against SEPP 33 threshold since the cogeneration plant would require additional engine oil.

Table 3-2: DG Screening Against SEPP33 Thresholds

Storage Location	Class	Packing Group	Maximum Quantity	Relevant SEPP33 Criteria	Exceed SEPP33 Criteria?
Depot D Engine Room	3	II/III	2.6 kL	3,000 kL at 70 m distance from boundary	No

The initial screening shows that the storage amount associated with the proposed development does not exceed the SEPP33 threshold. This indicates that the proposal would not result in additional hazards in terms of dangerous goods storage and handling. However, given that natural gas is supplied through pipelines to fuel the generator and the proximity of the cogeneration plant to other dangerous goods storage areas, further risk analyses were established to estimate the potential impacts.

3.3 DANGEROUS GOOD STORAGE REQUIREMENTS

The proposed development does not require additional dangerous good storage areas. The capacity of Depot D would increase to accommodate consumables used for the cogeneration plant.

As shown in Figure 3-1, Depot D contains the Class 3 Flammable Liquids, within a roofed store. The flammable liquids in focus are various engine oils. This area will need a ◇ Class 3 Flammable Liquids sign and placarding.

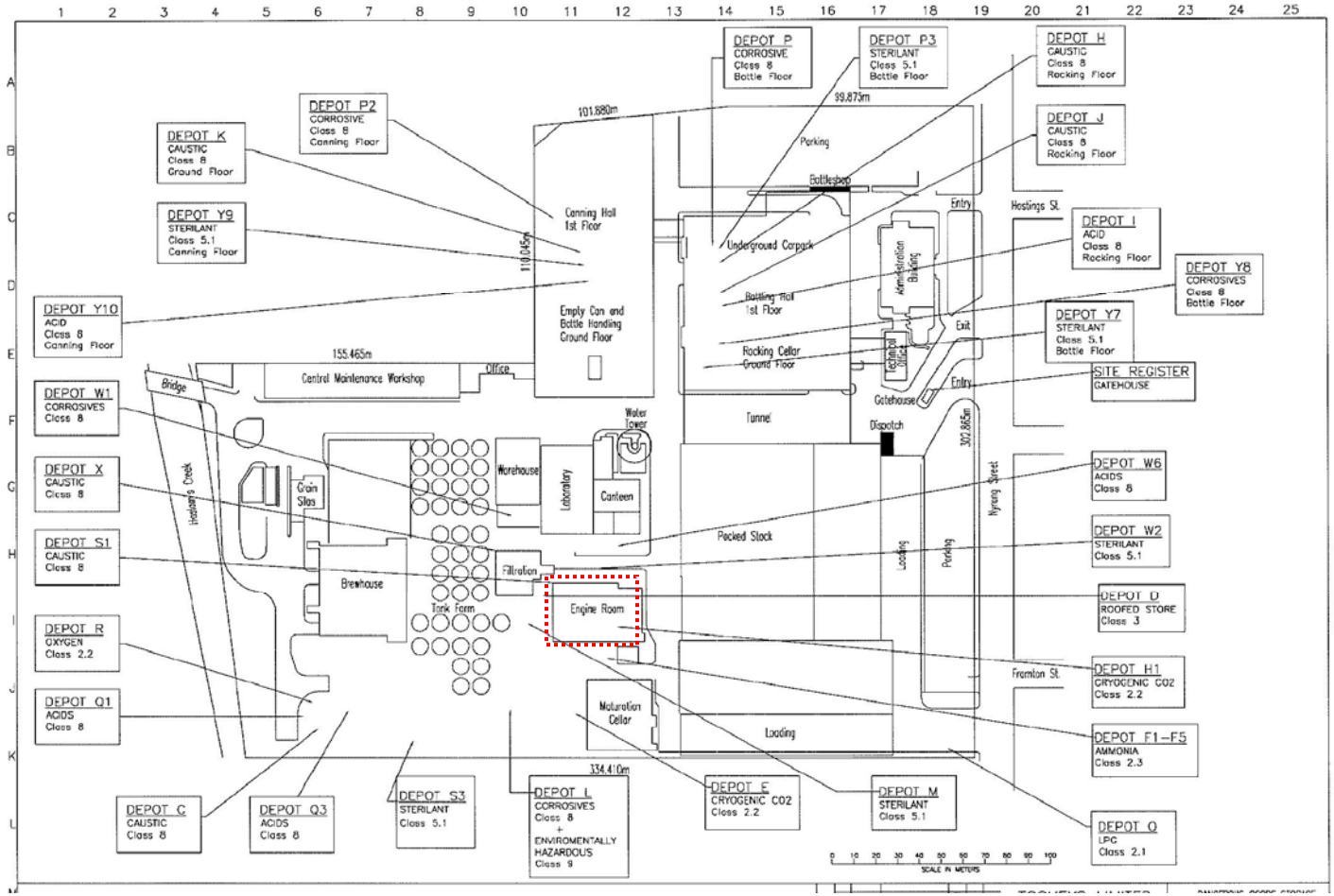
The total volume of the flammable liquids is 2.3 kL. Storage of Class 3 - Flammable liquids would be in accordance with AS 1940-2004 – The Storage and Handling of Flammable and Combustible Liquids.

The depot designs have been designed to conform to the Occupational Health and Safety Amendment (Dangerous Goods) Regulation 2005 and relevant Australian Standards. A summary of the general depot requirements follows:

- Ability to hold the first 90 minutes of fire fighting water on the site;
- Depot signage and erection of warning notices and HAZCHEM signs;
- Provision of adequate fire protection services;
- Provision of spill control kits at all loading/unloading areas;
- The site shall be securely locked when not in operation;
- Establishing environmental work practice procedures; and
- Ensuring Toohey's personnel are regularly informed about the storage and handling practices that are prescribed for particular types of dangerous goods.

All dangerous good storage and handling practices should comply with Australian Dangerous Goods Code 7th Edition, Occupational Health and Safety Regulation 2001, the WorkCover Code of Practice for Storage and Handling of Dangerous Goods and relevant Australian standards.

Figure 3-1: Site Plan Showing Location of Dangerous Good Depots



Engine Room – Location of the Proposed Cogeneration Plant

4. HAZARD IDENTIFICATION

The hazard analysis and quantified risk assessment approach developed and recommended by the Department of Planning (formerly DIPNR) relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications. The Department of Planning has advocated a merit-based approach, the level and extent of analysis must be appropriate to the hazards present and therefore, need only progress to the extent necessary for the particular case.

4.1 METHODOLOGY

The procedures adopted by this study for assessing hazardous impacts involve the following steps:

Step 1: Hazard identification;
Step 2: Hazard analysis (consequence and probability estimations); and
Step 3: Risk evaluation and assessment against specific criteria.

