

Graincorp Liquid Terminals
ATTN: Philip Neville
105 Tingira St
PINKENBA QLD 4008

APPLICATION	CD-2013/23
Determination	Approved
Approval Authority	Wollongong City Council
Endorsement Date	21 January 2014

NOTICE OF DETERMINATION FOR COMPLYING DEVELOPMENT CERTIFICATE

Issued under Section 85A of the Environmental Planning and Assessment Act 1979

The development application described below has been determined:

Description	Bulk Liquid Storage Facility
Location	Lot 20 DP 1046295, Lot 12 DP 1182111, Lot 2001 DP 1030233, Lot 70 DP 1182824 Grain Terminal, Tom Thumb Road, PORT KEMBLA NSW 2505, Lot 12 Springhill Road, PORT KEMBLA NSW 2505, Grain Terminal, Tom Thumb Road, PORT KEMBLA NSW 2505, Lot 70 Springhill Road, PORT KEMBLA NSW 2505
Building Classification	• 10a – facility shed, operator shed, loadout structures • 10b – bunding • Unclassified – bulk liquid storage tanks, shipping lines, loadout pumps and pipework

The application has been determined by the issue of a complying development certificate subject to the conditions set out below:

Conditions of Approval

General Conditions

1) Approved Plans and Specifications

The development shall be implemented substantially in accordance with the details and specifications set out on drawings listed below and any details on the application form except as amended by the conditions specified and imposed hereunder.

PT-PK00-99001 - Revision 1 dated 9 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.

PT-PK00-99002 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.

PT-PK00-99004 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.

PT-PK00-18001 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.

PT-PK00-16001 - Revision 1 dated 7 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.

PT-PK00-38502 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.
PT-PK00-51036 - Revision 6 dated 23 December 2013 prepared by Pacific Terminals (Australia) Pty Ltd.
PT-PK00-17001 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.
PT-PK00-99002 - Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.
PT-PK00-14001-Revision 1 dated 10 January 2014 prepared by Pacific Terminals (Australia) Pty Ltd.
131008 – E00 – Issue 1 dated 10 January 2014 prepared by Epsilon Consulting
SCAS20416 sheets 1 -6 dated 9 January 2013 prepared by SCA Garages and Sheds

2) **Building Code of Australia**

All building work must be carried out with the deemed-to-satisfy provisions of the Building Code of Australia.

Conditions Applying Before Commencement of Work

3) **Sydney Water Requirements**

Approved plans must be submitted to a Sydney Water Quick Check agent or Customer Centre to determine whether the development will affect Sydney Water's sewer and water mains, stormwater drains and/or easements, and if further requirements need to be met. Plans will be appropriately stamped. For Quick Check agent details please refer to the web site www.sydneywater.com.au, see Building Developing and Plumbing then Quick Check or telephone 13 20 92.

Prior to the commencement of work evidence must be submitted to Council to verify that a Quick Check agent/Sydney Water has appropriately stamped the plans.

4) **Protection of Adjoining Areas**

A temporary hoarding or a temporary construction site fence must be erected between the work site and adjoining lands before the works begin and must be kept in place until after the completion of works if the works:

- a) could cause a danger, obstruction or inconvenience to pedestrian or vehicular traffic, or
- b) could cause damage to adjoining lands by falling objects, or
- c) involve the enclosure of a public place or part of a public place.

5) **Notice of Commencement of Work**

Two days before any site works, building or demolition work commences, the applicant must:

- a) forward "Notice of Commencement of Work and Appointment of Principal Certifying Authority" to the Council; and
- b) notify the adjoining owners that work will commence.

6) **Toilet Facilities**

- a) Toilet facilities must be available or provided at the work site before works begin and must be maintained until the works are completed at a ratio of one toilet plus one additional toilet for every 20 persons employed at the site.
- b) Each toilet must:
 - i.) be a standard flushing toilet connected to a public sewer, or
 - ii.) have an on-site effluent disposal system approved under the Local Government Act 1993, or
 - iii.) be a temporary chemical closet approved under the Local Government Act 1993.

7) **Sign – Supervisor Contact Details**

Before commencement of any work, a sign must be erected in a prominent, visible position:

- a) stating that unauthorised entry to the work site is not permitted;
- b) showing the name, address and telephone number of the Principal Certifying Authority for the work; and

- c) showing the name and address of the principal contractor in charge of the work site and a telephone number at which that person can be contacted at any time for business purposes.

This sign shall be maintained while the work is being carried out and removed upon the completion of the construction works.

8) **Garbage Receptacle**

- a) A garbage receptacle must be provided at the work site before works begin and must be maintained until the works are completed.
- b) The garbage receptacle must have a tight fitting lid and be suitable for the reception of food scraps and papers.

9) **Notification to Neighbours**

The person having the benefit of the complying development certificate must give at least 2 days' notice in writing of the intention to commence the works to the owner or occupier of each dwelling that is situated within 20m of the lot on which the works will be carried out.

10) **Adjoining Wall Dilapidation Report**

- a) If a wall on a lot is to be built to a boundary and there is a wall (the *adjoining wall*) on the lot adjoining that boundary that is less than 0.9m from that boundary, the person having the benefit of the complying development certificate must obtain a dilapidation report on the adjoining wall.
- b) If the person preparing the report is denied access to the adjoining lot for the purpose of inspecting the adjoining wall, the report may be prepared from an external inspection of the adjoining wall.
- c) In this clause:-
Dilapidation report means a report, prepared by a professional engineer, confirming the structural condition of the adjoining wall before the development commences.

11) **Shoring and Adequacy of Adjoining Property**

If the development involves an excavation that extends below the level of the base of the footings of a building on adjoining land, the person having the benefit of the certificate must at the person's own expense:

- a) protect and support the adjoining premises from possible damage from the excavation, and
- b) where necessary, underpin the adjoining premises to prevent any such damage.

12) **Construction Hours**

Construction may only be carried out between 7.00 am and 5.00 pm Monday to Saturday, unless construction cannot be heard at the nearest residence.

13) **Erosion Controls**

Run-off and erosion controls must be implemented during construction to prevent soil erosion, water pollution or the discharge of loose sediment on the surrounding land by:

- a) diverting uncontaminated run-off around cleared or disturbed areas, and
- b) erecting a silt fence to prevent debris escaping into drainage systems and waterways, and
- c) preventing tracking of sediment by vehicles onto roads, and
- d) stockpiling top soil, excavated materials, construction and landscaping supplies and debris within the lot,

14) **Compliance with Plans**

Works must be carried out in accordance with the plans and specifications to which the complying development certificate relates.

15) **At the following stages, the Principal Certifying Authority must be given the following survey certificates prepared by a registered land surveyor:-**

- a) Before any form work below the ground floor slab is completed or (if there is no such form work) before the concrete is poured for the ground floor slab, a survey certificate showing the location of the structure relative to the boundaries,

- b) At the completion of the lowest floor, a survey certificate confirming that levels are in accordance with the Complying Development Certificate (with the levels relating to data on the certificate).
- 16) Any earthworks, including any structural retaining system or other related structure for the purposes of the development must comply with the following:-
- a) Must not cause damage to any adjoining buildings or structures on the land comprising the lot on which the earthworks are carried out or to any building or structure on land comprising an adjoining lot,
 - b) Must not redirect the flow of surface water onto adjoining property,
 - c) Must not exceed 3m above ground level (existing),
 - d) Any excavated soil found to be contaminated as classified under guidelines made under the Contaminated Land Management Act 1997 must be removed from the site in accordance with any requirements of the Protection of the Environment Operations Act 1997, or appropriately remediated or managed on site.
 - e) In the case of fill brought to the site, must use fill that contains only virgin excavated natural material (VENM) as defined by guidelines made under the Contaminated Land Management Act 1997, or fill covered by a valid exemption under clause 51 of the Protection of the Environment Operations (Waste) Regulation 2005 that permits the reuse of such fill.
- 17) To control dust emissions from the site, suitable screens or barricades must be erected prior to any demolition, excavation or building work.
- 18) **Sedimentation and Erosion Controls**
Run-off and erosion controls must be effectively maintained until the site has been stabilised and landscaped.
- 19) **Maintenance of Site**
- a) Building materials and equipment must be stored wholly within the work site unless an approval to store them elsewhere is held.
 - b) Waste materials must be disposed of at a waste management facility.
 - c) The work site must be left clear of waste and debris at the completions of the works.
- 20) **Bulk Liquid Storage Tanks**
- a) An emergency plan that is developed in accordance with the *Hazardous Industry Planning Advisory Paper No. 1, Emergency Planning*, dated January 2011 and published by the Department of Planning and Infrastructure on its website, must be prepared and implemented in relation to the development.
 - b) A safety management system that is developed in accordance with the *Hazardous Industry Planning Advisory Paper No. 9, Safety Management*, dated January 2011 and published by the Department of Planning and Infrastructure on its website, must be prepared and implemented in relation to the development.
 - c) The commissioning and operation of the tanks must comply with the applicable recommendations of the studies referred to in Clause 11(2) of Schedule 2 of the State Environmental Planning Policy (Port Botany and Port Kembla) 2013.
 - d) A hazard audit of the development that complies with Clause 11(2) of Schedule 2 of the State Environmental Planning Policy (Port Botany and Port Kembla) 2013 must be carried out 12 months after the commencement of the use of the tanks and every 3 years thereafter.
 - e) The hazard audit must comply with the *Hazardous Industry Planning Advisory Paper No. 5, Hazard Audit Guidelines*, dated January 2011 and published by the Department of Planning and Infrastructure on its website and include an implementation schedule for recommendations.
 - f) A certificate by a qualified engineer must be provided to the Principal Certifying Authority Certifying that:-
 - i.) The tank has been installed in accordance with the specifications for the design certified by a qualified engineer, and
 - ii.) The tank is structurally adequate.

- g) On completion of the building work, the Principal Certifying Authority must be satisfied that the tank is structurally adequate for its intended purpose.

21) Staging Construction

- a) If the complying development is the erection of, or alterations or additions to, a dwelling house, the roof stormwater drainage system must be installed and connected to the drainage system before the roof covering is installed.
- b) An approval that is required for connection to the drainage system under the Local Government Act 1993 must be held before the connection is carried out.
- c) If the complying development involves the construction of a vehicular access point, the access point must be completed before the occupation certificate for the complying development on the site is obtained.

22) Utility Services

If the complying development requires alteration to, or the relocation of, utility services on the lot on which the complying development is carried out, the complying development is not complete until all such works are carried out.

Notes

- 1 A complying development certificate becomes effective and commences from the date endorsed on the certificate.
- 2 Unless acted upon a complying development certificate lapses 5 years from the commencement date.
- 3 Section 85A of the Environmental Planning and Assessment Act 1979 gives no right of appeal against the determination of an application for a complying development certificate.

This letter is authorised by:

Andrew Walters

Senior Development Project Officer

Accreditation No. BPB1297

Wollongong City Council

Telephone (02) 4227 7111

WOLLONGONG CITY COUNCIL COMPLYING DEVELOPMENT

This is the plan/document referred to in Certificate Y 13/23
Dated: 21 JAN 2014

LUMINAIRE SCHEDULE

-  H1 POLE MOUNT ROAD LIGHT
250W METAL HALIDE & 2 x 250W METAL
HALIDE FLOODLIGHT
-  H2 POLE MOUNT ROAD LIGHT
250W METAL HALIDE & 250W METAL
HALIDE FLOODLIGHT
-  H3 POLE MOUNT ROAD LIGHT
250W METAL HALIDE
-  F1 WEATHERPROOF POLYCARBONATE
FLUORESCENT BATTEN 2 x 36W
-  F2 SPIGOT MOUNT WEATHERPROOF POLYCARBONATE
FLUORESCENT BATTEN 2 x 36W
-  H3 FLOODLIGHT 250W METAL HALIDE

NOTE: LIGHTING TO COMPLY WITH AS 4282-1997,
CONTROL OF THE OBTRUSIVE EFFECTS OF
OUTDOOR LIGHTING

ISSUE	DATE	AMENDMENT
A	25.11.13	ISSUED FOR REVIEW
B	13.12.13	ISSUED FOR REVIEW
1	10.01.14	ISSUED FOR CONSTRUCTION

PORT KEMBLA
BULK LIQUID STORAGE

ELECTRICAL CONTRACTOR
COMMSPOWER PTY LTD
COMMUNICATION & POWER SOLUTIONS

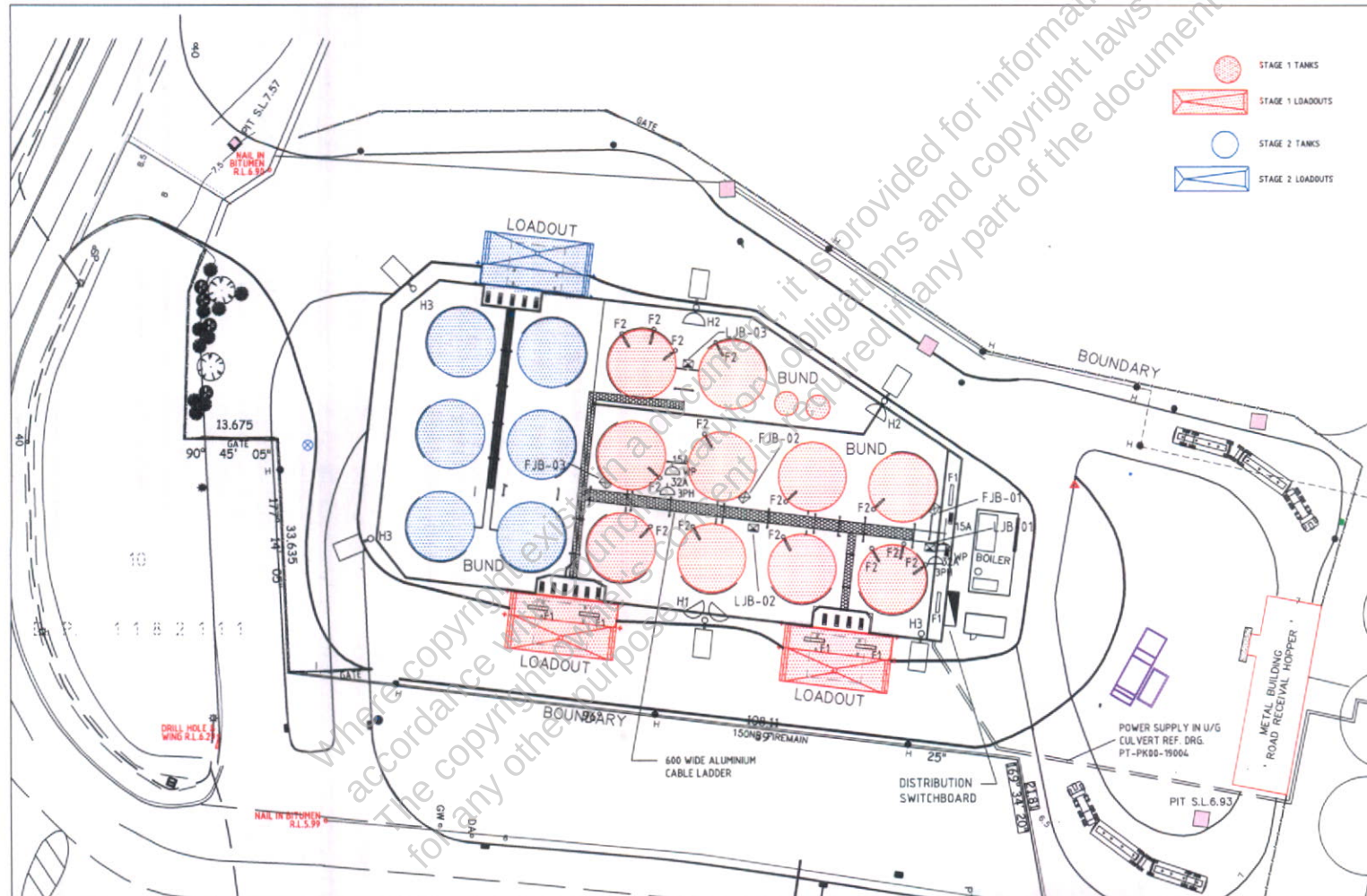
DAVID CAMPBELL
P.O. BOX 234 MOOROOKA QLD 4105