The following sections of the report discusses the hazard identification and analysis process as prescribed by the Department of Planning in the document *Hazardous Industry Planning Advisory Paper No 6* (HIPAP No. 6) – *Guidelines for Hazard Analysis* (DUAP 1992).

4.1.1 Hazard Identification

This is the first step in the risk assessment. It involves the identification of all theoretically possible hazardous events as the basis for further quantification and analysis. This does not in any way imply that the hazard identified or its theoretically possible impact will occur in practice. Essentially, it identifies the particular characteristics and nature of hazards to be further evaluated in order to quantify potential risks.

To identify hazards, a survey of operations was carried out to isolate the events which are outside normal operating conditions and which have the potential to cause off-site impacts. In accordance with HIPAP No. 6, these events do not include occurrences that are a normal part of the operational cycles of the site but rather the atypical and abnormal, such as the occurrence of a significant liquid spill during product transfer operations.

4.1.2 Hazard Analysis

After a review of the events identified in the hazard identification stage and the prevention/protection measures incorporated into the design of the site, any events which are considered to have the potential to result in impacts off-site or which have the potential to escalate to larger incidents are carried over to the next stage of analysis.

4.1.3 Consequence Estimation

This aspect involves the analysis and modelling of the credible events carried forward from the hazard identification process in order to quantify their impacts outside the boundaries of the site. In this case, these events typically include fire and the potential effects on people and/or damage to property.

4.1.4 Probability Likelihood Estimation

Where necessary, the likelihood of incidents quantified as a result of Section 5.6 are determined by adopting probability and likelihood factors derived from published data.

4.1.5 Risk Evaluation and Assessment against Specific Criteria

The risk analysis includes the assessment of consequences for each hazardous event and the frequencies of each initiating failure. The results of these consequence calculations together with the probabilities and likelihood's estimated were then compared against the accepted criteria, as specified by Department of Planning risk criteria applicable for the site. Whether it is considered necessary to conduct the predictions would depend on the probabilities and likelihood's estimated and if the risk criteria are exceeded.

4.2 ASSESSMENT CRITERIA

The risk criteria applied by Department of Planning are published in the document *Hazardous Industry Planning Advisory Paper No 4* (HIPAP No. 4) - *Risk Criteria for Land Use Safety Planning* (DUAP 1992). The following is a general discussion of the criteria that is used to assess the risk of a development on the surrounding community and environment.

4.2.1 Individual Fatality Risk Levels

The following paragraphs are reproduced from HIPAP No. 4 relating to individual fatality risk levels:

"People in hospitals, children at school or old-aged people are more vulnerable to hazards and less able to take evasive action, if need be, relative to the average residential population. A lower risk than the one in a million criteria (applicable for residential areas) may be more appropriate for such cases. On the other hand, land uses such as commercial and open space do not involve continuous occupancy by the same people.

The individual's occupancy of these areas is on an intermittent basis and the people present are generally mobile. As such, a higher level of risk (relative to the permanent housing occupancy exposure) may be tolerated. A higher level of risk still is generally considered acceptable in industrial areas" (DUAP 1992).

The risk assessment criteria for individual fatality risk are presented below.

Table 4-1: Individual Fatality Risk Criteria

Land Use	Risk Criteria x 10^{-6}
Hospitals, schools, etc	0.5
Residential	1
Commercial	5
Sporting and active open space	10
Industrial	50

4.2.2 Injury Risk Levels

Injury risk levels from HIPAP No. 4 are stated below for heat of radiation.

- Incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2, at frequencies of more than 50 chances in a million per year; and
- Incident explosion overpressure at residential areas should not exceed 7 kPa, at frequencies of more than 50 chances in a million per year.

The requirements for toxic exposure are stated as follows:

- Toxic concentrations in residential areas should not exceed a level that would be seriously injurious to sensitive members of the community following a relatively short period of exposure at maximum frequency of 10 in a million per year; and
- Toxic concentrations in residential areas should not cause irritation to the eyes or throat, coughing or other acute physiological responses in sensitive members of the community over a maximum frequency of 50 in a million per year.

Please note that a risk hazard assessment only examines events that are considered to have the potential for significant off-site consequences.

4.2.3 Risk of Property Damage and Accident Propagation

HIPAP No. 4 indicates that siting of a hazardous installation must account for the potential for propagation of an accident, causing a "domino" effect on adjoining premises. This risk would be expected within an industrial estate where siting of hazardous materials on one site may potentially cause hazardous materials on an adjoining premises to further develop the size of the accident.

The criteria for risk of damage to property and of accident propagation are stated as follows:

- Incident heat flux at neighbouring potentially hazardous installations or at land zones to accommodate such installations should not exceed a risk of 50 in a million per year for the 23 kW/m^2 heat flux level; and

- Incident explosion overpressure at neighbouring potentially hazardous installations, at land zoned to accommodate such installations or at nearest public buildings should not exceed a risk of 50 in a million per year for the 14 kPa explosion overpressure level.

4.2.4 Criteria for Risk Assessment to the Biophysical Environment

The assessment of the ultimate effects from toxic releases into the natural ecosystem is difficult, particularly in the case of atypical accidental releases. Consequence data is limited and factors influencing the outcome variable and complex. In many cases, it may not be possible or practical to establish the final impact of any particular release. Because of such complexity, it is inappropriate to provide generalised criteria to cover any scenario. The acceptability of the risk will depend upon the value of the potentially affected zone or ecosystem to the local community and wider society.

The suggested criteria for sensitive environmental areas relate to the potential effects of an accidental release or an emission on the long-term viability of the ecosystem or any species within it and are expressed as follows:

- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the effects or consequences of the more likely accidental emissions may threaten the long-term viability of the ecosystem or any species within it; and
- Industrial developments should not be sited in proximity to sensitive natural environmental areas where the likelihood or probability of impacts that may threaten the long-term viability of the ecosystem or any species within it is not substantially lower than the existing background level threat to the ecosystem.

4.2.5 Assessment Criteria Applicable to the Proposed Development Application

In accordance with *HIPAP No 4 Risk Criteria for Land Use Safety Planning* (DUAP 1990), following is a discussion of the risk assessment criteria that shall be applied to the proposed development application.

4.2.5.1 Heat-Flux Radiation Criteria

Heat flux radiation criteria are applicable due to the potential consequences of a fire occurring from a leak or a catastrophic rupture of the natural gas pipeline on site.

4.2.5.2 Explosion Over-Pressure Criteria

The gas generator engine would operate at 340^{o}C and 3 Bar. The combustion cylinders may experience overpressure resulting in an explosion inside the engine, which then may cause over-pressure impacts against nearby activities or properties.

However the likelihood for this event to occur would be very low due to the presence of a pressure relief vent, the ability of the engine parts to withstand explosions due to their material construction, and the implementation of engine controls to ensure operational parameters are regulated.