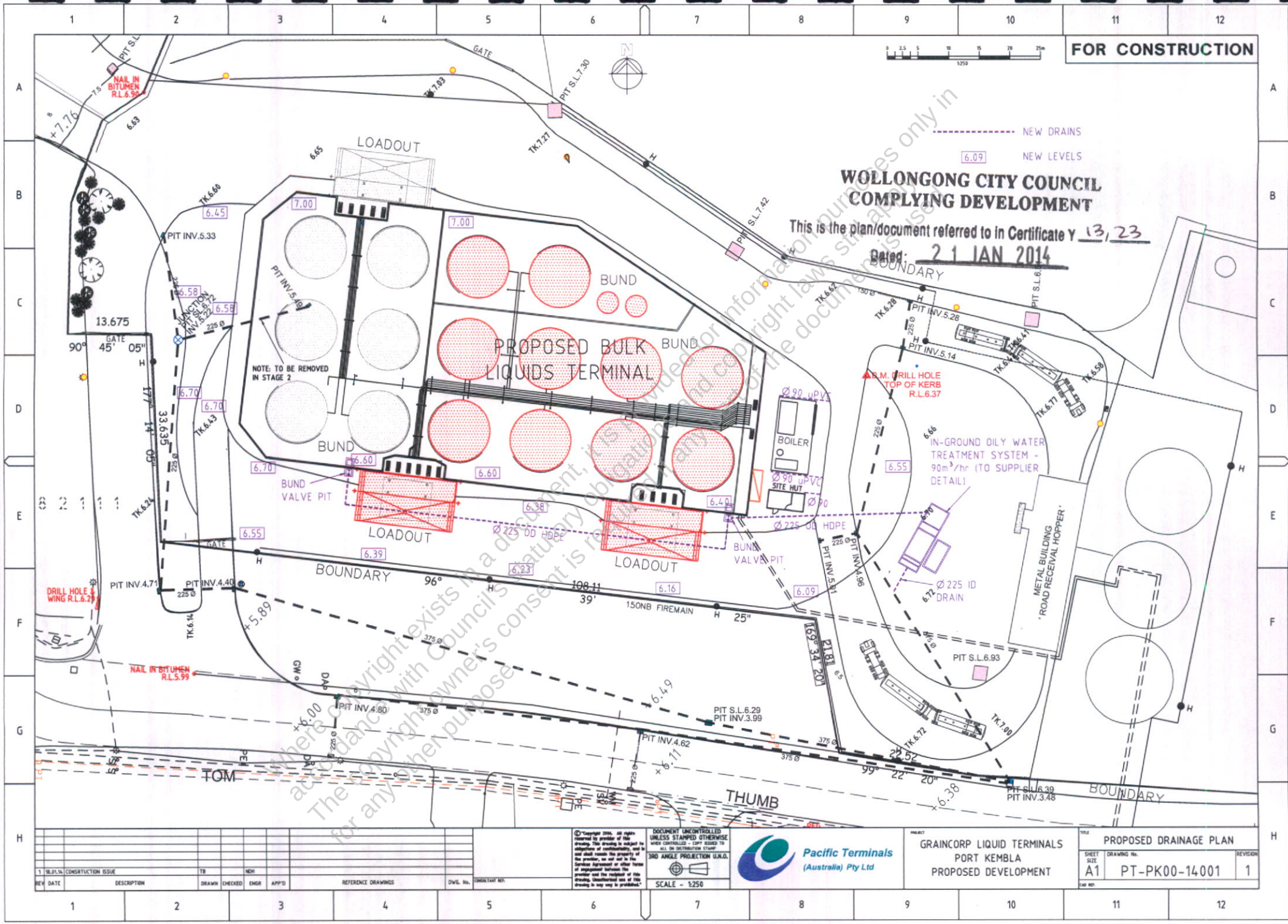
ELECTRICAL CONSULTANT
EPSILON CONSULTING
7 CHISHOLM COURT
ALBANY CREEK QLD 4035

Mobile: 0402 649 018. email: cooper42@bigpond.net.au
TITLE

SITE LIGHTING PLAN

DATE: OCT 2013	PROJECT No	DRAWING NUMBER	ISSUE
SCALE: AS SHOWN		131008-E00	1
DRAWN:			





FOR CONSTRUCTION

**WOLLONGONG CITY COUNCIL
COMPLYING DEVELOPMENT**

This is the plan/document referred to in Certificate Y 13/23

Dated: 21 JAN 2014

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENGR	APPROD	REFERENCE DRAWINGS	DWG. No.	CONSULTANT REF.
1		1. W.P.L.N. CONSTRUCTION ISSUE							

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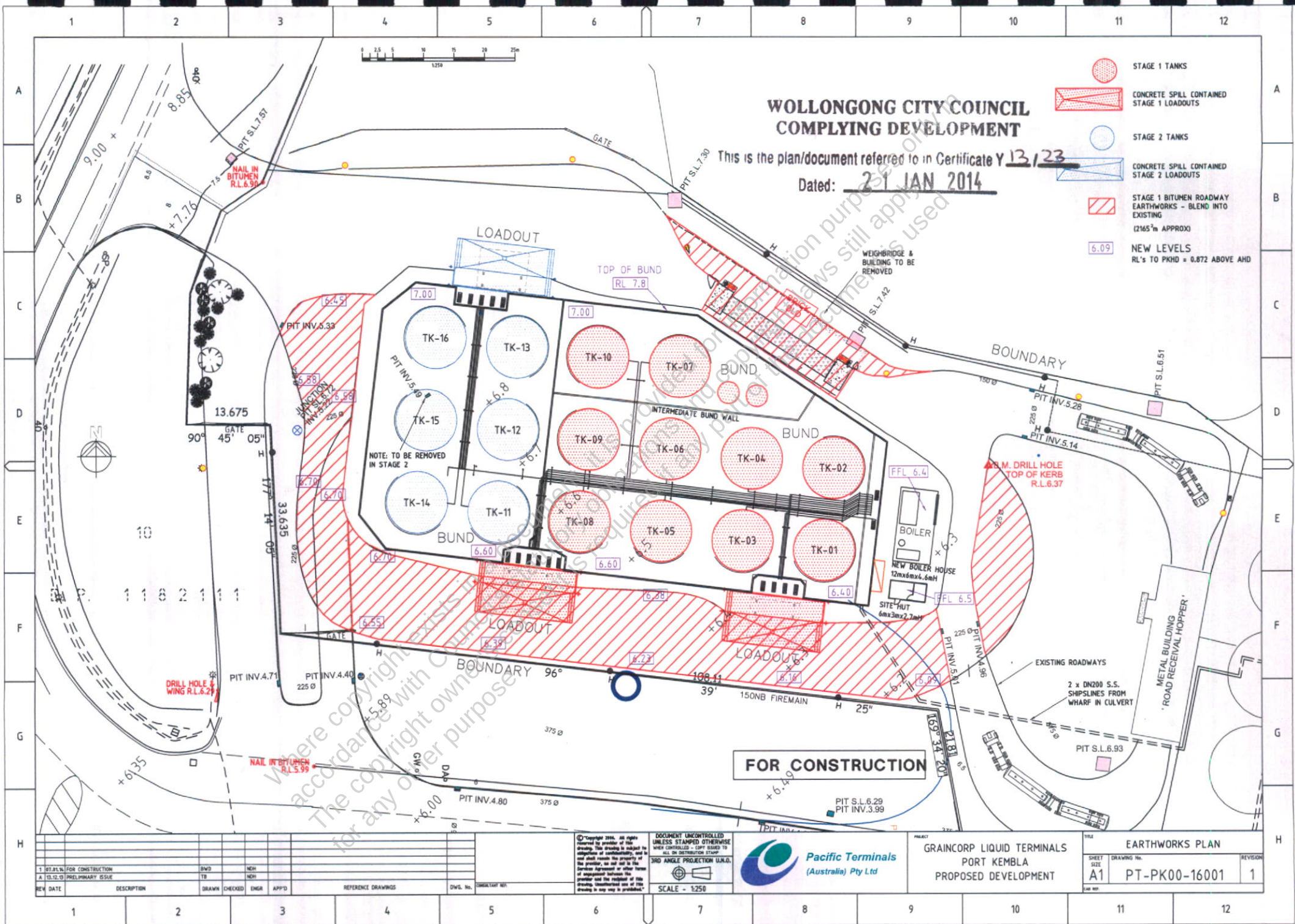
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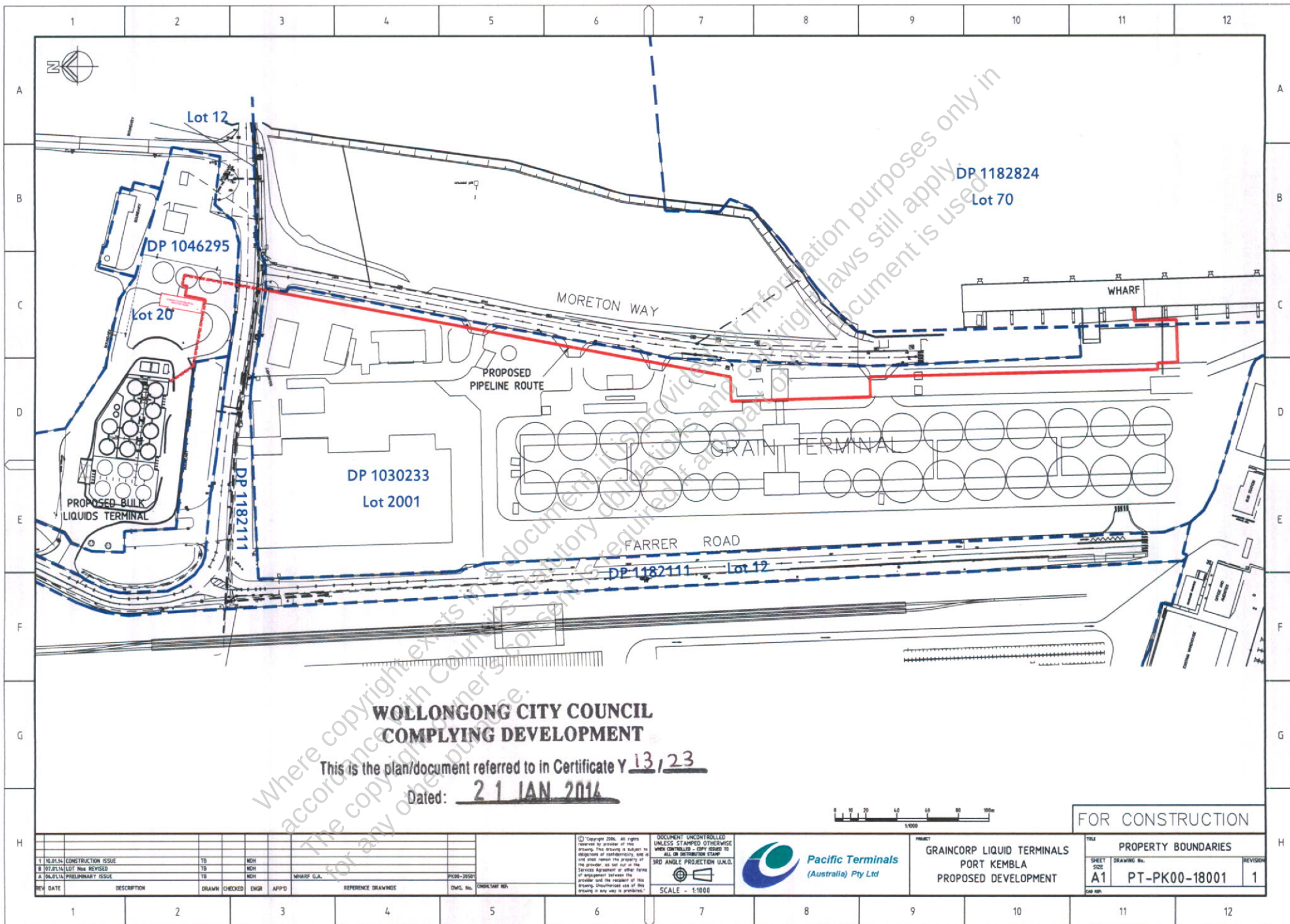
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PROJECT
**GRAINCORP LIQUID TERMINALS
PORT KEMBLA
PROPOSED DEVELOPMENT**

SHEET	DRAWING No.	REVISION
A1	PT-PK00-14001	1



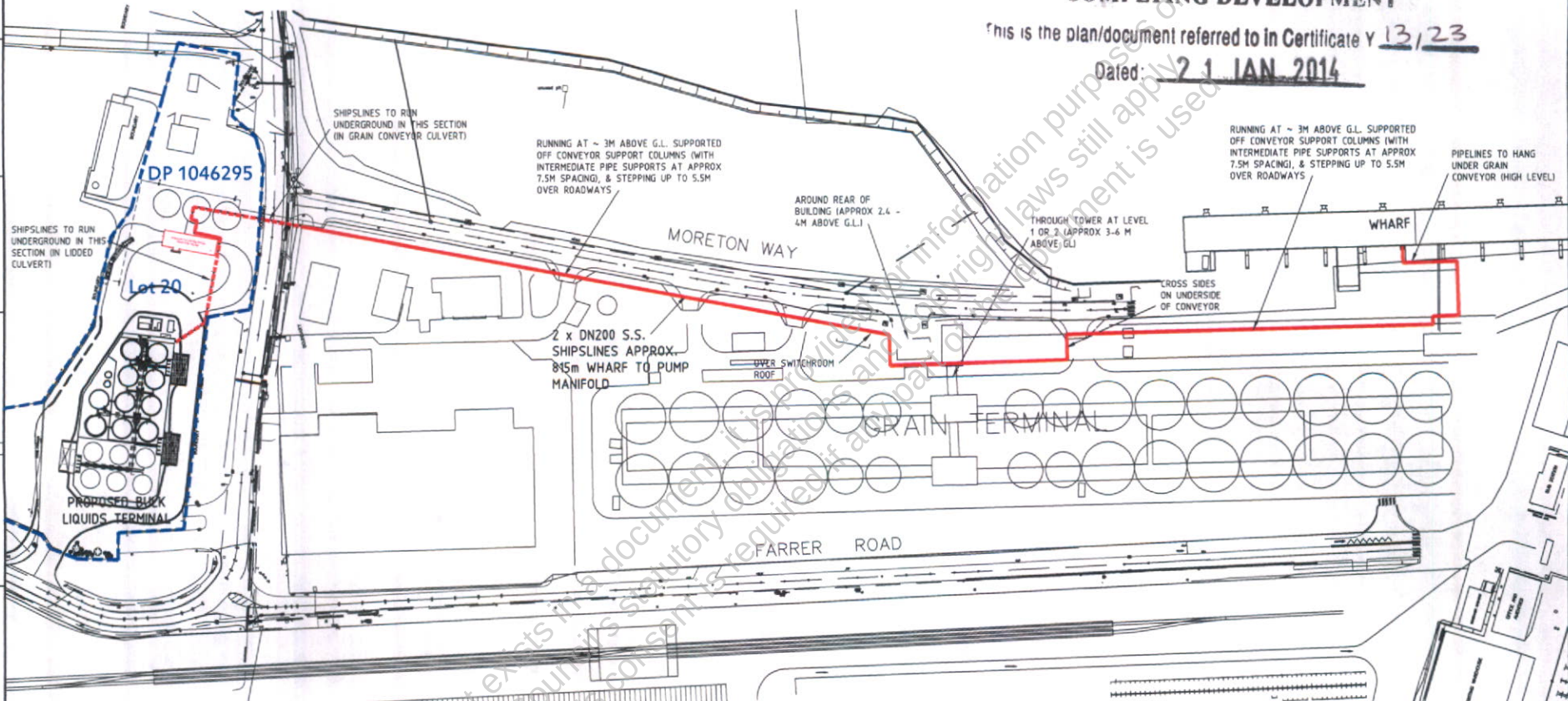




WOLLONGONG CITY COUNCIL COMPLYING DEVELOPMENT

This is the plan/document referred to in Certificate V 13/23

Dated: 21 JAN 2014



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FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENGR	APPR'D	REFERENCE DRAWINGS	CIVIL No.	CONTRACT No.	PROJECT	SHEET No.	REVISION
1	18/01/14	FOR CONSTRUCTION	BWS	NOH						GRAINCORP LIQUID TERMINALS PORT KEMBLA PROPOSED DEVELOPMENT	SHIPSLINE PIPE ROUTE	
A	05/11/13	PRELIMINARY ISSUE	TS	NOH							A1	PT-PK00-38502 1

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Pacific Terminals
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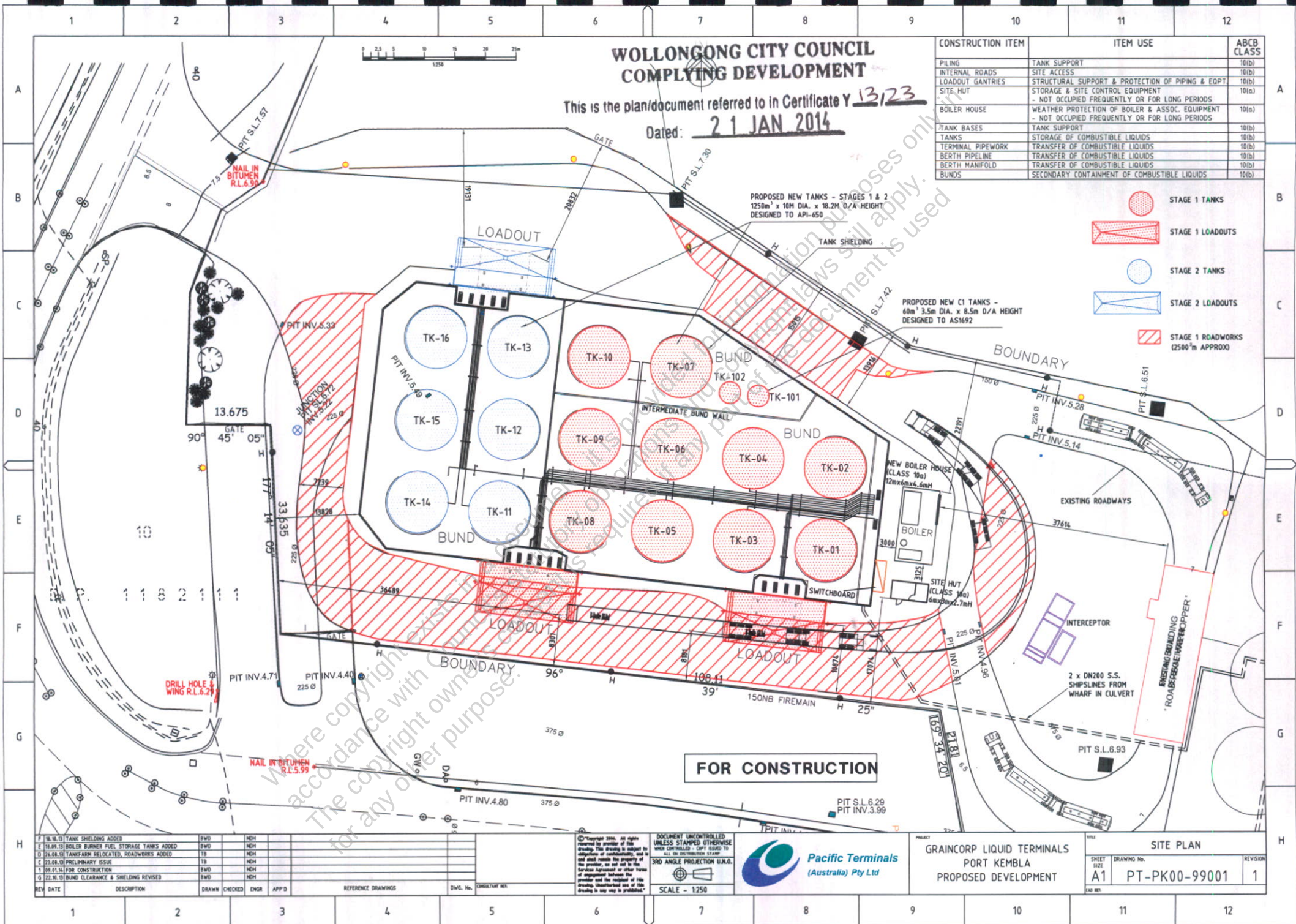
GRAINCORP LIQUID TERMINALS
PORT KEMBLA
PROPOSED DEVELOPMENT

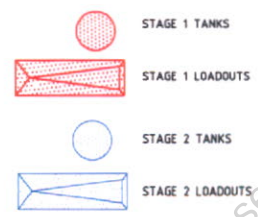
PROJECT	SHEET No.	REVISION
GRAINCORP LIQUID TERMINALS PORT KEMBLA PROPOSED DEVELOPMENT	SHIPSLINE PIPE ROUTE	
	A1	PT-PK00-38502 1

Dated: 21 JAN 2014

The diagram illustrates the four stages of the construction process for the 2500m² roadworks, showing the progression from initial tanks to final roadworks.

- STAGE 1 TANKS:** Shows a circular tank and a rectangular tank, both filled with a stippled pattern.
- STAGE 1 LOADOUTS:** Shows a rectangular tank with a diagonal line across it, indicating the removal of material.
- STAGE 2 TANKS:** Shows a circular tank and a rectangular tank, both empty.
- STAGE 2 LOADOUTS:** Shows a rectangular tank with a diagonal line across it, indicating the removal of material.
- STAGE 1 ROADWORKS (2500m² APPROX):** Shows a rectangular area with a diagonal line across it, indicating the removal of material.

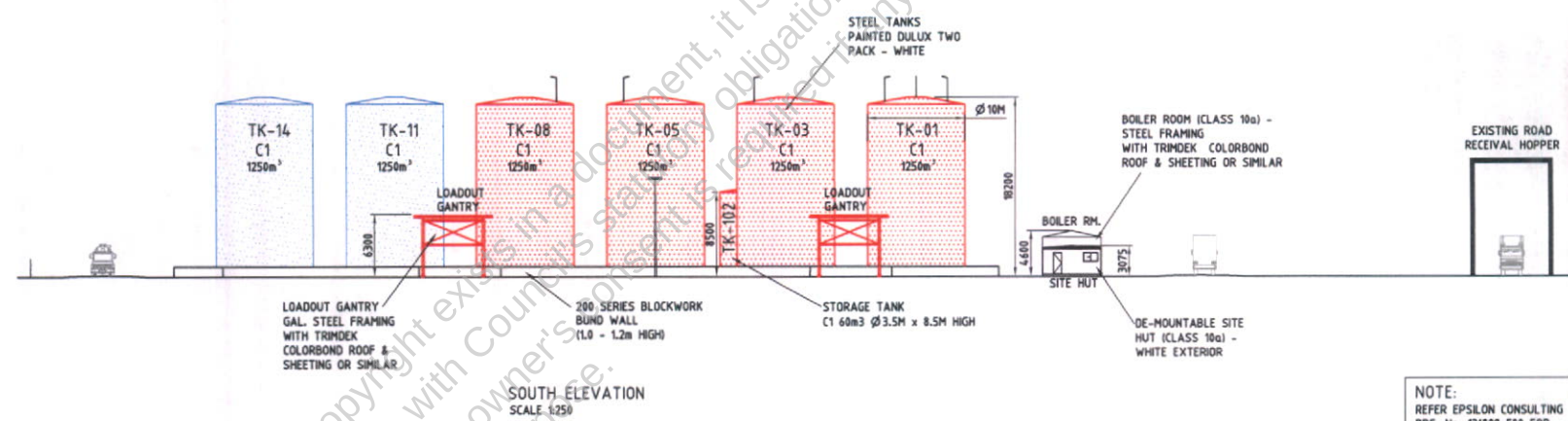




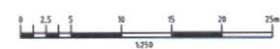
CONSTRUCTION ITEM	ITEM USE	ABC CLASS
PILING	TANK SUPPORT	10(b)
INTERNAL ROADS	SITE ACCESS	10(b)
LOADOUT GANTRIES	STRUCTURAL SUPPORT & PROTECTION OF PIPING & EQPT	10(b)
SITE HUT	STORAGE & SITE CONTROL EQUIPMENT - NOT OCCUPIED FREQUENTLY OR FOR LONG PERIODS	10(a)
BOILER HOUSE	WEATHER PROTECTION OF BOILER & ASSOC. EQUIPMENT - NOT OCCUPIED FREQUENTLY OR FOR LONG PERIODS	10(a)
TANK BASES	TANK SUPPORT	10(b)
TANKS	STORAGE OF COMBUSTIBLE LIQUIDS	10(b)
TERMINAL PIPEWORK	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BERTH PIPELINE	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BERTH MANIFOLD	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BUNDS	SECONDARY CONTAINMENT OF COMBUSTIBLE LIQUIDS	10(b)

**WOLLONGONG CITY COUNCIL
COMPLYING DEVELOPMENT**

This is the plan/document referred to in Certificate Y 13/23
Dated: 21 JAN 2014



NOTE:
REFER EPSILON CONSULTING
DRG. No. 131008-E00 FOR
LIGHTING LAYOUT



1	18.61.14	FOR CONSTRUCTION	BWD		NDH								
D	19.12.10	MATERIALS & FINISHES ADDED	TR		NDH								
C	18.69.10	BOILER BURNER FUEL STORAGE TANKS ADDED	BWD		NDH								
B	26.68.10	PRELIMINARY ISSUE	TR		NDH								
A	23.68.10	PRELIMINARY ISSUE	TR		NDH								
REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENGR	APP'D	REFERENCE DRAWINGS				DWG. No.	CONSULTANT REF.	

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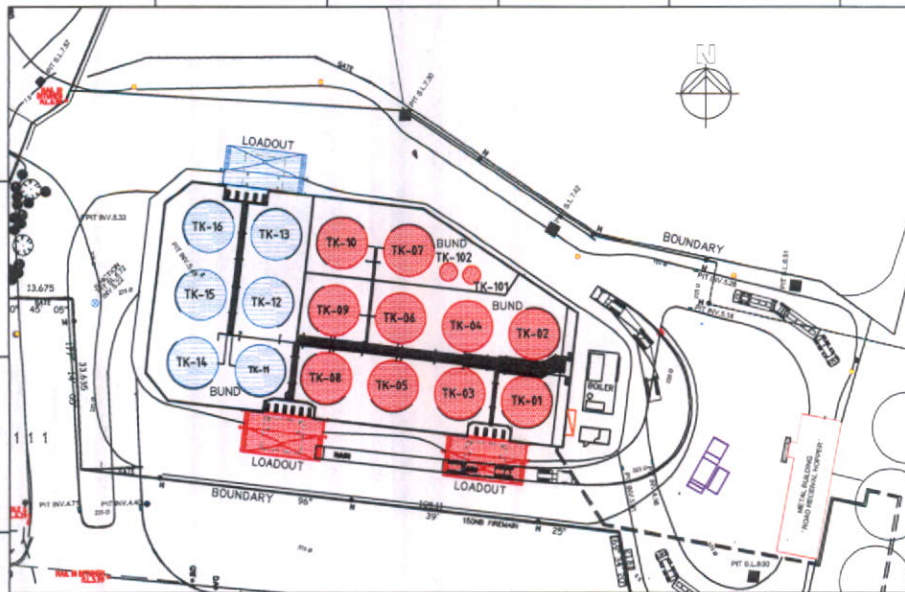


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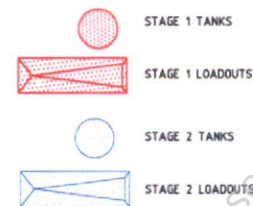


PROJECT
GRAINCORP LIQUID TERMINALS
PORT KEMBLA
PROPOSED DEVELOPMENT

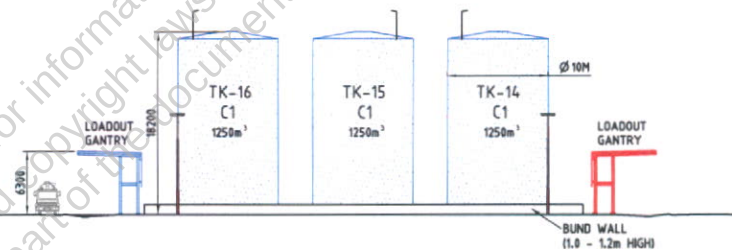
FOR CONSTRUCTION		
TANK FARM ELEVATIONS		
SHEET SIZE	DRAWING No.	REVISION
A1	PT-PK00-99002	1
SHEET NO.:		



SITE PLAN
SCALE 1:500



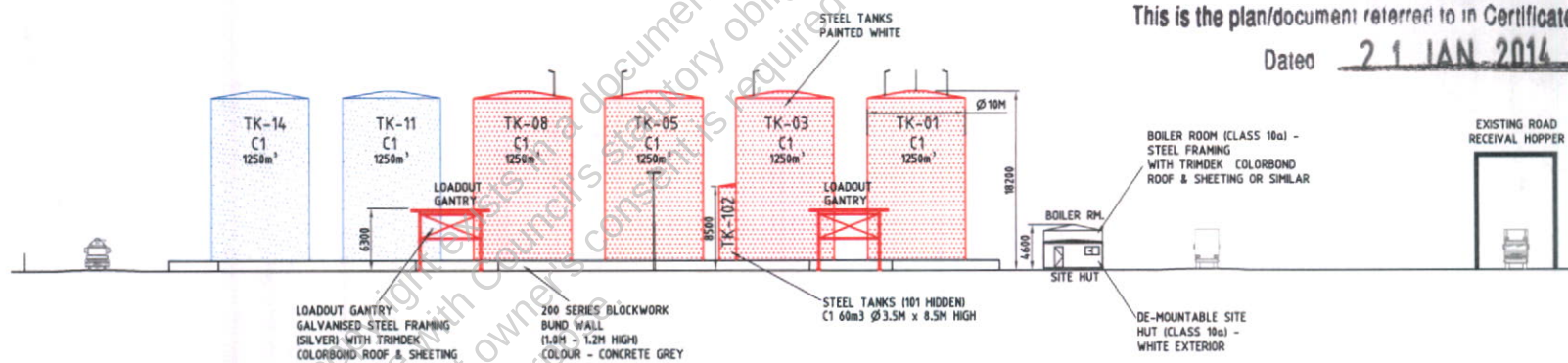
CONSTRUCTION ITEM	ITEM USE	ABCB CLASS
PILING	TANK SUPPORT	10(b)
INTERNAL ROADS	SITE ACCESS	10(b)
LOADOUT GANTRIES	STRUCTURAL SUPPORT & PROTECTION OF PIPING & EQPT	10(b)
SITE HUT	STORAGE & SITE CONTROL EQUIPMENT - NOT OCCUPIED FREQUENTLY OR FOR LONG PERIODS	10(a)
BOILER HOUSE	WEATHER PROTECTION OF BOILER & ASSOC. EQUIPMENT - NOT OCCUPIED FREQUENTLY OR FOR LONG PERIODS	10(a)
TANK BASES	TANK SUPPORT	10(b)
TANKS	STORAGE OF COMBUSTIBLE LIQUIDS	10(b)
TERMINAL PIPEWORK	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BERTH PIPELINE	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BERTH MANIFOLD	TRANSFER OF COMBUSTIBLE LIQUIDS	10(b)
BUNDS	SECONDARY CONTAINMENT OF COMBUSTIBLE LIQUIDS	10(b)



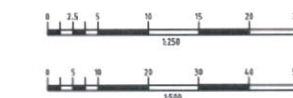
WEST ELEVATION
SCALE 1:250
**WOLLONGONG CITY COUNCIL
COMPLYING DEVELOPMENT**

This is the plan/document referred to in Certificate Y13/23

Dated 21 JAN 2014



SOUTH ELEVATION
SCALE 1:250



NOTE:
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LIGHTING LAYOUT

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENGR	APP'D	REFERENCE DRAWINGS	DWG. No.	CONSULTANT REF.
1	18.01.14	FOR CONSTRUCTION	BWD	NEH					
A	11.12.13	PRELIMINARY ISSUE	BWD	NEH					

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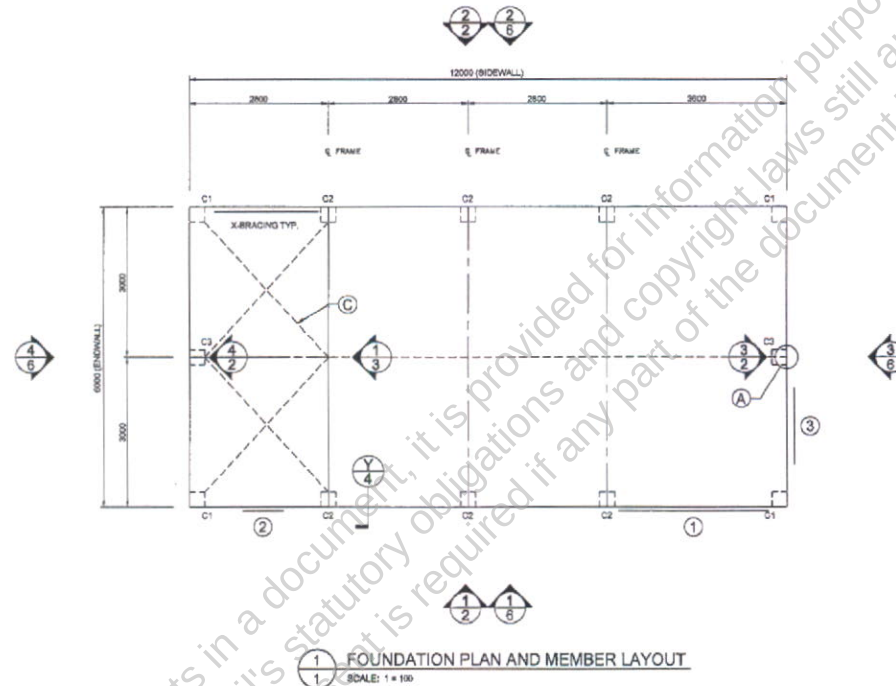


PROJECT
GRAINCORP LIQUID TERMINALS
PORT KEMBLA
PROPOSED DEVELOPMENT

FOR CONSTRUCTION		
TITLE	TANKFARM COLOURS & FINISHES	
SHEET	DRAWING No.	REVISION
A1	PT-PK00-99004	1

WOLLONGONG CITY COUNCIL COMPLYING DEVELOPMENT

This is the plan/document referred to in Certificate Y 13/23
Dated: 21 JAN 2014



1 FOUNDATION PLAN AND MEMBER LAYOUT
SCALE: 1:100

ROOF STRAP BRACING TO BE CONNECTED TO THE PURLIN CLOSEST TO THE LINE OF THE END WALL MULLION.