The impact of this event, should it occur, would only damage the engine itself and would likely be contained in the engine room. Given this consideration, the explosion over-pressure criteria is readily satisfied.

4.2.5.3 Toxic Criteria

Combustion of natural gas produces carbon dioxide and water vapour which are naturally present in the atmosphere. Toxic criteria would be assessable if a fire event impinges other dangerous goods storage areas storing toxic material and/or storing material which can further oxidise releasing toxic gases.

4.2.5.4 Biophysical Environment Risk Criteria

The site is located within an Industrial area however Haslams Creek sits adjacent to the brewery, and formulates the discharge point for stormwater run-off from both the brewery and other industrial sites located within this sector. The proposed development does not introduce significant storage of liquid chemicals that would cause water pollution in the event of spill. Therefore the proposed development would not introduce additional risk that may threaten the long-term viability of the local environment. Consequently, the criteria stipulated in the DUAP document are readily satisfied and no further discussions are considered necessary.

4.3 HAZARD IDENTIFICATION CHARTS

Hazard Identification Charts have been prepared for the proposed site based on operating scenarios that are relevant to the proposed development. Each chart consists of four columns:

Column 1
Heading: Functional/Operation Area
The area of the site involved with the potential event is listed.

Column 2
Heading: Possible Initiating Event
The individual events that are considered to be likely or realistic are then listed. Where the possible consequences are similar the events are listed together, each one individually numbered.

Column 3
Heading: Possible Consequences
The outcomes of an event if it occurred are listed.

Column 4
Heading: Prevention/Protection Measures
The measures designed into the functional/operation area and the site are listed. These measures may include for example safeguards, design features, management methods and/or operator training.

Table 4-2: Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
1. Natural Gas Pipelines.	• Hole in supply piping. • Leak from pump seal failure. • Leak at inlet to the generator due to hose failure	• Release of natural gas, possible ignition and fire. • Possible explosion if natural gas was allowed to accumulate • Radiant heat risk to adjacent dangerous goods storage areas.	• Pressure control would indicate the presence of leak due to pressure drop in supply. • Regular inspection and maintenance of pipelines and pump seals and inlet hose. • Hazardous zoning is implemented in accordance with AS 2430-2004. • Hot work permit system is established on site. • No smoking policy. • Fire fighting measure (hose reels, hydrants and fire extinguishers) are available around the site maintained in accordance with the relevant Australian Standards. • Emergency procedures are available for the site and all staff will be trained in the appropriate emergency procedures. Note that these need to be updated to include operations of the new cogeneration plant. • Natural gas has distinct odour which would allow early detection by staff member. • The engine room is well ventilated to prevent accumulation of natural gas that could lead to an explosive atmosphere being present.

Table 4-3: Event/Consequence Analysis Table

Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
2. Gas Generator Engine	• Overpressure in combustion cylinders. • Pressure regulator failure resulting in over or under supply of natural gas • Incomplete combustion resulting in natural gas being released through the exhaust • Failure of heat extraction system causing temperature engine overheating.	• Internal explosion of combustion cylinders damaging significant parts of the engine. • Release of natural gas, possible ignition and fire. • Radiant heat risk to adjacent dangerous goods storage areas. • Interrupted electricity and steam supply affecting operation of brewery.	• Pressure relief vent is installed to prevent overpressure inside the combustion cylinders. • Change in temperature or pressure would be detected via the Master Control Panel, which would allow automatic shutdown of the entire system. • Gas sniffer is installed to detect any leak of natural gas in the exhaust pipe. Combustion is controlled by maintaining specific temperature and pressure for complete combustion. These parameters are monitored via the Master Control Panel. • Regular inspection and maintenance of the gas generator engine. • The engine room housing the cogeneration equipment is well ventilated to prevent accumulation of flammable gas vapour. • Hazardous zoning is implemented in accordance with AS 2430-2004. • Hot work permit system is established on site. • No smoking policy. • Fire fighting measure (hose reels, hydrants and fire extinguishers) are available around the site maintained in accordance with the relevant Australian Standards. • Emergency procedures are available for the site and all staff will be trained in the appropriate emergency procedures. Note that these need to be updated to include operations of the new cogeneration plant.

Table 4-4: Event/Consequence Analysis Table			
Functional/Operational Area	Possible Initiating Event	Possible Consequences	Prevention/Protection Measures
3. Exhaust Steam Generator	• Overpressure in heat exchanger • Flow regulator failure resulting in over or under supply of water. • Insufficient heat from exhaust gas due to incomplete combustion. • Release of natural gas residue in exhaust stack due to incomplete combustion inside the gas generator. • Failure of heat extraction system causing temperature engine overheating. • Failure of exhaust silencer.	• Physical damage to the steam generator engine. • Increased exhaust stack temperature. • Noise complaints. • Interrupted steam supply affecting operation of brewery.	• Pressure relief vent is installed to prevent overpressure. • Change in temperature or pressure would be detected via the Master Control Panel, which would allow automatic shutdown of the entire system. • Regular inspection and maintenance of the steam generator engine and exhaust silencer.

5. CONSEQUENCE AND FREQUENCY ESTIMATIONS

The consequences of an accident involving a particular hazardous substance depends on the type and quantity of hazardous substance, the type of activity using the substance as well as the exposed population.

A risk analysis of the proposed storage of Class 3 PG II, Class 3 PG III and Class 6.1 has been conducted in accordance with the prescribed Multi-Level Assessment guidelines document provided by the Department of Planning. Following is a summary of the risk analysis results.

5.1 RISK CLASSIFICATION AND PRIORITISATION

The Department of Planning document Multi-Level Risk Assessment (DUAP 1997) outlines a method of risk classification and prioritisation to assist in assessment of risks. The technique is based on the Manual for classification of risks due to major accidents in process and related industries (IAEA, 1993). The IAEA method was developed to produce a broad estimate of the risks due to major accidents from the production, storage, handling and transport of hazardous materials. The technique involves three stages:

- Estimation of the consequences of a major accident;
- Estimation of the probability of a major accident happening; and
- Estimation of societal risk.

5.1.1 Estimation of Consequence of a Major Accident

The consequences of a major accident depend on the type of substance and activity and the quantity involved, as well as the exposed population. After excluding those substances and activities, which neither present a significant off-site risk nor could potentially affect adjacent inventories, the following steps are undertaken:

- Classify the activity;
- Estimate the effect distance and area;
- Estimate the population distribution; and
- Consider Mitigation Correction Factors, which takes into account possible mitigatory actions that people could take, such as evacuation and sheltering.

An estimate of the external consequences of a major accident may be calculated using these factors.

5.1.2 Estimation of Probability of a Major Accident Occurring

The method used for estimating probability is based on probability numbers related to the type of installation and hazardous substance used, together with the following probability correction factors:

- Frequency of loading/unloading operations;
- Provision of safety systems associated with the storage and handling of flammable substances;
- A quantitative assessment of the management and safety levels of the organisation; and
- A quantitative assessment of the wind direction towards a populated area.