MAIN FRAME COLUMN LEGEND

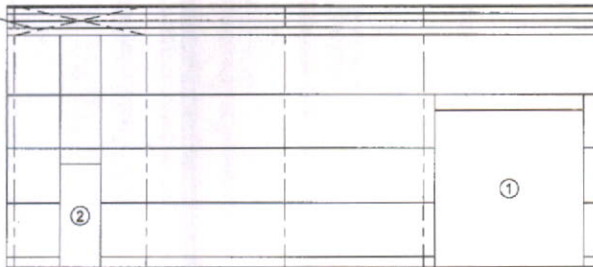
C1	C20015
C2	C20024
C3	C15019

SHEET 1 OF 6	JOB NO. SCAS20416	DATE 9/1/2014	CHECKED TM	DRAWN FDHS	STEEL BUILDING BY (CONTACT) SCA GARAGES & SHEDS PHONE 042 751991 GRAINCORP LIQUID TERMINALS TOM THUMB RD PORT KEMBLA		 Civil & Structural Engineers 50 Punari Street Currajong, Qld 4812 Fax: 07 4725 5850 Email: design@noeng.com.au ABN 341 008 173 56 Registered Chartered Professional Engineer Registered Professional Engineer (Civil & Structural) QLD Registered Certifying Engineer (Structural) N.T. Registered Engineer - (Civil) VIC Registered Engineer - (Civil) TAS	Mr Timothy Roy Messer BE MIEAust RPEQ Registered Professional Engineer 2558980 Signature <i>T. Messer</i> Date 9/1/14 Registered on the NPER in the areas of practice of Civil & Structural National Professional Engineers Register
	FOR AT							

DO NOT SCALE THIS DRAWING. USE FIGURED DIMENSIONS ONLY. ALL DIMENSIONS TO BE VERIFIED ON SITE.

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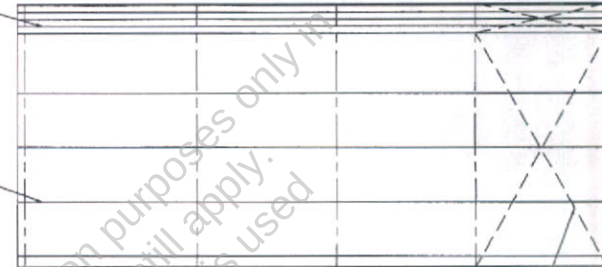
ROOF PURLINS PER MEMBER SCHEDULE ON SHEET 5



1 SIDEWALL EXTERIOR ELEVATION
2 SCALE: 1 = 100

ROOF PURLINS PER MEMBER SCHEDULE ON SHEET 5

SIDEWALL GIRTS PER MEMBER SCHEDULE ON SHEET 5

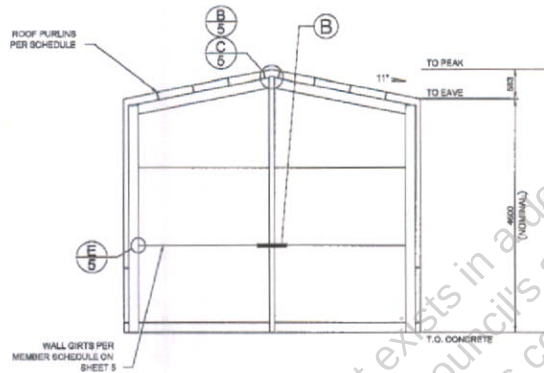


X-BRACING TYP. SEE DETAIL 105

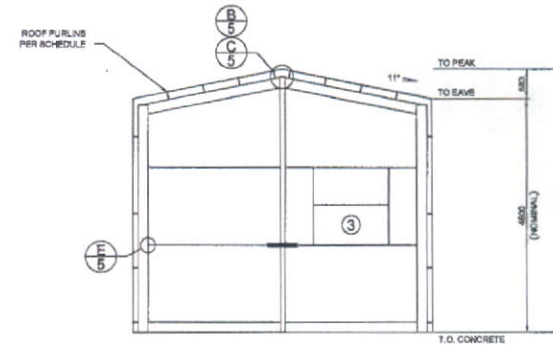
2 SIDEWALL EXTERIOR ELEVATION
2 SCALE: 1 = 100

WOLLONGONG CITY COUNCIL COMPLYING DEVELOPMENT

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4 ENDWALL INTERIOR ELEVATION
2 SCALE: 1 = 100



3 ENDWALL INTERIOR ELEVATION
2 SCALE: 1 = 100

X Bracing is required in 1 side bay(s) and 1 roof bay(s) (both sides).
Fly Bracing is included in this building to be placed on every second Purlin/Girt.

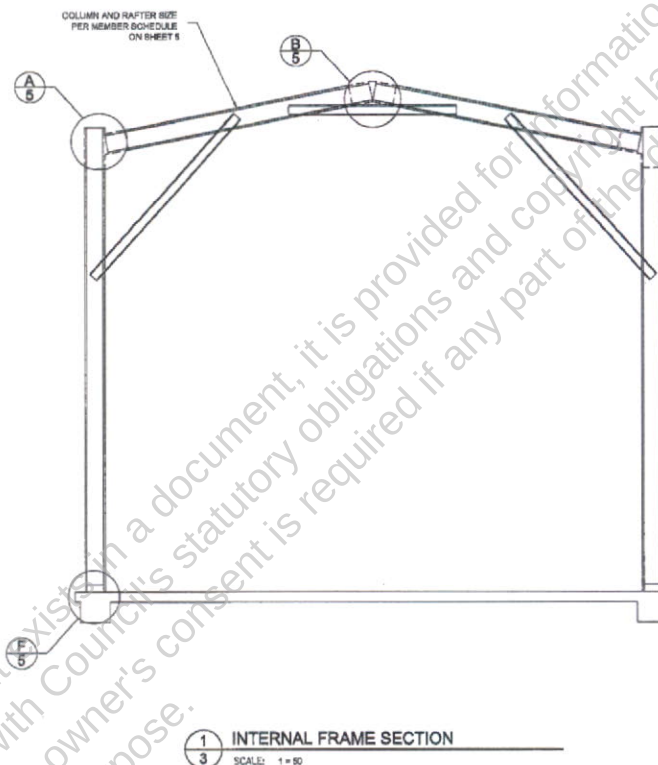
NOTE: CLADDING OMITTED FOR CLARITY. SEE SHEET #5 FOR CLADDING DETAILS.

2 OF 6	SHEET SCAS20416	JOB NO. SCAS20416	DATE 9/1/2014	CHECKED TM	DRAWN FDHS	STEEL BUILDING BY (CONTACT) SCA GARAGES & SHEDS PHONE 042 751991 FOR AT GRAINCORP LIQUID TERMINALS TOM THUMB RD PORT KEMBLA			Civil & Structural Engineers 60 Punnett Street Curlong, Qld 4812 Fax: 07 4726 5850 Email: design@noeng.com.au ABN 341 008 173 56	Mr Timothy Roy Messer BE MIEAust RPEQ Registered Professional Engineer 2556980 Signature: <i>T. Messer</i> Date: 9/1/14 Registered on the NPER in the areas of practice of Civil & Structural National Professional Engineers Register
	Registered Chartered Professional Engineer Registered Professional Engineer (Civil & Structural) QLD Registered Certifying Engineer (Structural) N.T. Registered Engineer - (Civil) VIC Registered Engineer - (Civil) TAS									Regn. No. 2556980 Regn. No. 9585 Regn. No. 11637363 Regn. No. 1205695 Regn. No. C058464M

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Refer to Sheet #4 for concrete specification.

SHEET 3 OF 6	DATE 9/1/2014	CHECKED TM	DRAWN FDHS	STEEL BUILDING BY (CONTACT) SCA GARAGES & SHEDS PHONE 042 751991	 	 Civil & Structural Engineers 80 Punari Street Currelong, Qld 4812 Fax: 07 4725 6850 Email: design@nceng.com.au ABN 341 008 173 58 Registered Chartered Professional Engineer Registered Professional Engineer (Civil & Structural) QLD Registered Certifying Engineer (Structural) N.T. Registered Engineer - (Civil) VIC Registered Engineer - (Civil) TAS	Mr Timothy Roy Messer BE MIEAust RPEQ Registered Professional Engineer 2558980 Signature <i>T. Messer</i> Date 9/1/14
	JOB NO. SCAS20416	FOR AT	GRAINCORP LIQUID TERMINALS TOM THUMB RD PORT KEMBLA	Registered on the NPER in the areas of practice of Civil & Structural National Professional Engineers Register			

STRUCTURAL GENERAL NOTES

1. GOVERNING CODE: BUILDING CODE OF AUSTRALIA (BCA), LOADING TO AS1170 - ALL SECTIONS. BUILDING SUITABLE FOR DOMESTIC/LIGHT INDUSTRIAL USE UNLESS OTHERWISE SPECIFICALLY NOTED.
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6. INSPECTIONS: NO SPECIAL INSPECTIONS ARE REQUIRED BY THE GOVERNING CODE ON THIS JOB. ANY OTHER INSPECTIONS REQUESTED BY THE LOCAL BUILDING DEPARTMENT SHALL BE CONDUCTED AT THE OWNER'S EXPENSE.
7. SOIL REQUIREMENTS: SITE CLASSIFICATION TO BE A, B OR M ONLY. SOIL SAFE BEARING CAPACITY VALUE INDICATED ON DRAWING SHEET 4 OCCURS AT 100mm BELOW FINISH GRADE, EXISTING NATURAL GRADE, OR AT FOOT DEPTH SPECIFIED BY LOCAL BUILDING DEPARTMENT, WHICHEVER IS THE LOWEST ELEVATION. REGARDLESS OF DETAIL Y ON SHEET 4 THE MINIMUM FOUNDATION DEPTH SHOULD BE 100mm INTO NATURAL GROUND OR BELOW FOOT DEPTH SPECIFIED BY LOCAL COUNCIL. ROLLS OR COMPACTED FILL MAY BE USED UNDER SLAB, COMPACTED TO 150mm LAYER TO A MINIMUM DEPTH OF 900mm. CONCRETE FOUNDATION EMBEDEDMENT DEPTHS DO NOT APPLY TO LOCATIONS WHERE ANY UNCOMPACTED FILL OR DISTURBED GROUND EXISTS. OR WHERE WALLS OF THE EXCAVATION WILL NOT STAND WITHOUT SUPPLEMENTAL SUPPORT, IN THIS CASE SEEK FURTHER ENGINEERING ADVICE.
8. CLASS 10a FOOTING DESIGN: THE FOUNDATION CONCERNED IS ALSO APPROPRIATE FOR CLASS 10a BUILDING DESIGNS ON 'M-D', 'E', 'H-D' OR 'E' CLASS SOILS, IF TOTAL SLAB AREA IS UNDER 100m² AND THE MAXIMUM SLAB DIMENSION (LENGTH AND WIDTH) IS LESS THAN 12m. PLEASE BE AWARE THAT THE SLAB DESIGN FOR H & E CLASS SOILS IN THESE INSTANCES ARE DESIGNED TO EXPERIENCE SOME CRACKING. THIS CRACKING IS NOT CONSIDERED A STRUCTURAL FLAW OR DESIGN ISSUE, AND IS SIMPLY COSMETIC IN NATURE. IF THIS IS A CONCERN TO THE CLIENT IT IS ADVISED THEY DISCUSS OTHER OPTIONS WITH THE RELEVANT DISTRIBUTOR PRIOR TO THE POURING OF THE SLAB.
9. CONCRETE REQUIREMENTS: ALL CONCRETE DETAILS AND PLACEMENT SHALL BE PERFORMED IN ACCORDANCE WITH AS2870 AND AS3600. CONCRETE SHALL HAVE A MIN. 28-DAY STRENGTH OF 20MPa FOR EXPOSURE A1 & A2, 25MPa FOR EXPOSURE A3 & A4 AND 30MPa FOR EXPOSURE C, IN ACCORDANCE WITH SECTION 4, AS3600. CEMENT TO BE TYPE A, MAX AGGREGATE SIZE OF 20mm. SLABS TO BE 60mm - 12mm. SLABS TO BE CURED FOR 7 DAYS BY WATERING OR COVERING WITH A PLASTIC MEMBRANE, AFTER WHICH CONSTRUCTION CAN BEGIN. NOTE CARE GIVEN NOT TO OVER-TIGHTEN HOLD DOWN BOLTS. GIVEN ALLOWABLE SOIL TYPES 2 LAYER OF B172 REINFORCING MESH IS TO BE INSTALLED ON STANDARD SLABS WITH A MINIMUM 30mm COVER FROM CONCRETE SURFACE. CONCRETE REINFORCING TO CONFORM TO AS 1362, AS1302 & AS 1304. ALL REINFORCING COVER TO BE A MINIMUM OF 30mm.
10. STRUCTURAL STEEL REQUIREMENTS: ALSO STRUCTURAL STEEL, INCLUDING SHEETING THROUGH EXISTING CONCRETE REINFORCING, SHALL CONFORM TO AS 1397 (GAUGE < 1mm, fy = 550MPa, GAUGE > 1mm < 1.5mm fy = 500MPa, GAUGE > 1.5mm fy = 450MPa). NO WELDING IS TO BE PERFORMED ON THIS BUILDING. ALL STRUCTURAL MEMBERS AND CONNECTIONS DESIGNED TO AS4600. ALL BOLT HOLE DIAMETERS TO STRAITEN GENERAL TOLERANCES.
11. DESIGN WIND REQUIREMENTS: THE FRAME AS A BASIC STRUCTURE IS DESIGNED AS AN "AIR LEAKY BUILDING" IN COMPLIANCE WITH AS 1170.5.3, AS SUCH, SHOULD A WINDOW OR DOOR FAIL, INTEGRITY OF THE BUILDING WILL BE MAINTAINED.
12. FOOT TRAFFIC: FOR SECTION AND MAINTENANCE PLEASE NOTE THE FOLLOWING DEFINED FOOT TRAFFIC ZONES:
 - CORRUGATED: WALK ONLY WITHIN 200mm OF SCREEN LINES. FEET SPREAD OVER AT LEAST TWO RIMS.
 - MONOCLAD: WALK ONLY IN PANS, OR ON RISERS AT SCREEN LINES.