An estimate of the probability of a major accident may be calculated using these factors.

5.1.3 Estimation of Societal Risk

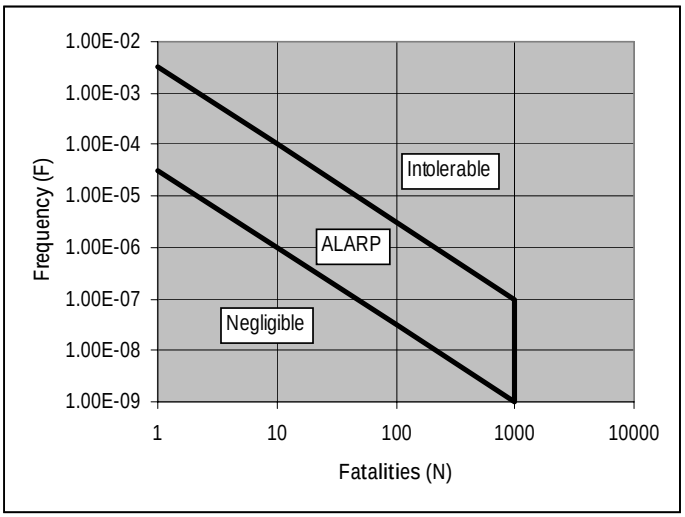
At this stage, pairs of numbers have been calculated for each activity, comprising the number of fatalities per accident and expected frequency of the accident. The results may be transferred to a plot of frequency verses consequence (F-N curve) and a direct estimate of societal risk can be determined. The F-N curve is divided into three regions:

- Negligible - accidents are not considered to have significant off-site consequences;
- ALARP - while risk of an accident may be tolerable, steps should be taken to reduce the risk level to as low as reasonably possible (ALARP); and
- Intolerable - risk of an accident with the potential for significant off-site consequences is unacceptable.

The Department of Planning is currently refining this approach as it is seen as a complex one, which does not lend itself to easy implementation and may not be possible in practice. Therefore, the Department of Planning suggests that judgements on societal risk be made on the basis of qualitative approach on the merit of each case rather than on specifically set numerical values.

The F-N curve used to classify societal risk is shown in Figure 5-1.

Figure 5-1: IAEA F-N Curve



The proposed development would not result in additional societal risk as there would not be a significant increase in dangerous goods stored.

5.2 HAZARDS IDENTIFIED FOR FURTHER ANALYSIS

Following a review of the Hazard Identification Charts in Section 4.3, a series of potentially hazardous events or scenarios require a more comprehensive quantitative analysis. Each event or scenario will be discussed in detail.

The main pipeline supplying natural gas to the engine room is approximately 241 m in length, starting from the south eastern boundary near the LPG tank (Depot O). The existing pipe has been extended by 5 m pipe to connect this pipe to the new gas generator. As there is a possibility for leaks to occur in a pipe that has been extended, the following hazard is identified for further analysis:

- Fire inside the engine room.

Consequences in terms of heat flux impacts were assessed for the scenarios above and modelling was conducted based on credible worst case scenarios. If relevant, the potential release of toxic chemicals due to heat impingement will be assessed qualitatively.

5.2.1 Fire inside the Engine Room

An estimation of the consequences resulting from fire event initiated by a major natural gas pipe leak inside the engine room has been modelled using Effects 7.6 by TNO safety software. This scenario considers that the new natural gas pipe connecting the mains to the generator has leaked, releasing a significant amount of flammable gas, finds a source of ignition and results in fire inside the engine room.

The leak was assumed to originate from a large hole with 120 mm diameter on the new pipe section. This pipe is located around 3.7 m from the ground and this was used as the release height. The flow from the entire pipe length of 246 m, supplying natural gas at 100 kPa is considered to contribute to this event. Pure methane was used as the representative chemical for natural gas. The outflow angle was assumed to be horizontal as this would give the most conservative heat impact. The torch fire model was selected to predict the heat radiation impact resulting from this fire event. This model is considered most appropriate for fire initiated by a leak of flammable gas from pressurised pipe.

The predicted heat of radiation levels are tabulated in Table 5-1and Table 5-2 below. The 4.7 kW/m^2 heat radiation level was estimated to occur at a radial distance of 10.5 m from the source. The heat contour diagram for the 4.7 kW/m^2 is shown in Figure 5-3.

As shown in Figure 5-2, the model predicted a maximum heat radiation level of 7.8 kW/m^2, which is lower than the 2 most significant criteria stipulated in the HIPAP No. 4 guidelines. These results would also negate the potential for heat impingement to the surrounding dangerous goods area, in particular, ammonia storage area located just outside the engine room to the south direction.

Table 5-2 clearly shows negligible heat of radiation impact potentially experienced by the closest residences in the area. Given these considerations, the impact of heat radiation due to fire in engine room is considered negligible.

Table 5-1: Estimated Distances for Specific Heat Radiation Levels (Fire inside the Engine Room)

Heat Radiation Levels (kW/m^2)	Effect	Calculated Distance from Model (m)
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur).	10.53
12.6	Significant chance of fatality; High chance of injury; Wood can potentially be ignited; Thin steel insulation may suffer thermal stress and potential structural failure.	Not reached*
23	Fatality; Spontaneous ignition of wood; unprotected steel will suffer thermal stress and cause failure; Pressure vessel failure.	Not reached*

Note: * The predicted maximum heat of radiation is 7.8 kW/m^2

Table 5-2: Estimated Heat Radiation Levels at Nearest Receptors (Fire inside the Engine Room)

Receptors	Approximate Distance from the Source (m)	Heat Radiation (kW/m^2)
R1	262	0.000342
R2	246	0.000384
R3	243	0.000394
R4	254	0.000360
R5	261	0.000344
R6	466	0.000105
R7	449	0.000114
R8	445	0.000116
R9	423	0.000129
R10	535	0.000079
R11	1440	0.000011
R12	1380	0.000010