PROJECT DESIGN CRITERIA

ROOF LIVE LOAD: 0.25 kPa
 BASIC WIND SPEED: VR 40 m/s
 SITE WIND SPEED: V_{sl} 41 m/s
 WIND REGION: Reg A
 TOPOGRAPHY FACTOR, k_t: 1
 SHIELDING FACTOR, k_s: 1
 MAX GROUND SNOW LOAD: NA
 MAX ROOF SNOW LOAD: NA
 SITE ALTITUDE: NA
 TERRAIN CATEGORY: TCat 2
 SOIL SAFE BEARING CAPACITY: 100 kPa
 RETURN PERIOD: 1:500
 LIMITING CPI 1: -0.3
 LIMITING CPI 2: 0
 IMPORTANCE LEVEL: 2

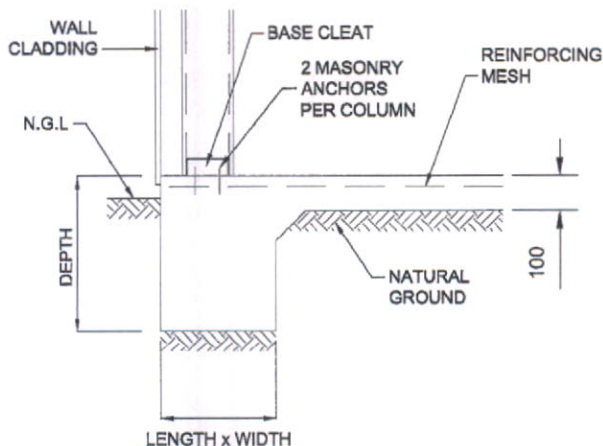
DETAIL KEYS

- (A) ENDWALL VERTICAL MULLION (SEE DETAIL C/S FOR TOP CORN. AND F/S FOR BASE CORN.)
- (B) FLYBRACING PER DETAIL L/S
- (C) X-BRACING IN ROOF ABOVE (SEE DETAIL M/S)
- (D) DOUBLE X-BRACING IN ROOF ABOVE (SEE DETAIL M/S)

DOOR SCHEDULE

DOOR	WIDTH	HEIGHT	OPENING TYPE	HEADER GIRT	OPENING JAMBS
①	800	2100	3.10X 3.10S SERIES A	SINGLE	
②	800	2040	PA DOOR 2 OR SPECIAL	SINGLE	
③	1510	2760	WINDOM	SINGLE	

NOTE: 1. SEE SHEET 8 FOR DOOR OPENING FRAMING INFORMATION.
 2. ALL DOOR SCHEDULE HEAD/JAMBS ARE ACTUAL. DOOR/DOORWAY SIZE NOT OPENING SIZE.



Length x Width x Depth (mm)
 300 x 300 x 300

N.G.L. - NATURAL GROUND LINE

Y BLOCK LOCAL THICKENING DETAIL SBLMA

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Dated: 21 JAN 2014

4
 OF
 6

SHEET
 JOB NO. SCAS20416
 DATE 9/1/2014
 CHECKED TLM
 DRAWN FDHS

STEEL BUILDING BY
 FOR
 AT

SCA GARAGES & SHEDS
 PHONE 042 751991
 GRAINCORP LIQUID TERMINALS
 TOM THUMB RD
 PORT KEMBLA



fairdinkum
 SHEDS

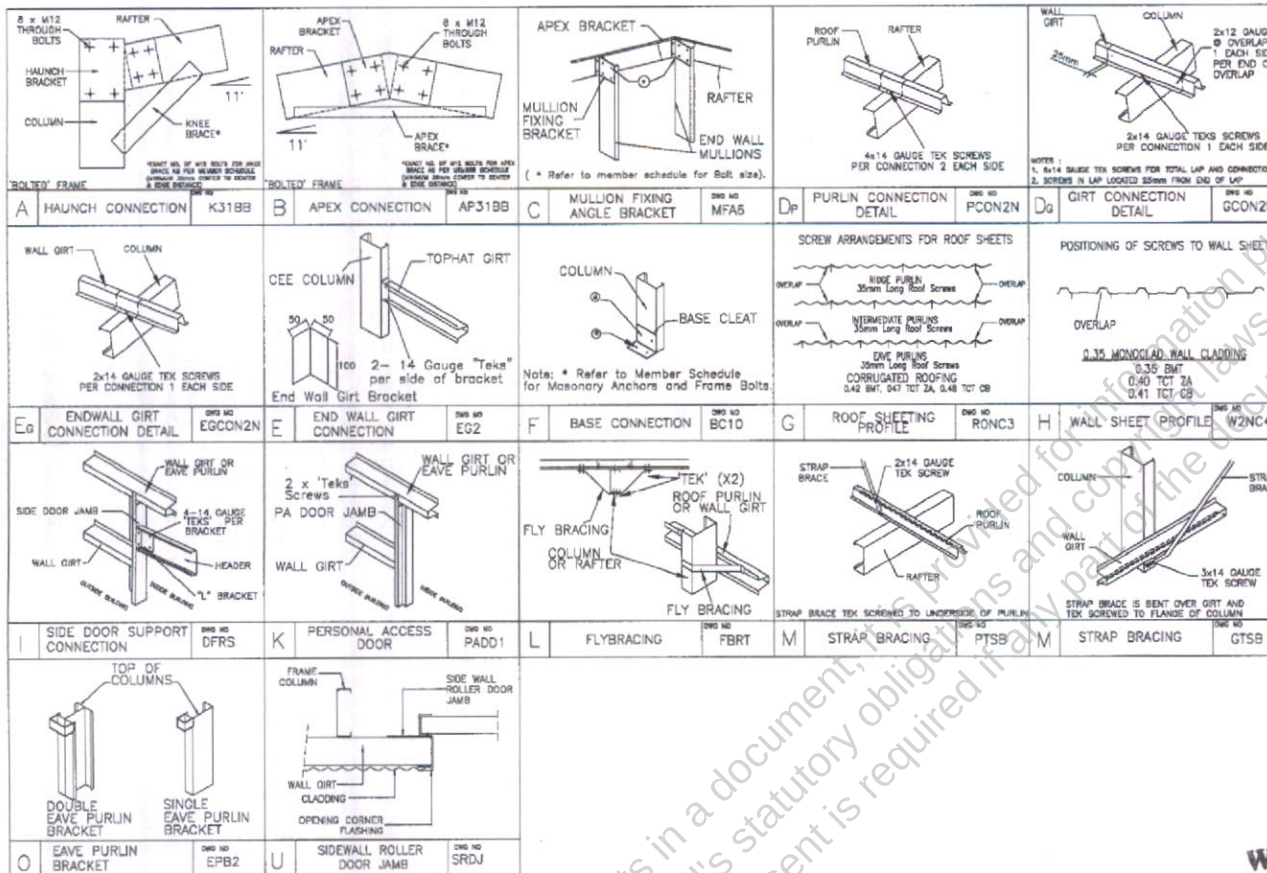
NORTHERN CONSULTING
 engineers
 Registered Chartered Professional Engineer
 Registered Professional Engineer (Civil & Structural) QLD
 Registered Certifying Engineer (Structural) N.T.
 Registered Engineer - (Civil) VIC
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Civil & Structural Engineers
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 Currenjong, Qld 4812
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 ABN 341 008 173 56

Mr Timothy Roy Messer BE MIEAust RPEQ
 Registered Professional Engineer 2558980

Signature T. Messer
 Date 9/1/14
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MEMBER AND MATERIAL SCHEDULE

1	END WALL RAFTER	Single C20015
2	O.S. FRAME RAFTER	Single C20015
3	END FRAME COLUMN (C1)	Single C20015
4	O.S. FRAME COLUMN (C2)	Single C20015
5	MULLION (C3)	Single C15019
6	O.S. FRAME KNEE BRACE	Single C10015 @ 2.01 LONG 2 bolts each end
7	KNEE BRACE HEIGHT UP COLUMN	3.05m
8	KNEE BRACE LENGTH UP RAFTER	1.41m
9	O.S. FRAME APEX BRACE	Single C10015 @ 1.66 LONG 2 bolts each end
10	APEX POSITION FROM RAFTER END	0.68m
11	ANCHOR BOLTS (9 PER DET.)	Sleeve Anchor 15.0x10.20Y
12	RAVE PURLIN	C10015 (Sleeve Purlin Bracket 25mm down from top of column)
13	TYP. ROOF PURLIN SIZE	Tophat 64 x 1.0
14	MAIN BLDG. PURLIN SPACING	0.73 m. (4 rows) (Max Allow. 0.74m)
15	TYP. SIDEWALL GIRT SIZE	Tophat 64 x 1.0
16	MAIN BLDG. SIDEWALL GIRT SPACING	1.07 m. (4 rows) (Max Allow. 1.08m)
17	TYP. ENDWALL GIRT SIZE	Tophat 64 x 1.0
18	MAIN BLDG. ENDWALL GIRT SPACING	1.52 m. (3 rows) (Max Allow. 1.55m)
19	MAIN BLDG. ENDWALL GIRT LENGTH	2.89 m. (0.1m Overlap)
20	FRAME SCREW FASTENERS	14-13x22 Hex C/B (SP HD 6/16" Hex Drive)
21	FRAME BOLT FASTENERS	Purlin Assy M12x30 ZP
22	X-BRACING STRAP AND FASTENERS	Single Bracing Strap Per Post Heavy
23	WALL COLOUR	COLOURBOND
24	ROOF COLOUR	COLOURBOND
25	ROLLER DOOR COLOUR	COLOURBOND
26	P.A. DOOR COLOUR	COLOURBOND
27	WINDOW COLOUR	COLOURBOND
28	DOWNPIPE COLOUR	COLOURBOND
29	GUTTER COLOUR	COLOURBOND
30	CORNER FLASHING COLOUR	COLOURBOND
31	BARGE FLASHING COLOUR	COLOURBOND
32	OPENING FLASHING COLOUR	COLOURBOND
33	OPEN BAY HEADER HEIGHT	0.5

"C.S." = CLEARSPAN "L" = LEFT "R" = RIGHT

PURLIN AND GIRT LENGTHS

BAY	WIDTH	PURLIN LENGTH	GIRT LENGTH
1	2.8m	2.9 m. (0.1m Lap)	2.94 m. (0.14m Lap)
2	3.8m	3.9 m. (0.1m Lap)	3.99 m. (0.20m Lap)
3	3.8m	3.9 m. (0.1m Lap)	3.12 m. (0.32m Lap)
4	3.8m	3.7 m. (0.1m Lap)	3.74 m. (0.14m Lap)

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6

SCAS20416

9/1/2014

TM

FDHS

STEEL BUILDING BY

(CONTACT)

SCA GARAGES & SHEDS

PHONE 042 751991

GRAINCORP LIQUID TERMINALS

TOM THUMB RD

PORT KEMBLA

FOR

AT

SHED SAFE

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Registered Certifying Engineer (Structural) N.T.

Registered Engineer - (Civil) VIC

Registered Engineer - (Civil) TAS

Mr Timothy Roy Messer BE MIEAust RPEQ

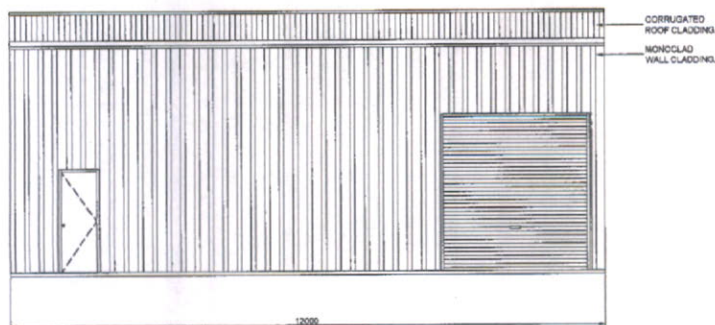
Registered Professional Engineer 2558980

Signature *T. Messer*

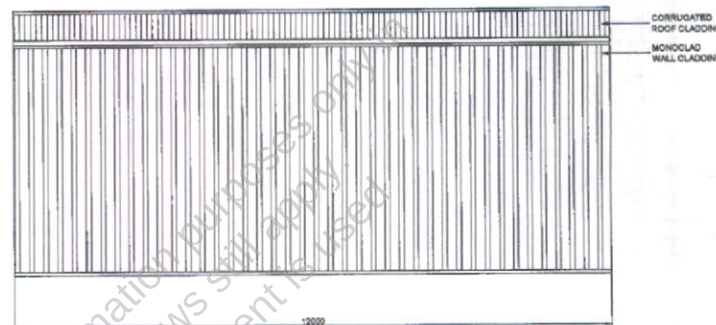
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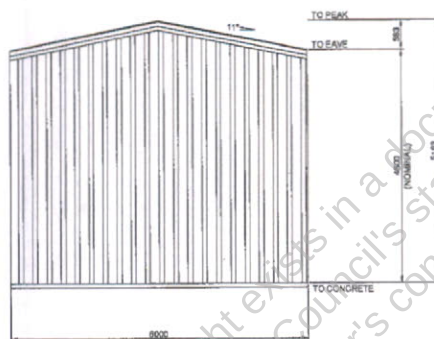
1 SIDEWALL EXTERIOR ELEVATION
SCALE: 1 = 100



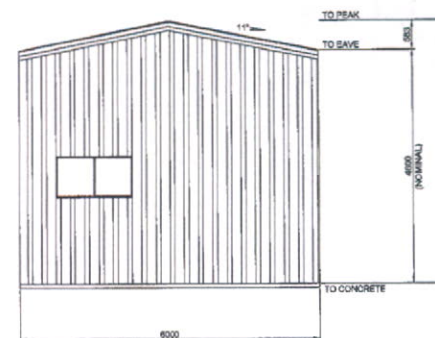
2 SIDEWALL EXTERIOR ELEVATION
SCALE: 1 = 100

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4 ENDWALL EXTERIOR ELEVATION
SCALE: 1 = 100



3 ENDWALL EXTERIOR ELEVATION
SCALE: 1 = 100

BUILDING COLOURS

WALL	COLOURBOND
ROOF	COLOURBOND
ROLLER DOOR	COLOURBOND
P.A. DOOR	COLOURBOND
WINDOW	COLOURBOND
DOWNPIPE	COLOURBOND
GUTTER	COLOURBOND
CORNER FLASHING	COLOURBOND
BASE FLASHING	COLOURBOND
OPENING FLASHING	COLOURBOND

STEEL BUILDING BY (CONTACT)
SCA GARAGES & SHEDS
FOR PHONE 042 751991
AT **GRAINCORP LIQUID TERMINALS**
TOM THUMB RD
PORT KEMBLA



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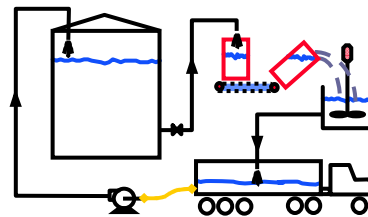
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Registered Certifying Engineer (Structural) N.T.
Registered Engineer - (Civil) VIC
Registered Engineer - (Civil) TAS

Mr Timothy Roy Messer BE MIEAust RPEQ
Registered Professional Engineer 2558980

Signature *T. Messer*

Date 9/1/14

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Monday, 13th January 2014

RE: Graincorp Port Kembla Bulk Liquids Storage

I confirm that the above development as shown on drawing PT-PK00-99001r1 (Site Plan) has been designed to meet the requirements of AS1940 (The Storage and Handling of Flammable & Combustible liquids).

I also confirm that the 16 x 1,250m³ tanks numbered TK-01 to TK16 inclusive, as shown on drawings PT-PK00-99001r1 (Site Plan) and PT-PK00-51036r6 (Tank General Arrangement) have been designed to comply with the requirements of API 650 (Welded Steel Tanks for Oil Storage).

The 2 x 60m³ tanks numbered TK-101 & TK102 are to be supplied prefabricated by an external tank supplier to meet the requirements of AS1692 (Steel tanks for flammable & combustible liquids).

Yours sincerely,

N.D Harley

Director/Principal Consultant

BE (Mech)

CPE (Chartered Professional Engineer – IEAust)

NPER (National Professional Engineer Register)

Port Kembla Proposed Bulk Liquids Storage Terminal

Fire Safety Study

For Pacific Terminals Pty Ltd

7 November 2013



Doc. No.: J-000048-03

Revision: 1



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Prepared by: Joel Leonard

Date: 31 October 2013

Reviewed by: Philip Skinner

Date: 31 October 2013

Approved by: Joel Leonard

Date: 31 October 2013

DOCUMENT HISTORY AND AUTHORISATION

Issue	Date	Changes
A	28/10/2013	Draft for client comment
0	31/10/2013	Incorporated client comments
1	7/11/2013	Incorporated updated layout, deleted recommendation 7

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Summary of Main Findings and Recommendations

The proposed fire protection system is adequate to maintain two hydrants each supplying 300 L/min of firewater unassisted and two additional foam branchpipes each supplying 240 L/min of foam provided the Port Kembla fire system can supply at least 1080 L/min at 711 kPa. Furthermore, a total of 1680 L/min assisted by fire brigade pumper is achievable if 735 kPa can be achieved at the supply to the Bulk Liquid Terminal hydrant system. The placement of the ten hydrants proposed can cover all parts of the storage compounds via a 10m stream issuing from two lengths of 30m hose, consistent with AS 2419.1 requirements.

Recommendation 1: As per AS 1940 Clause 11.13.7, provide sixteen 9 kg powder type extinguishers having a rating of at least 2A 60B€ located strategically around the storage. Some extinguishers may be located at product pumps and fill points to cover requirements for these areas as well as serving to protect combustible liquid storage.

Recommendation 2: The distance from the tank shells to the inside of the bund walls is much less than half the tank height, and therefore does not satisfy AS 1940 clause 5.8.3 without further consideration. Provide shielding from the top of the tank down to approximately 6 m height to deflect any spills into the compound.

Recommendation 3: Install a 600mm high intermediate bund within the compound for stage 1 storage in such a manner so that not more than 10,000 m³ are stored in the either of the two section created by the intermediate bund. A suggestion is to have an intermediate bund separating tanks 1 to 4 from tanks 5 to 10. This is required as the aggregate capacity of the stage one compound is greater than 10,000 m³.

Recommendation 4: Ensure suitable treatment is available for the condensate that is returned to the boiler from the heating coil in Tank 01 so that boiler water is not contaminated with hydrocarbons, as required by AS 1940 clause 6.5.2.

Recommendation 5: Provide one 9 kg powder-type extinguisher at each pump installation. These extinguishers may also be counted amongst extinguishers required to protect other areas, such as pumps and tanks that are nearby (refer recommendations 1 and 8).

Recommendation 6: Provide one 9 kg powder-type extinguisher at each hose connection / fill point. These extinguishers may also be counted amongst extinguishers required to protect other areas, such as pumps and tanks that are nearby (refer recommendations 1 and 5).

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Glossary and Abbreviations

Abbreviation	Description
AS/NZS	Australian Standard/ New Zealand Standard
DOP	Department of Planning, NSW
kW/m ²	kilo-Watts per square metre
L / min	Litres per minute
m	metres
m ³	Cubic metres
mm	Millimetres
HIPAP	Hazardous Industry Planning Advisory Paper
PTA	Pacific Terminals Australia Pty Ltd

1 SCOPE OF REPORT

The purpose of this report is to analyse the bulk liquids storage terminal at Port Kembla proposed by Pacific Terminals Australia (PTA) with regard to the fire protection required. The analysis is consistent with the NSW Department of Planning Hazardous Industry Planning Advisory Paper No 2 [1], AS1940-2004 The Storage and Handling of Flammable and Combustible Liquids [2], and AS 2419.1 Fire hydrant installations Part 1: System design, installation and commissioning [3], were referenced.

A fire safety study and compliance with AS 1940 are two criteria that must be satisfied for bulk liquid storage tank developments to be approved under the complying development provisions of the State Environmental Planning Policy SEPP (Ports) [4].

2 DESCRIPTION OF FACILITY

2.1 Facility Location and Surrounding Land Uses

The facility is located on Tom Thumb road at Port Kembla, within land owned by NSW Ports. It will be to the North and West of existing GrainCorp facilities.

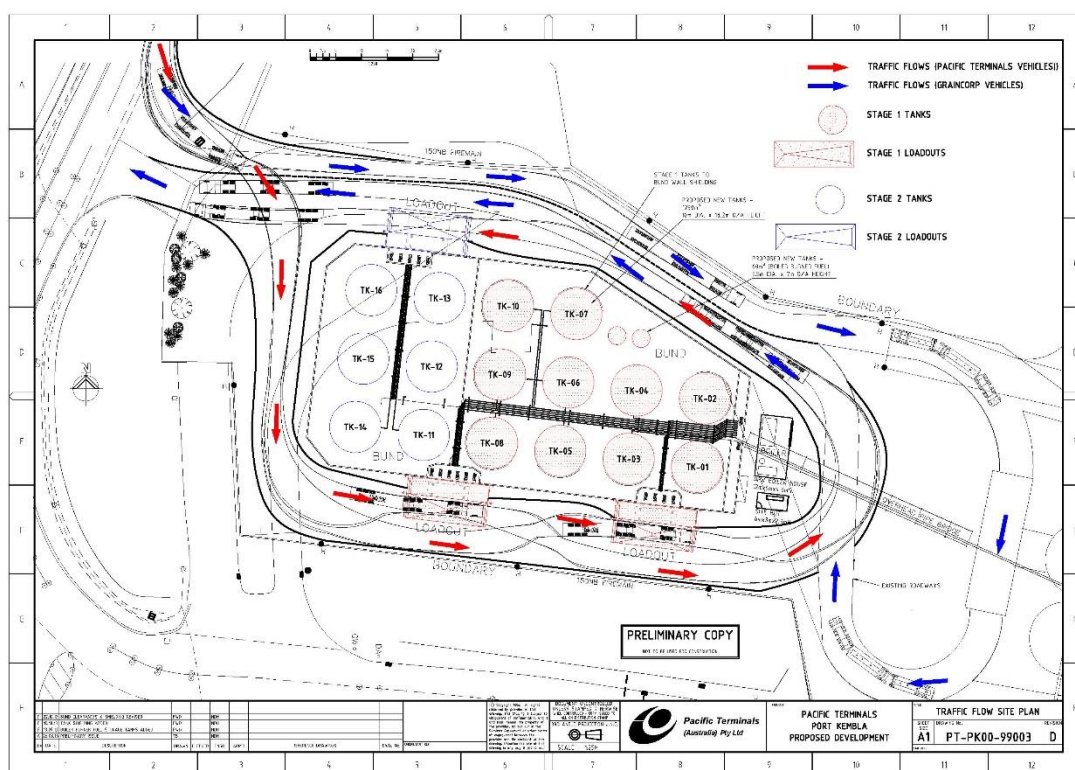


Figure 1: Proposed Bulk Liquid Storage Layout

The Terminal will store combustible hydrocarbon liquids (Class C1 and C2). No flammables will be stored. The development will be completed in two stages.

Stage 1 Development:

- Construction of 10 x 1,250m³ Carbon Steel Storage Tanks 10mt Diameter x 17.62 meters high and associated Pipe Work. The tanks are designed to API 650 standard.
- Install a 200NB Stainless Steel Shipping Line from the facility to Berth 104. The proposed shipping line will run aboveground from Berth 104 to Tom Thumb Road; from there it will run under Tom Thumb Road to the proposed new facility where it will again rise up above ground.
- Install a 150NB Carbon Steel Fire Ring Main.
- Install site specific Fire Equipment including hydrants and associated equipment.
- Construct bunding for stage 1 tanks.
- Construct 2 x Road Tanker Load Out Gantries
- Install Gantry Load Out Pumps and associated pipe work
- Construction of a Facility Shed to facilitate Steam/Hot water Boiler, Air Compressor and associated equipment.
- Install a small prefab operator office
- Construct road works for stage 1 with entry from Tom Thumb Road on the Northern side.

Stage 2 Development:

- Construction of 6 x 1,250m³ Carbon Steel Storage Tanks 10 meter Diameter x 17.62 meters High and associated Pipe Work.
- Install a second 200NB Stainless Steel Shipping Line from the facility to Berth 104. The proposed Shipping Line will run aboveground from Berth 104 to Tom Thumb Road; from there it will run under Tom Thumb Road to the proposed new facility where it will again rise up above ground.
- Install site specific Fire Equipment including, extra Fire Hydrants as required along with associated equipment.
- Construct bunding for stage 2 tanks.
- Construct 1 x Road Tanker Load Out Gantries
- Install Gantry Load Out Pumps and associated pipe work
- Construct required road works for stage 2.

2.2 Fire Protection System

A conceptual plan of the fire protection system is also shown in Figure 1. The fire protection system consists of:

- Six fire hydrants surrounding the two compounds that make up the proposed bulk liquids storage terminal. The hydrants are supplied from a 150 mm NB main.
- Fire water is supplied from the existing Port Kembla fire water system (out of scope)

3 HAZARDS IDENTIFIED

3.1 Materials Present

PTA propose to store a number of different materials at the terminal. While only details of Combustible Liquids C2 are available at present, this study has assumed Combustible Liquids C1 will also be stored. Materials associated with the bulk liquids storage for which details are presently available are presented in Table 1

Table 1: Inventory of Dangerous Goods in Proposed Bulk Liquids Storage Terminal

Name	Class	UN No.	HAZCHEM Code	Inventory
Distillates, hydrotreated heavy paraffinic	Combustible liquid (C2)	N/A	N/A	Up to 12,500 kL in stage 1. Up to 20,000 kL including stage 1 and 2
Residual oils (petroleum) solvent-refined	Combustible liquid (C2)	N/A	N/A	Up to 12,500 kL in stage 1. Up to 20,000 kL including stage 1 and 2

The total storage capacity of the terminal is 12,500 kL in stage 1, and 20,000 in stage 2.

Under fire conditions the products may emit toxic and/or irritating fumes and gases including carbon monoxide, carbon dioxide, aldehydes, ketones combustion products of nitrogen and sulfur.

3.2 Hazard Identification

The first step of the risk assessment was hazard identification. The activities involved in hazard identification included:

- A review of materials stored, handled and processed on the facility. None of the materials are classified as class 3 flammable goods.
- A desktop review of process and storage information (e.g. P&IDs, etc.) to identify the distribution and location of tanks in the facility.
- A hazard and operability study (HAZOP) [5] for the proposed development.
- A review of historic loss of containment events in bulk liquids storage terminals.

The hazards identified in the facility have been screened for potential impact on land use safety.

The consequences from accident events could result in the following final events:

- Fires (pool fires in the bund) from leaks into the bund;
- Tank roof fires. This is unlikely for combustible liquids storage in fixed roof tanks as described by AS 1940-2004 [2].
- Pump seal leak and fire
- Road tanker loading hose failure and pool fire at the loading gantry

There are no explosion events or toxic gas events in the facility.

3.2.1 Corrosion

The distillate products to be stored are clean liquids and non-corrosive. Therefore, the chance of internal corrosion is negligible. The tanks are externally painted with a corrosion resistant surface coating, and inspected regularly.

All pipework is either stainless steel or painted with a corrosion resistant paint, and inspected externally on a regular basis.

The chance of a major failure of tanks and pipework due to corrosion is considered negligible.

3.2.2 Mechanical Failure

The site is protected by a security gate, and normally there is no vehicular access to the storage tanks.

The system does not require frequent maintenance, and any crane access to the site is rare. Even then no heavy objects are moved in the tankfarm, and hence the chance of a mechanical damage due to impact is low.

The pipework has minimum flanged connections, and is mostly welded. No instruments are provided on the piping.

3.2.3 Failure of Flange Gaskets

A gasket failure would vary from a weeping leak to a small section of gasket being blown away (typically the section between two adjacent bolts). The maximum possible hole size for such failures was postulated as 9 mm, based on the distance between bolts and the gasket thickness.

3.2.4 Tanker Loading Hose Failure

The likelihood of this incident is low due to the following reasons:

The hoses are pressure tested to 1.5 times the maximum operating pressure.

Terminal provided hoses are used and not tanker's hoses. The Terminal hoses are regularly inspected for integrity.

There has been no reported cases in Australia, of a petroleum product hose failure or failure of the joint between the rubber hose and the metal casing in the last 20 years.

3.3 Operational Failures

The following Operational failures have been identified:

- Overfilling of tank when product is received from ship
- Road tanker overfill
- Tanker drive-away while connected

These operational scenarios have been discussed and assessed in detail in Table 1.

3.4 Fires

The only type of incident that could occur at the facility is a pool fire. The probability of ignition is very low. High energy ignition source such as welding would be required to ignite a potential spill as the flash point of the materials are high ($> 60^{\circ}\text{C}$), and no vapour would be generated from the spill even under hot summer conditions.

3.5 List of Incident Scenarios

Table 2 provides a list of incident scenarios modelled in the hazard analysis.

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Table 2: Hazard Identification

Hazardous Event	Causes	Possible Consequences	Prevention/Protection Measures
1 Leak of product from tanks, pipework	Corrosion failure Impact Overpressure	Product spill. Bund fire if ignited. Thermal radiation impact	Product non-corrosive. Corrosion resistant surface coating on tanks and pipework. Integrity inspections Tank vent sized for transfer flows Ignition control (permit to work system, no smoking on site) High flash point material, hard to ignite Fire protection system including portable foam
2 Tank overfilling during ship/ shore transfer	Human error Level transmitter failure	Product leak into bund through vent and bund fire if ignited Thermal radiation impact	Independent high high alarm Regular calibration and maintenance of level sensors Ignition control (permit to work system, no smoking on site) High flash point material, hard to ignite Fire protection system including portable foam
3 Tank top fire	Internal explosion, roof failure and ignition	Potential for escalation of fire to other tanks	Tank top fire is not considered possible for fixed roof tanks containing combustible liquids. No vapour above the liquid level. This is supported by AS 1940-2004.

Hazardous Event		Causes	Possible Consequences	Prevention/Protection Measures
4	Product spill during tanker loading.	Transfer hose failure Tanker overfill Driveaway while connected	Possible pool fire if ignited. Possible runoff to environment	Driver is constantly in attendance during loading. Pressure tested hoses. Scully system protection to prevent overfill. Microloader software for loading control that stops automatically after preset quantity is reached Mechanical brake interlock of truck to enable loading. Driveaway is possible only after the disconnection of hose. Extinguishers (dry chemical and foam). Site fire protection system.
5	Tanker runs into filling gantry.	Excessive speed Tanker backs into gantry when reversing	Damage to filling gantry and pipework. Potential for pipework leak. Product spill. Fire if ignited.	Speed limit on site. One-way traffic flows. Product hard to ignite. Spill containment at loading gantry.
6	Pump seal failure.	Mechanical failure during transfer operations	Spillage of product. Pool fire if ignited.	Maintenance program include regular inspection of pump system. Pumps located inside the bund and hence spill is collected in the sump within the bund.

Table 3: Hazardous Scenarios Anlased

Scenario No.	Scenario	Material	Event Location
1	Release from Tanks 1-10 from small bore fitting failure and bund fire	Distillate	Tankfarm (Tanks 1-10)
2	Tank rupture (Tk1-10) and product release into bund, bund fire	Distillate	Tankfarm (Tanks 1-10)
3	Release from Tanks 11-16 from small bore fitting failure and bund fire	Distillate	Tankfarm (Tanks 11-16)
4	Tank rupture (Tk11-16) and product release into bund, bund fire	Distillate	Tankfarm (Tanks 11-16)
5	Product release from seal failure of Loading Pump No.1 and pool fire at pump slab	Distillate	Loading gantry No.1
6	Product release from seal failure of Loading Pump No.2 and pool fire at pump slab	Distillate	Loading gantry No.2
7	Product release from seal failure of Loading Pump No.3 and pool fire at pump slab	Distillate	Loading gantry No.3
8	Product release from hose failure at Loading gantry No.1 and pool fire	Distillate	Loading gantry No.1
9	Product release from hose failure at Loading gantry No.2 and pool fire	Distillate	Loading gantry No.2
10	Product release from hose failure at Loading gantry No.3 and pool fire	Distillate	Loading gantry No.3

4 CONSEQUENCES OF INCIDENTS

Consequences of pool fires were modelled in PhastRisk 6.7 software. The results are provided in Table 4.