Figure 5-2: Heat Radiation vs. Distance Plot for Fire inside the Engine Room

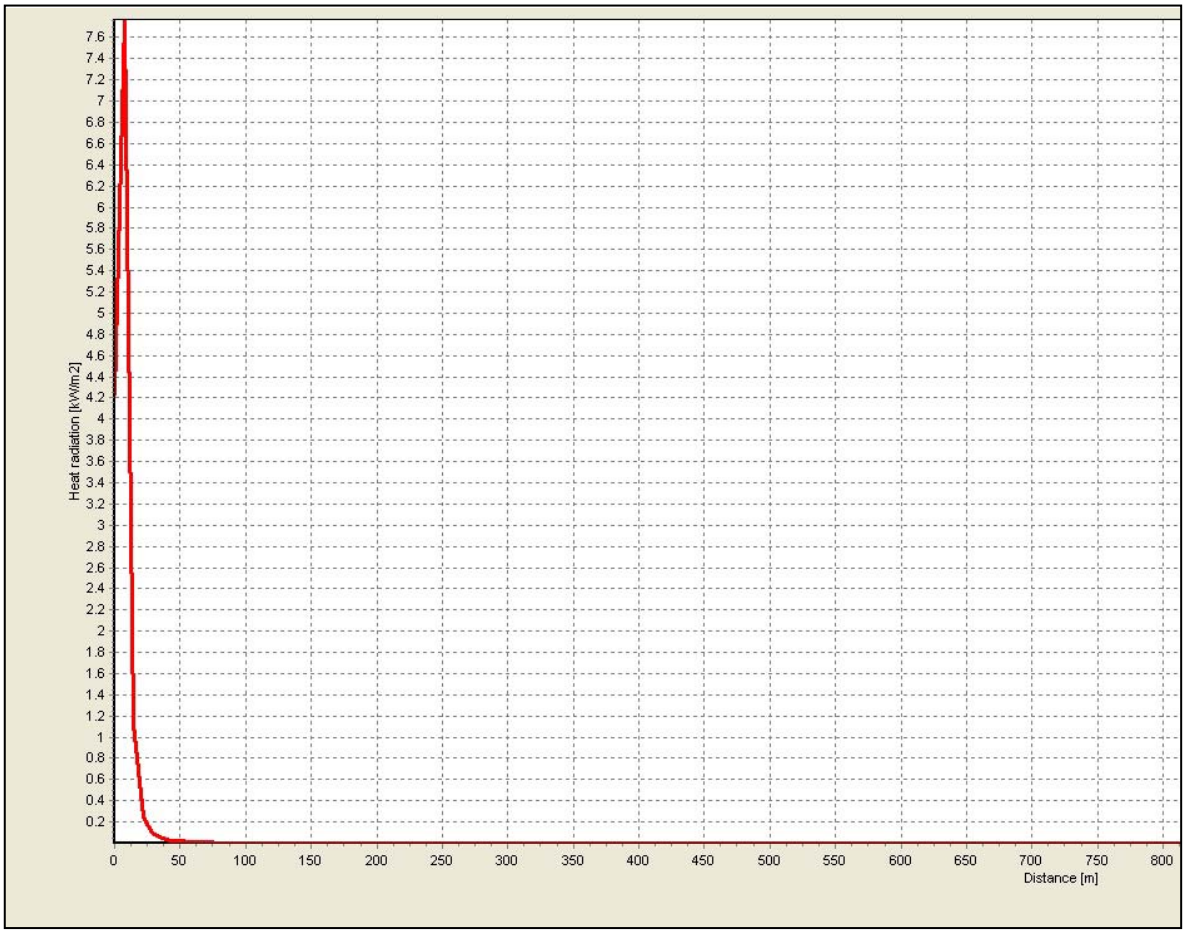
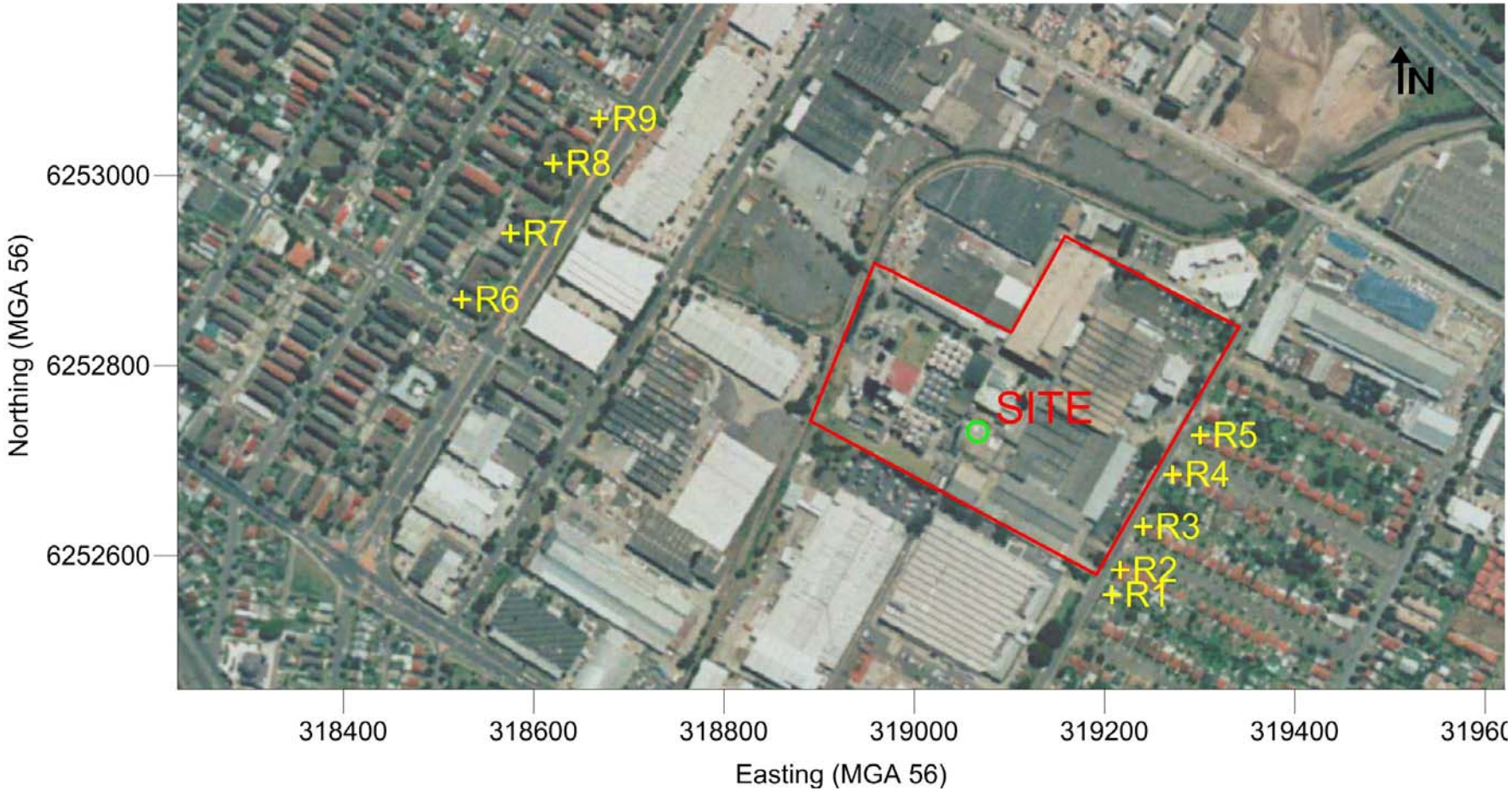


Figure 5-3: Heat Radiation Contour (4.7 kW/m^2) for Fire inside the Engine Room



6. RECOMMENDATIONS

The following recommendations are considered to be fundamental in aiding to control any of the fire risks presented by the proposed development:

- Regular inspection, maintenance and testing of the natural gas pipeline and cogeneration plant equipment;

- Standard operating procedures to be developed and appropriate training to be completed by the cogeneration plant operators to ensure a full understanding of the control system via the Master Control Panel. The monitoring and alert features would enable early detection of a leak from the natural gas pipe;

- Ensure adequate ventilation in the engine room; and

- As stated in the fire safety studies previously prepared by Benbow Environmental, in the event of fire and the accumulation of fire water, an emergency system of allowing the capture of fire water shall be activated and re-routed to the equalisation tank.