The consequence analysis performed in the previous section has shown that not all the events would contribute to risk. Events such as pump seal leaks have localised effect only.

Table 4: Extent of Hazardous Scenarios

Scenario No.	Scenario	Pool Diameter, m	Flame height, m	Distance to heat radiation, m			
				3 kW/m ²	4.7 kW/m ²	12.6 kW/m ²	23 kW/m ²
1	Release from Tanks 1-10 from small bore fitting failure and bund fire	6.8	10.5	34	28	18.5	14
2	Tank rupture (Tanks 1-10) and full bund fire	51.9	43.2	182	150	100	76
3	Release from Tanks 11-16 from small bore fitting failure and bund fire	6.8	10.5	34	28	18.5	14
4	Tank rupture (Tanks 11-16) and full bund fire	39.7	35.9	147	121	80	61
5	Product release from seal failure of Loading Pump No.1 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
6	Product release from seal failure of Loading Pump No.2 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
7	Product release from seal failure of Loading Pump No.3 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
8	Product release from hose failure at Loading gantry No.1 and pool fire	10	13.8	48	26	20	15.7
9	Product release from hose failure at Loading gantry No.2 and pool fire	10	13.8	48	26	20	15.7
10	Product release from hose failure at Loading gantry No.3 and pool fire	10	13.8	48	26	20	15.7

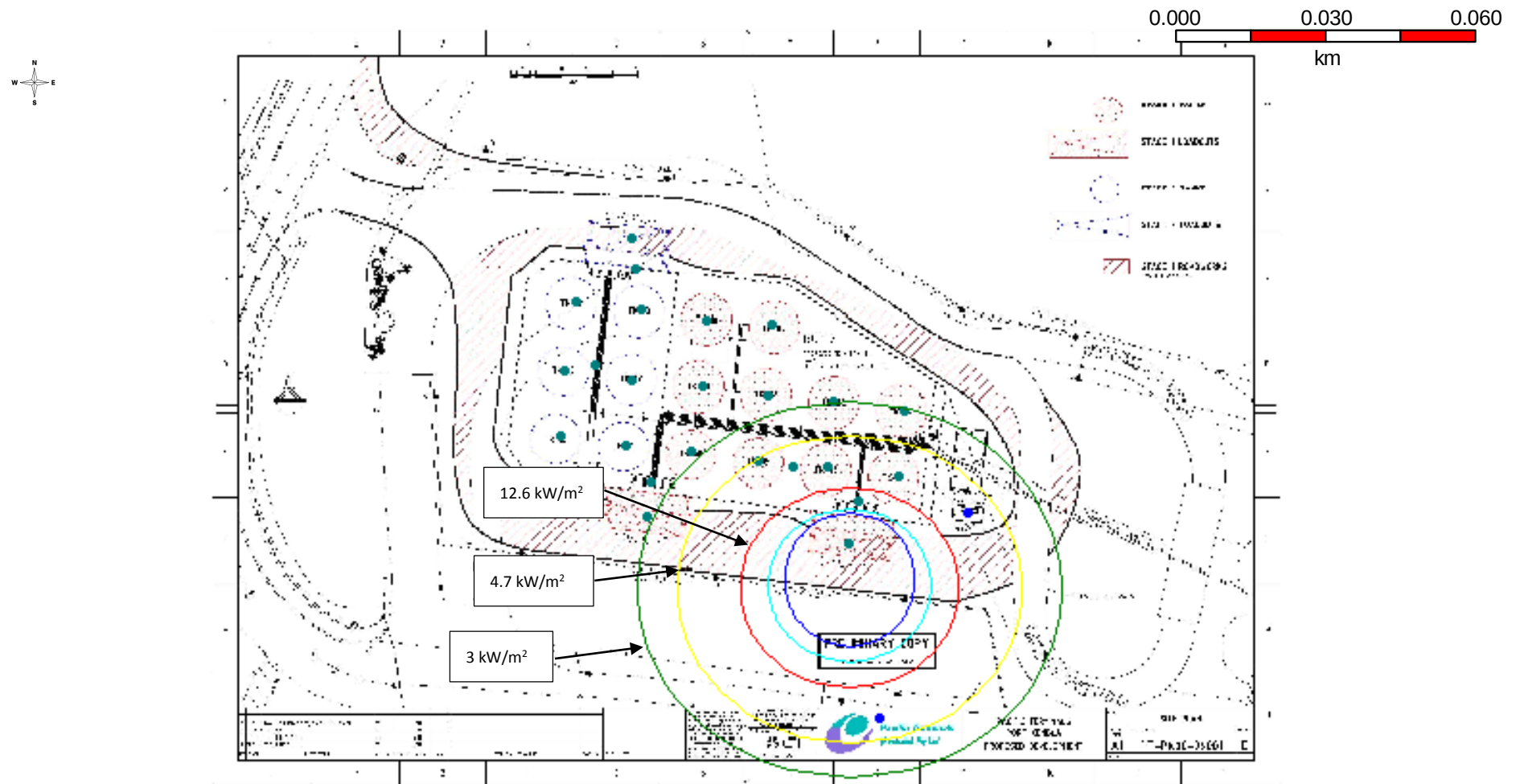


Figure 2: Heat Radiation Contours of Loadout Bay 1 Spill and Fire

5 FIRE PREVENTION AND PROTECTION STRATEGIES

5.1 Prevention

The proposed Bulk Liquids Storage Terminal will store C1 and C2 combustible liquids. These have flash points greater than 60°C and are therefore difficult to ignite. Fire prevention methods will focus on preventing escalation from hot work or other fire sources.

Access to the site is controlled, limiting the potential for unauthorised lighting of fires.

No hazardous areas will be classified within the storage terminal as the materials stored are combustible, and therefore do not generate explosive atmospheres.

5.2 Protection

Fire protection strategies are based upon the requirements of AS 1940 for C1 combustible liquids and the requirements for protection open yards from AS 2419.1.

6 DETAILS OF DETECTION AND PREVENTION

6.1 Detection

No fire detection is proposed for the bulk liquids storage terminal.

6.2 Prevention

The proposed Bulk Liquids Storage Terminal will store C1 and C2 combustible liquids. These have flash points greater than 60°C and are therefore difficult to ignite. Fire prevention methods will focus on preventing escalation from hot work or other fire sources.

Access to the site is controlled, limiting the potential for unauthorised lighting of fires. All non-routine maintenance or new works is controlled by issuing work permits, including hot-work permits where applicable, following a review of the work scope, site hazards and precautions in place.

No hazardous areas will be classified within the storage terminal as the materials stored are combustible.

7 DETAILED HYDRAULIC CALCULATIONS FOR FIRE-FIGHTING

Detailed hydraulic calculations are presented in Appendix A. The fire hydrant supply is from the Port Kembla fire protection system.

The maximum firewater demand is 1,680 L/min, based upon two hydrants discharging 600 L/min each and two foam branchpipes discharging 240 L/min each. These are based upon AS 2419 requirements for an open protected yard between 3,000 and 9,000 m² and AS 1940 requirements for branchpipes supplied where a hydrant system is provided with trained crews are available.

With a 150 NB fire main and assuming a 150m run of hydrant main, the Port Kembla fire system will need to provide unassisted 1080 L/min at 711 kPa to the Proposed Bulk Liquids Storage Terminal.

Table 5: Flow and Pressure Requirements for Supply of Firewater to Bulk Liquids Terminal

	Flow (L/min)	Pressure (kPa g)
Unassisted	1080	711
Assisted by Fire Brigade Pumper	1680	735

8 ARRANGEMENTS FOR CONTAINING CONTAMINATED FIRE FIGHTING WATER

The capacity of the storage compound is 1,375 m³. This exceeds the capacity of the largest tank (1,250 m³), plus 20 minutes firewater (33.6 m³). Contaminated firewater will be contained within the storage compound.

9 FIRST AID FIRE PROTECTION ARRANGEMENTS AND EQUIPMENT

9.1 Portable Fire Extinguishers

Recommendation 1: As per AS 1940 Clause 11.13.7, provide sixteen 9 kg powder type extinguishers having a rating of at least 2A 60B(E) located strategically around the storage. Some extinguishers may be located at product pumps and fill points to cover requirements for these areas as well as serving to protect combustible liquid storage.

9.2 Hose Reels

No hose reels are provided. This is consistent with no trained site fire crew.

9.3 Site Fire Crews

There are no trained site fire crews. Fire fighting philosophy is to muster, evacuate to a safe location and await the fire brigade.

10 CODES AND REFERENCE

10.1 Standards Referenced

AS 1940 – 2004 Storage and Handling of Flammable and Combustible Liquids

AS 2419.1 – 2005 Fire hydrant installations. Part 1: System design, installation and commissioning

10.2 Deviations from Standards

10.2.1 AS1940

5.8.3 Design and construction

(h) The location of a bund relative to the closest tank shall be such that the top inside perimeter of the bund is not inside the crest locus limit specified in Figure 5.2, except where it can be demonstrated that a reduced distance would be appropriate due to viscosity or other considerations.

Recommendation 2: The distance from the tank shells to the inside of the bund walls is much less than half the tank height, and therefore does not satisfy AS 1940 clause 5.8.3 without further

consideration. Provide shielding from the top of the tank down to approximately 6 m height to deflect any spills into the compound.

5.8.4 Compound subdivision

Where the aggregate capacity of the tanks in any compound exceeds 10 000 m³, intermediate bunds of at least half of the average height of the main bunds or 600 mm, whichever is the lesser, shall be provided so that any subdivision so created contains tanks having an aggregate capacity not exceeding 10 000 m³, or a single tank if such tank exceeds that capacity.

Recommendation 3: Install a 600mm high intermediate bund within the compound for stage 1 storage in such a manner so that not more than 10,000 m³ are stored in the either of the two section created by the intermediate bund. A suggestion is to have an intermediate bund separating tanks 1 to 4 from tanks 5 to 10. This is required as the aggregate capacity of the stage one compound is greater than 10,000 m³.

6.5.2 Condensate

Condensate from a steam heater that might be contaminated with flammable or combustible liquid should not be returned to a boiler feed without treatment to ensure that it is suitable as feed water.

Recommendation 4: Ensure suitable treatment is available for the condensate that is returned to the boiler from the heating coil in Tank 01 so that boiler water is not contaminated with hydrocarbons, as required by AS 1940 clause 6.5.2.

11.6.1 Product pumps

A pump installation for handling flammable or combustible liquids shall be provided with at least one powder-type extinguisher not less than 3 m nor more than 10 m from each risk being protected.

Recommendation 5: Provide one 9 kg powder-type extinguisher at each pump installation. These extinguishers may also be counted amongst extinguishers required to protect other areas, such as pumps and tanks that are nearby (refer recommendations 1 and 6).

11.6.2 Manifolds and hose connection points

Except as otherwise required by this Section, a powder-type extinguisher shall be provided within 10 m of a hose connection point or a manifold.

Recommendation 6: Provide one 9 kg powder-type extinguisher at each hose connection / fill point. These extinguishers may also be counted amongst extinguishers required to protect other areas, such as pumps and tanks that are nearby (refer recommendations 1 and 5).

11.13.7 Combustible liquids

Where only combustible liquids are stored, the installation shall be provided with at least the following:

- (a) A hydrant system comprising at least one hydrant riser per tank, which is capable of reaching all parts of all compounds.

- (b) Accessories and foam concentrate, as applicable.
- (c) One powder-type extinguisher per tank, with a minimum of three powder-type extinguishers for the storage area, strategically located around the storage.

Ten hydrants will be provided, but at the completion of stage 2, there will be 16 storage tanks. However, using AS 2419 as a guide, the ten hydrants ensure all parts of the storage compound are within reach of a 10m hose stream issuing from a nozzle at the end of two lengths of 30m hose.

11 REFERENCES

- [1] NSW Department of Planning and Infrastructure, "Hazardous Industry Planning Advisory Paper No 2, Fire Safety Study Guidelines," 2011.
- [2] Standards Australia, "The Storage and Handling of Flammable and Combustible Liquids," SAIGlobal Limited, 2004.
- [3] Standards Australia, "Fire Hydrant Installations - Part 1: System Design, Installation and Commissioning," SAIGlobal Limited, 2005.
- [4] NSW Department of Planning & infrastructure, "State Environmental Planning Policy (Port Botany and Port Kembla) 2013 (Ports SEPP)," 2013.
- [5] Arriscar Pty Limited, "Hazard and Operability Study of Pacific Terminals Port Kembla Bulk Liquids Facility," 2013.

Appendices

Appendix A Detailed Hydraulic Calculations

A.1 Assisted Performance

DESIGN DATA AND SUMMARY RESULTS

Page 1 of 1 - Job No.

Designer :	DATE :28 OCT 2013
Client :	TIME : 7:48
Project :	

Maximum unbalanced head loss is = 0.00000 kPa
Maximum node unbalanced flow is = 0.00024 l/m and occurs at node 22
Maximum loop unbalanced flow is = 0.00047 l/m and occurs in Pipe Loop 1

Fittings Specified as AS2118
Design Point Calculation With Min Flow

Hazen-Williams formula used

Number of Nozzles Operating : 1
Total water flow for Nozzles : 600 l/m

Number of Fixed Discharges : 2
Total water flow for Discharges : 1080 l/m

Required Flow & Pressure, Input Node 1 : 1680 l/m at 732 kPa

Specified available pressure at input node 1: 800 kPa
Available pressure minus required pressure is : 68.2 kPa

Calculated Total Pipe Volume is : 2851 Litres

Authourising Company :
Certification Number :

Input data file name : C:/PROGRAM FILES (X86)/HYENA6102/DATA/PORT KEMBLA ASSIS
.. TED WITH FOAM.DAT
Results file name : C:/PROGRAM FILES (X86)/HYENA6102/DATA/PORT KEMBLA ASSIS
.. TED WITH FOAM.OUT

PIPE CHARACTERISTICS

Page 1 of 1 - Job No.

Designer : DATE :28 OCT 2013
Client : TIME : 7:48
Project :

Pipe No.	Pipe node Numbers	Flow (l/m)	Pipe diam. Nom (mm)	Pipe diam. Actual (mm)	Pipe & Ftg. CODE #	Pipe Length (m)	TOTAL Length (m)	Loss Per m (KPa)	Loss Over pipe (KPa)	Static Loss (KPa)	TOTAL Loss (KPa)	H&W Co-eff	Water Vel. (m/s)	Vel. Press (KPa)
11	1 22	1680.32	150	155	ASAM	100.0	109.1	0.173	18.831	0.000	18.831	120	1.48	1.097
			150		1TT	9.1								
12	22 23	600.32	150	155	ASAM	25.0	25.0	0.0257	0.642	0.000	0.642	120	0.53	0.140
			150		1TN	0.0								
31	22 2	600.00	100	105	ASAM	1.0	30.0	0.171	5.109	7.836	12.946	120	1.15	0.663
			100		2TT	12.2								
			100		1NV	16.8								
32	23 3	600.32	100	105	ASAM	1.0	30.0	0.171	5.114	7.836	12.951	120	1.15	0.664
			100		2TT	12.2								
			100		1NV	16.8								
41	22 4	480.00	150	155	ASAM	25.0	25.0	0.0170	0.424	7.836	8.260	120	0.42	0.0895

LEGEND - Fittings and Pipe Materials used in this run

TT = Tee Branch

NV = Angle Valve

TN = Tee 90 deg Turn

ASAM = Medium Steel Tube to AS1074 -1989 & BS 1387

Maximum unbalanced head loss is = 0.00000 kPa

Maximum loop unbalanced flow is = 0.00047 l/m and occurs in Pipe Loop 1

Maximum node unbalanced flow is = 0.00024 l/m

NODE CHARACTERISTICS

Page 1 of 1 - Job No.

Designer :	DATE :28 OCT 2013
Client :	TIME : 7:48
Project :	

SPRINKLER/NOZZLE (N) POINTS				REFERENCE POINTS			DEMAND POINTS				Entered	K-Factor
Node	Discharge	P-TOTAL	P-NET	Node	Fixed	Pressure	Node	Demand	Pressure	Elevation	Discharge	
No.	l/m	kPa	kPa	No.	l/m	kPa	No.	l/m	kPa	(mm)	(l/m)	
3	600.32	699.377	698.713				1	1680.32	731.801	0		
				2	600.00	700.024				800	600.00	
				4	480.00	704.709				800	600.00	22.700
				22		712.969				800	480.00	
				23		712.328				0		

ADDITIONAL PRESSURE INFORMATION

Page 1 OF 1 - Job No.