7. CONCLUSIONS

The Preliminary Hazard Analysis has found that the operations of the proposed development meets the criteria laid down in HIPAP No. 4 *Risk Criteria for Land Use Safety Planning* and would not cause any risk, significant or minor, to the community. Furthermore, the site's proposed operations are not an offensive or hazardous industry based on applying the DIPNR guidelines.

It is the conclusion of this PHA that the proposed development meets all the safety requirements stipulated by DIPNR and hence would not be considered to be an offensive or hazardous development.

This concludes the Preliminary Hazard Analysis.

Prepared by:

Filbert Hidayat	Gusni Melington	RT Benbow
Environmental Engineer	Senior Environmental Engineer	Principal Consultant

8. LIMITATION

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

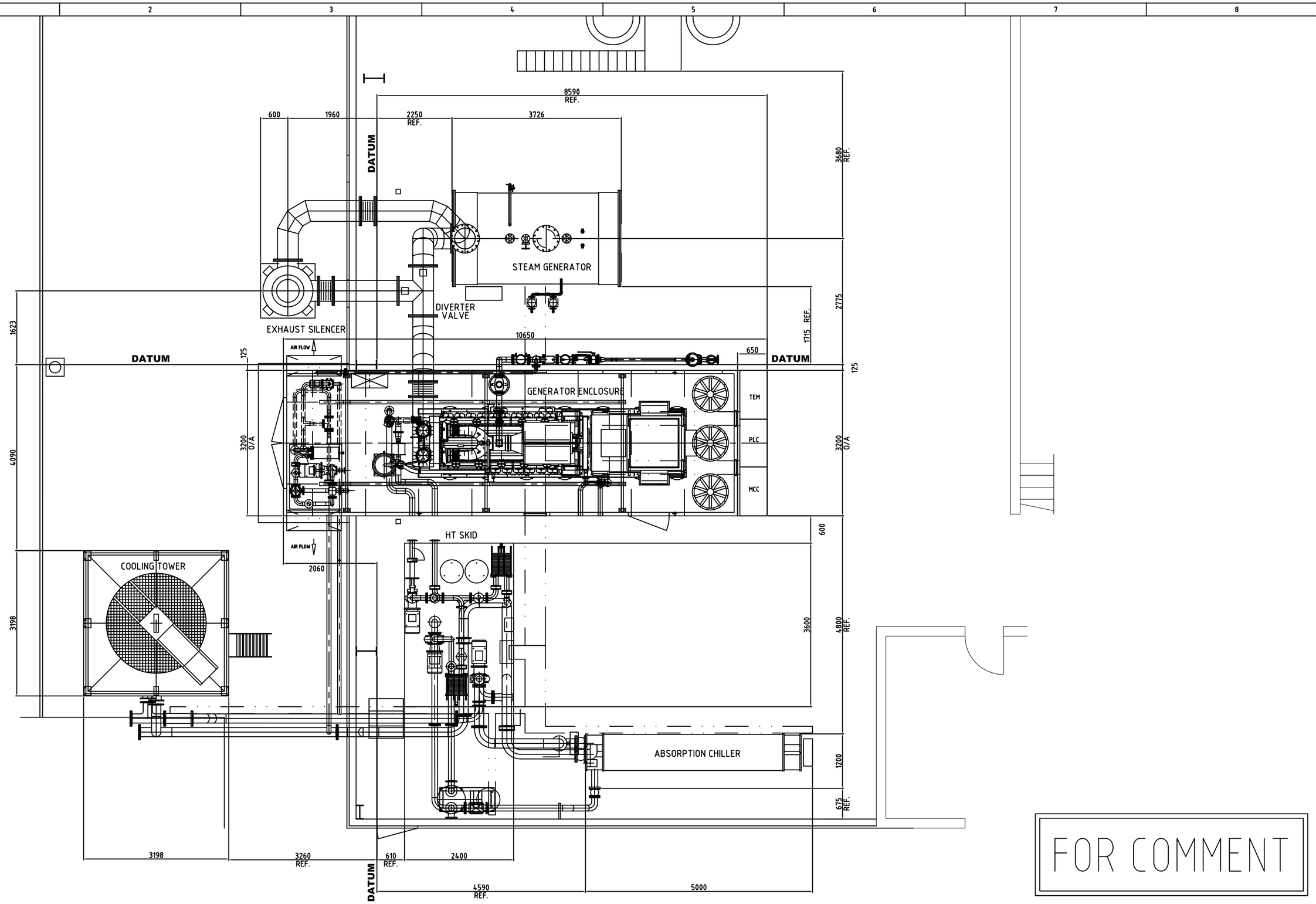
This report has been prepared solely for the use by Tooheys Pty Ltd, as per our agreement for providing environmental assessment services. Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that required by law) in relation to the information contained within this document.

Tooheys Pty Ltd is entitled to rely upon the findings in the report within the scope of work described in this report. No responsibility is accepted for the use of any part of the report in any other context or for any other purpose.

Opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

ATTACHMENTS

Attachment 1: Cogeneration Plant – General Arrangement and Site Layout



FOR COMMENT

ASSOC DRGS	DESCRIPTION	REV	DESCRIPTION	DATE
		E	LAYOUT REVISED AND UPDATED	12.08.09
		D	ENCLOSURE AIR DISCHARGE MODIFIED	19.06.09
		C	REVISED LAYOUT	04.05.09
		B	NEW LAYOUT	16.04.09
		A	ORIGINAL ISSUE	24.10.08

DO NOT SCALE IF IN DOUBT ASK ALL DIM IN MM

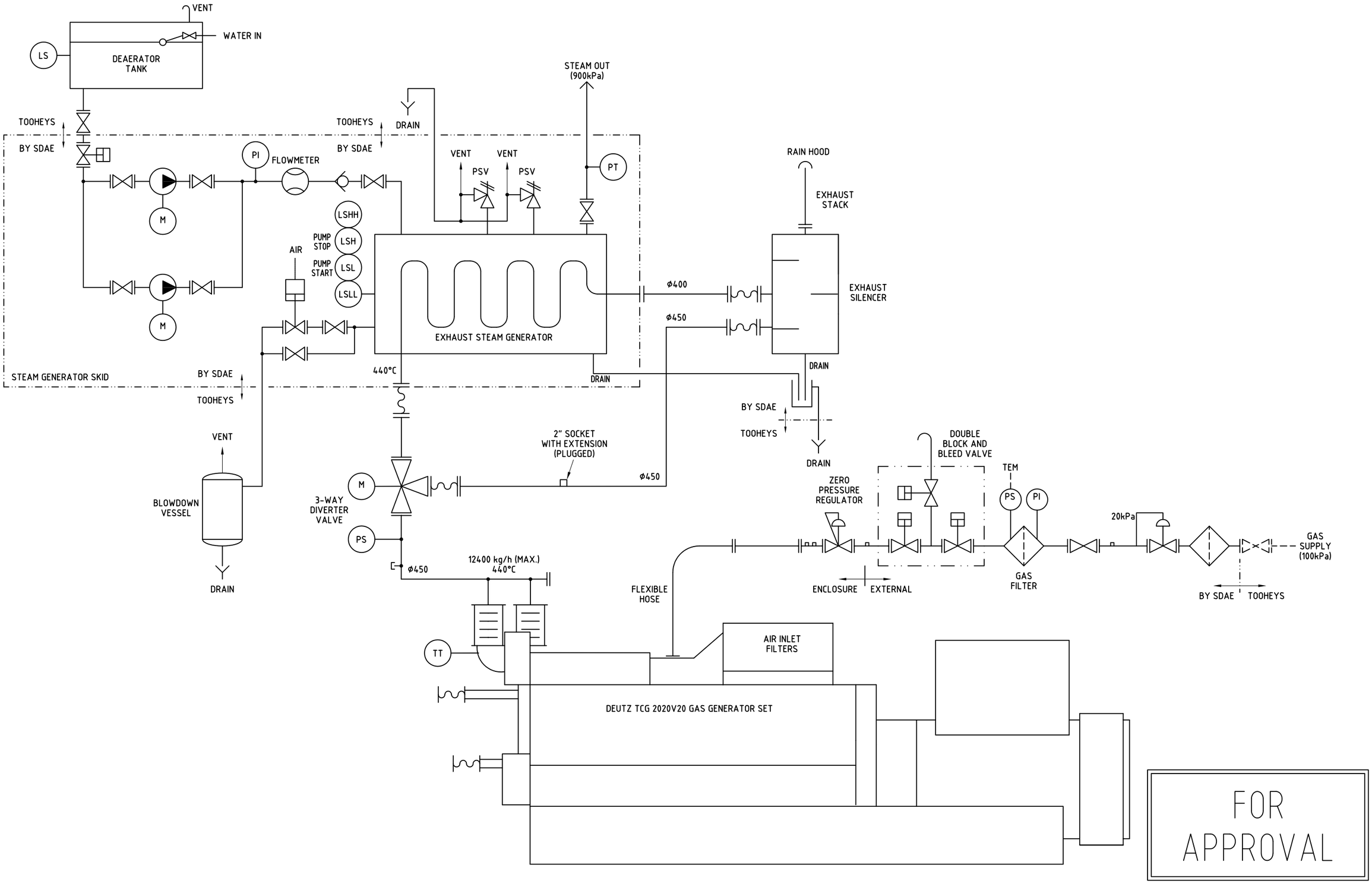
PROJECT: TOOHEYS CO-GEN PROJECT

TITLE: PROPOSED SITE LAYOUT 2.0MW ENCLOSED GENERATOR

SDA Engineering Pty Ltd
UNIVERSITY OF ADELAIDE
COMMERCE AND RESEARCH PRECINCT
26 STIRLING STREET, THEBARTON SA 5038
PH.:(08) 8238 9404 FAX:(08) 8152 0722
E-MAIL: sda@sdaengineering.com.au

JOB No	E1299	DRAWING No	E1299-01-003
DRAWN	J.PRING		
DATE	23.10.2008		
CHECKED	SC	SHT 1 OF 1	A1
SCALE	1:40	REV E	

Attachment 2: Cogeneration Plant – Fuel and Gas Exhaust P&ID Diagram



ASSOC DRGS	DESCRIPTION	REV	DESCRIPTION	DATE
		D	MODIFIED AS PER COMMENTS FROM PROJECT HAZOP	13.07.09
		C	EXH FLOW, STEAM PRESS. & SILENCER DRAIN MODIFIED	04.05.09
		B	FLOWMETER, PT & 2 LS ADDED, TEST SOCKET RELOCATED	22.04.09
		A	ORIGINAL ISSUE	26.03.09

DO NOT SCALE — IF IN DOUBT ASK — ALL DIM IN MM

PROJECT: TOOHEYS COGEN PROJECT

TITLE: FUEL GAS AND EXHAUST P&ID

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UNIVERSITY OF ADELAIDE
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JOB No	E1299
DRAWN	C. LA DRU
DATE	26.03.2009
CHECKED	J.PRING
SCALE	NTS

DRAWING No: E1299-07-005

SHT 1 OF 1 — REV D — A3

Attachment 3: Cogeneration Plant – Protection Single Line Diagram

ENERGY AUSTRALIA SUPPLIES

3194,4137,4444 1653,4025 5986

ENERGY AUSTRALIA INCOMING FEEDER

REF TOOHEYS DWG A0910-076

NEW RMU FOR CO-GEN

S2
630A
SPARE

S1
630 A

INTERCONNECTING CABLE

SUB STATION No.1 HV
MAIN SWITCH BOARD

800A BUSBAR

800: 5A

40VA

TRIP

CLOSE

TRIP

Q1
200A

150: 5A

VTXX

SUPPLY TO EXISTING PLANT

REF TOOHEYS DWG A0910-076

EXISTING PF
MONITORING

POWER AT
MAIN INCOMER
SIGNAL TO PLC

INTERCONNECTING CABLE

SEPAM G87
PROTECTION
RELAY
Refer 'Table A'
REF DWG 142

POWER
METER 2
REF DWG XXX

ROCOF
RELAY
Refer 'Table A'
REF DWG 144

SYNCH
CHECK
REF DWG 143

SYNCHRONISING
RELAY
REF DWG 143

REVERSE
POWER
RELAY
Refer 'Table A'
REF DWG XXX

POWER
METER 1
REF DWG XXX

GENERATED
POWER
SIGNAL TO TEM

CO-GEN ACB CONTROL PANEL

GENERATOR
2014kW
11,000V
132A
0.80pf

G1

150: 5A

TABLE A: PROTECTION SETTINGS

ANSI	Function	Sepam Set point			Reverse Power		R.O.C.O.F Relay	
				t		t		t
3	Relay Watchdog/Self Check						n/a	
27	Under-voltage	92% Un	10120 V	1 sec			n/a	
		88% Un	9680 V	0.2 sec			n/a	
32	Reverse Power	15% Pn	302 kW	5 sec	0%	0 sec	n/a	
32P	Over Power (Export)	110% Pn	2215 kW	0.2 sec			n/a	
32Q	Over VARs (Export)	60% Qn	907 kVAr	1 sec			n/a	
46	Current Imbalance	50% In	66 A	5s			n/a	
50BF	Breaker Failure	20% In	26 A	0.15s			n/a	
50/51	Over-current	110% In	145 A	0.5 sec			n/a	
59	Over-voltage	108% Un	11880 V	30 sec			n/a	
		112% Un	12320 V	0.2 sec			n/a	
50N/51N	Earth Fault	5% In	7 A	0.2sec			n/a	
78	Vector Shift						18 Deg.	
	R.O.C.O.F (df/dt)						0.5Hz/s	
78PS	Pole Slip	2 Rotations		10 sec			n/a	
81O	Over-frequency		51.5 Hz	0.1 sec			n/a	
81U	Under-frequency		49.0 Hz	0.5 sec			n/a	
			48.0 Hz	0.1 sec			n/a	
87M	Differential Protection	30% In	40 A				n/a	

REV.	DESCRIPTION	DATE	DESIGN	DRAWN	CHECK
C	S1 CHANGED TO 630A, POWER METER ADD	02.06.09	M.Z	M.Z	
B	DRAWING REFS & DIFF PROT CTS ADDED	21.05.09	M.Z	M.Z	P.T
A	ORIGINAL ISSUE	06.05.09	M.Z	M.Z	P.T

DO NOT SCALE IF IN DOUBT ASK ALL DIM IN MM

PROJECT
TOOHEYS BREWERY
CO-GENERATION PROJECT

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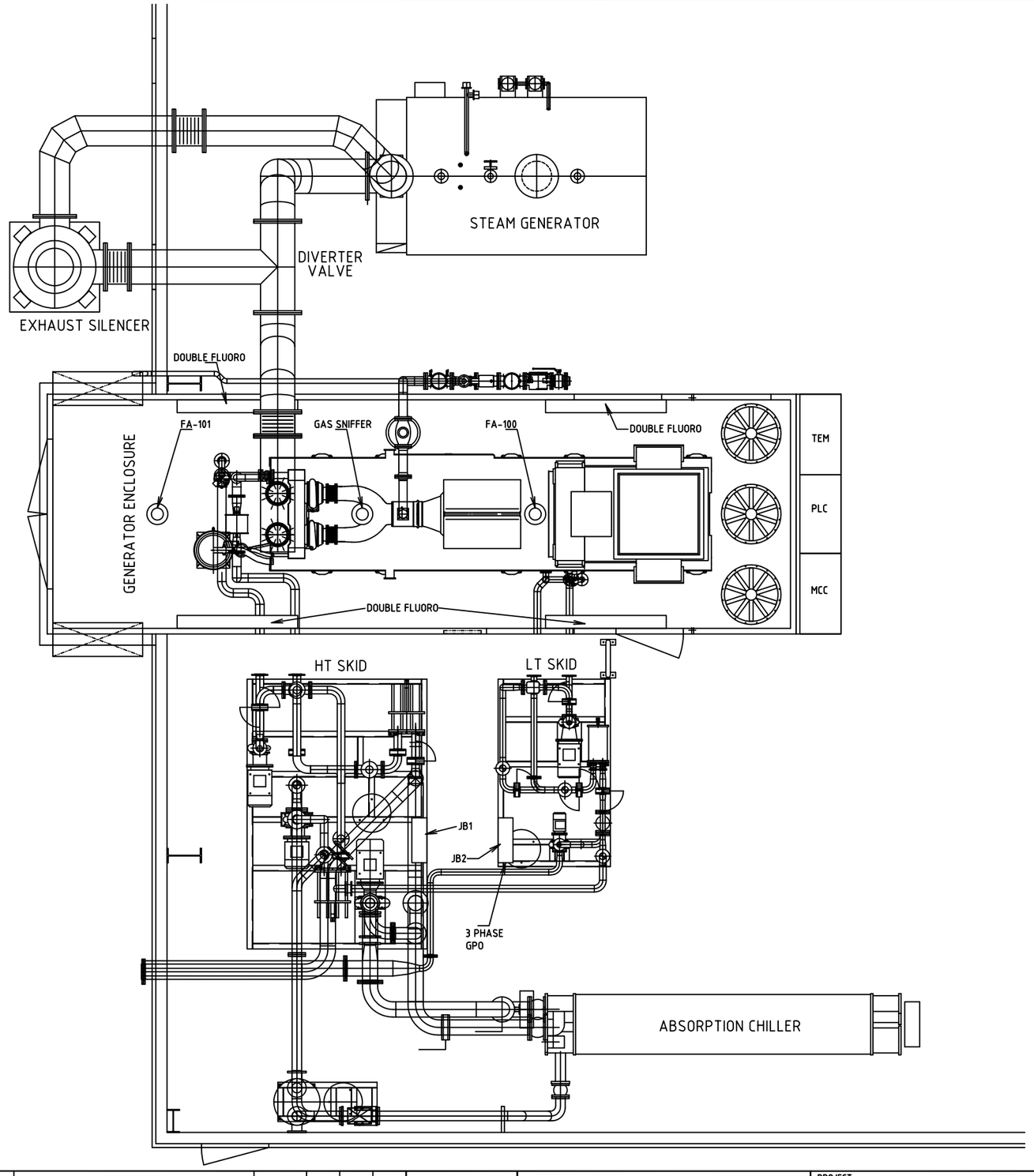
TITLE
PROTECTION SINGLE LINE DIAGRAM

JOB NO.	E1299
DRAWN	M.ZAPOROSHENKO
DATE	06.05.09
CHECKED	P.TAIT
SCALE	NTS

DRAWING NO. E1299-09-002

SHT 1 OF 1 REV. C A3



REV.	DESCRIPTION	DATE	DESIGN	DRAWN	CHECK
A	ORIGINAL ISSUE	23.07.09	M.Z	A.C.	Y.A.

PROJECT: TOOHEYS BREWERY CO-GENERATION PROJECT

TITLE: POWER, LIGHTING, GAS DETECTION AND FIRE DETECTION LAYOUT

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DESIGN	M.ZAPOROSHENKO
DRAWN	A.C
DATE	23.07.09
CHECKED	Y.A.
SCALE	NTS

DRAWING NO. E1299-09-005

SHT 1 OF 1 REV. A A2