Designer :	DATE :28 OCT 2013
Client :	TIME : 7:48
Project :	

Pipe No.	Pipe Node Numbers	Flow (l/min)	Pipe Diam.		Pipe & Ftg.		TOTAL Length (m.)	Loss Per m. (kPa)	Loss For Pipe (kPa)	Static Loss (kPa)	TOTAL Loss (kPa)	Pressure		
			Nom (mm)	Actual (mm)	Code #	Length (m.)						1st Node (kPa)	2nd Node (kPa)	
11	1	22	1680.32	150	155	ASAM	100.0	109.1	0.173	18.831	0.000	18.831	731.801	712.969
				150		1TT	9.1							
12	22	23	600.32	150	155	ASAM	25.0	25.0	0.0257	0.642	0.000	0.642	712.969	712.328
				150		1TN	0.0							
31	22	2	600.00	100	105	ASAM	1.0	30.0	0.171	5.109	7.836	12.946	712.969	700.024
				100		2TT	12.2							
				100		1NV	16.8							
32	23	3	600.32	100	105	ASAM	1.0	30.0	0.171	5.114	7.836	12.951	712.328	699.377
				100		2TT	12.2							
				100		1NV	16.8							
41	22	4	480.00	150	155	ASAM	25.0	25.0	0.0170	0.424	7.836	8.260	712.969	704.709

LEGEND - Fittings and Pipe Materials used in this run

TT = Tee Branch

NV = Angle Valve

TN = Tee 90 deg Turn

ASAM = Medium Steel Tube to AS1074 -1989 & BS 1387

Input Data

LABL1=Authourising Company
 TEXT1=
 LABL2=Certification Number
 TEXT2=
 OCC=High Hazard Process Risks
 DENS=
 AREA=
 ORIF=
 COVER=
 NOPLOT
 PLEN=M
 PDIAM=MM
 PRESSURE=KPA
 FLOW=L/MIN
 ELEV=MM
 FITTING=AS2118
 REPORT
 EQ
 FDESPT
 VEL
 MAXV=10
 Fitting Type =Comm
 Defaults for Elbows=SE
 Defaults for Tees=TT

Pipes

Pipes Mtr and Coef: Defaults= MCASAM HW120

P 11 1 22 100 150 ASAM120 1TT
 P 12 22 23 25 150 ASAM120 TN
 P 31 22 2 1 100 ASAM120 2TT NV
 PS 31 32 23 3
 P 41 22 4 25 150 ASAM120
 Default=

Nozzles

N 3 800 600 22.7

Fixed Discharge

R 2 800 600
 R 4 800 480

Reference Points

Point Default= ED0

R 22 0
R 23 0

InputPoints
IF 1 0 800
END

UNITS BEING USED: LENGTH DIAMETER FLOW HEAD ELEVATION PRESSURE
 METERS MM l/m CM MM KPA

ITERATION STOPS WHEN GREATEST FLOW CHANGE IS 0.168 IN ANY PIPE

THERE ARE 1 SPRINKLERS AND 0 BOOSTER PUMPS

THERE ARE 5 PIPES AND 4 REFERENCE POINTS

THE NUMBER OF INPUT POINTS IN SYSTEM IS 1

NODE NO.	NO. OF PUMPS IN PARALLEL	PUMP ELEVATION	INPUT FRACTION	PUMP PARAMETERS OR X-Y COORDINATES
1	1	0.00	1.00	800.00 0.0000E+00 0.0000E+00 0.0000E+00

Initial estimate of demand on the system is 1680.00

NET UNBALANCED DEMAND ON THE SYSTEM IS 0

LOOP INFORMATION

LOOP	PIPES
1	32 12 11

BANDWIDTH = 1

A.2 Unassisted Performance

DESIGN DATA AND SUMMARY RESULTS

Page 1 of 1 - Job No.

Designer :
Client :
Project :

DATE :28 OCT 2013
TIME : 7:57

Maximum unbalanced head loss is = 0.00000 kPa
Maximum node unbalanced flow is = 0.00000 l/m
Maximum loop unbalanced flow is = 0.00015 l/m and occurs in Pipe Loop 1

Fittings Specified as AS2118
Design Point Calculation With Min Flow

Hazen-Williams formula used

Number of Nozzles Operating : 1
Total water flow for Nozzles : 300 l/m

Number of Fixed Discharges : 2
Total water flow for Discharges : 780 l/m

Required Flow & Pressure, Input Node 1 : 1080 l/m at 711 kPa

Specified available pressure at input node 1: 800 kPa
Available pressure minus required pressure is : 89.0 kPa

Calculated Total Pipe Volume is : 2851 Litres

Authourising Company :
Certification Number :

Input data file name : C:/PROGRAM FILES (X86)/HYENA6102/DATA/PORT KEMBLA UNASS
.. ISTED WITH FOAM.DAT
Results file name : C:/PROGRAM FILES (X86)/HYENA6102/DATA/PORT KEMBLA UNASS
.. ISTED WITH FOAM.OUT

PIPE CHARACTERISTICS

Page 1 of 1 - Job No.

Designer :
 Client :
 Project :

DATE :28 OCT 2013
 TIME : 7:57

Pipe No.	Pipe node Numbers	Flow (l/m)	Pipe diam. Nom (mm)	Pipe diam. Actual (mm)	Pipe & Ftg. CODE #	Pipe Length (m)	TOTAL Length (m)	Loss Per m (KPa)	Loss Over pipe (KPa)	Static Loss (KPa)	TOTAL Loss (KPa)	H&W Co-eff	Water Vel. (m/s)	Vel. Press (KPa)
11	1 22	1080.16	150	155	ASAM	100.0	109.1	0.0762	8.308	0.000	8.308	120	0.95	0.453
			150		1TT	9.1								
12	22 23	300.16	150	155	ASAM	25.0	25.0	0.00711	0.178	0.000	0.178	120	0.26	0.0350
			150		1TN	0.0								
31	22 2	300.00	100	105	ASAM	1.0	30.0	0.0472	1.416	7.836	9.252	120	0.58	0.166
			100		2TT	12.2								
			100		1NV	16.8								
32	23 3	300.16	100	105	ASAM	1.0	30.0	0.0473	1.417	7.836	9.253	120	0.58	0.166
			100		2TT	12.2								
			100		1NV	16.8								
41	22 4	480.00	150	155	ASAM	25.0	25.0	0.0170	0.424	7.836	8.260	120	0.42	0.0895

LEGEND - Fittings and Pipe Materials used in this run

TT = Tee Branch

NV = Angle Valve

TN = Tee 90 deg Turn

ASAM = Medium Steel Tube to AS1074 -1989 & BS 1387

Maximum unbalanced head loss is = 0.00000 kPa

Maximum loop unbalanced flow is = 0.00015 l/m and occurs in Pipe Loop 1

Maximum node unbalanced flow is = 0.00000 l/m

NODE CHARACTERISTICS

Page 1 of 1 - Job No.

Designer :	DATE :28 OCT 2013
Client :	TIME : 7:57
Project :	

SPRINKLER/NOZZLE (N) POINTS				REFERENCE POINTS			DEMAND POINTS				Entered	K-Factor
Node	Discharge	P-TOTAL	P-NET	Node	Fixed	Pressure	Node	Demand	Pressure	Elevation	Discharge	
No.	l/m	kPa	kPa	No.	l/m	kPa	No.	l/m	kPa	(mm)	(l/m)	
							1	1080.16	710.996	0		
				2	300.00	693.436				800	300.00	
3	300.16	693.257	693.091	4	480.00	694.428				800	300.00	11.400
				22		702.688				800	480.00	
				23		702.510				0		
										0		

ADDITIONAL PRESSURE INFORMATION

Page 1 OF 1 - Job No.

Designer :	DATE :28 OCT 2013
Client :	TIME : 7:57
Project :	

Pipe No.	Pipe Node Numbers	Flow (l/min)	Pipe Diam.		Pipe & Ftg.		TOTAL Length (m.)	Loss Per m. (kPa)	Loss For Pipe (kPa)	Static Loss (kPa)	TOTAL Loss (kPa)	Pressure		
			Nom (mm)	Actual (mm)	Code #	Length (m.)						1st Node (kPa)	2nd Node (kPa)	
11	1	22	1080.16	150	155	ASAM	100.0	109.1	0.0762	8.308	0.000	8.308	710.996	702.688
				150		1TT	9.1							
12	22	23	300.16	150	155	ASAM	25.0	25.0	0.00711	0.178	0.000	0.178	702.688	702.510
				150		1TN	0.0							
31	22	2	300.00	100	105	ASAM	1.0	30.0	0.0472	1.416	7.836	9.252	702.688	693.436
				100		2TT	12.2							
				100		1NV	16.8							
32	23	3	300.16	100	105	ASAM	1.0	30.0	0.0473	1.417	7.836	9.253	702.510	693.257
				100		2TT	12.2							
				100		1NV	16.8							
41	22	4	480.00	150	155	ASAM	25.0	25.0	0.0170	0.424	7.836	8.260	702.688	694.428

LEGEND - Fittings and Pipe Materials used in this run

TT = Tee Branch

NV = Angle Valve

TN = Tee 90 deg Turn

ASAM = Medium Steel Tube to AS1074 -1989 & BS 1387

Input Data

LABL1=Authourising Company
 TEXT1=
 LABL2=Certification Number
 TEXT2=
 OCC=High Hazard Process Risks
 DENS=
 AREA=
 ORIF=
 COVER=
 NOPLOT
 PLEN=M
 PDIAM=MM
 PRESSURE=KPA
 FLOW=L/MIN
 ELEV=MM
 FITTING=AS2118
 REPORT
 EQ
 FDESPT
 VEL
 MAXV=10
 Fitting Type =Comm
 Defaults for Elbows=SE
 Defaults for Tees=TT

Pipes

Pipes Mtr and Coef: Defaults= MCASAM HW120
 P 11 1 22 100 150 ASAM120 1TT
 P 12 22 23 25 150 ASAM120 TN
 P 31 22 2 1 100 ASAM120 2TT NV
 PS 31 32 23 3
 P 41 22 4 25 150 ASAM120
 Default=

Nozzles

N 3 800 300 11.4

Fixed Discharge

R 2 800 300
 R 4 800 480

Reference Points

Point Default= ED0

R 22 0
R 23 0

InputPoints
IF 1 0 800
END

UNITS BEING USED: LENGTH DIAMETER FLOW HEAD ELEVATION PRESSURE
 METERS MM l/m CM MM KPA

ITERATION STOPS WHEN GREATEST FLOW CHANGE IS 0.108 IN ANY PIPE

THERE ARE 1 SPRINKLERS AND 0 BOOSTER PUMPS

THERE ARE 5 PIPES AND 4 REFERENCE POINTS

THE NUMBER OF INPUT POINTS IN SYSTEM IS 1

NODE NO.	NO. OF PUMPS IN PARALLEL	PUMP ELEVATION	INPUT FRACTION	PUMP PARAMETERS OR X-Y COORDINATES
1	1	0.00	1.00	800.00 0.0000E+00 0.0000E+00 0.0000E+00

Initial estimate of demand on the system is 1080.00

NET UNBALANCED DEMAND ON THE SYSTEM IS 0

LOOP INFORMATION

LOOP	PIPES
1	32 12 11

BANDWIDTH = 1

Our Ref: J000048

Your Ref: Email dated 3 January 2014

Pacific Terminals Australia Pty Ltd
105 Tingira St, Pinkenba QLD 4008
Sent by email: pneville@graincorp.com.au

Attention: Mr Phil Neville

JANUARY 3, 2014

Dear Mr Neville,

RE: PROPOSED PORT KEMBLA BULK LIQUIDS TERMINAL – ADDENDUM TO HAZARD ANALYSIS

I refer to your email dated today, regarding the query by Wollongong City Council (WCC) on the Hazard Analysis of the proposed Bulk Liquids Terminal, prepared by Arriscar Pty Ltd, Document Ref: J000032-AUS-002, Revision 0.

We wish to add the following addendum to the study:

CONCLUSIONS

Fatality risk criteria:

- The 0.5 in a million per year risk contour for individual risk of fatality does not reach sensitive land uses, and lies entirely within the Port.
- The 1 in a million per year risk contour for individual risk of fatality does not reach residential areas and lies entirely within the Port.
- The 10 in a million per year risk contour for individual risk of fatality does not reach active open space areas and lies entirely within the Port. The Port is a restricted access area for the public.
- The 50 in a million per year risk contour for individual risk of fatality falls within the GrainCorp land and does not encroach on other adjacent industries.

Injury/damage risk criteria:

- There is no risk of thermal radiation at 4.7kW/m² at residential areas, as the maximum distance to this level of thermal radiation does not reach residential areas.
- There is no risk of thermal radiation at 12.5kW/m² at residential areas, as the maximum distance to this level of thermal radiation does not reach residential areas.

- There is no risk of thermal radiation at 23k/m^2 at neighbouring industrial land, as the maximum distance to this level of thermal radiation lies entirely within the GrainCorp land in the Port.

Conclusion

The Hazard Analysis concluded that the proposed Port Kembla Bulk Liquids Terminal is fully compliant with the risk criteria specified in the Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning, dated January 2011, and published by the NSW Department of Planning and Infrastructure in its website.

Yours sincerely,

For Arriscar Pty Ltd



Dr Raghu Raman

DIRECTOR AND SENIOR PRINCIPAL CONSULTANT

Proposed Port Kembla Bulk Liquids Terminal

Hazard Analysis

For Pacific Terminals Australia Pty Ltd

29 October 2013

Doc. No.: J-000048-AUS-01

Revision: 0



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Project Master File	Arriscar Pty Ltd	Draft	Rev 0

Prepared by:	Dr Raghu Raman	Date: 25 Oct 2013
Reviewed by:	Philip Skinner	Date: 25 Oct 2013
Approved by:	Dr Raghu Raman	Date: 29 Oct 2013

DOCUMENT HISTORY AND AUTHORISATION

Issue	Date	Changes
Rev A	25-10-2013	Draft for Pacific Terminals review
Rev 0	29-10-2013	Final issue with comments on Rev A incorporated

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Notation

Abbreviation	Description
API	American Petroleum Institute
AS	Australian Standard
ESD	Emergency Shutdown
FSS	Fire Safety Study
HAZAN	Hazard Analysis
HAZOP	Hazard and Operability Study
HIPAP	Hazardous Industry Planning Advisory Paper
kW/m ²	Kilo-Watts per square metre
m	metres
m ³	Cubic metres
mm	millimetres
NB	Nominal Bore
P&ID	Piping & Instrumentation Diagram
PLC	Programmable Logic Controller
PTA	Pacific Terminals Australia
PTW	Permit to Work
SEPP	State Environmental Planning Policy
SS	Stainless Steel
UPS	Uninterruptable Power Supply

1 INTRODUCTION

1.1 Background

Pacific Terminals Australia Pty Ltd (PTA) operates seven bulk liquid terminal storage sites in Brisbane, Fremantle, Melbourne, Devonport and Adelaide. The facilities store and distribute the products on behalf of its customers.

PTA is proposing to build a new bulk liquids terminal to store combustible liquids at a site in Port Kembla, NSW. The site is owned by GrainCorp Ltd, the parent company of PTA. The tanks will store combustible liquids (not flammable) of flash point above 65°C, categorised as Class C1 and C2 liquids.

The State Environmental Planning Policy SEPP (Ports) (Ref.1) applicable to Port Botany and Port Kembla states that development for the purposes of bulk liquid storage tanks may be approved under the complying development provisions, subject to meeting a number of criteria. One of the criteria is to prepare a Hazard Analysis of the development and operations. The hazard analysis

- (i) is to be prepared in accordance with the Hazardous Industry Planning Advisory Paper (HIPAP) No 6, Hazard Analysis, dated January 2011 and published by the Department of Planning and Infrastructure on its website (Ref 2), and*
- (ii) demonstrates that the proposed development meets the applicable risk criteria set out in the Hazardous Industry Planning Advisory Paper No 4, Risk Criteria for Land Use Safety Planning, dated January 2011 and published by the Department of Planning and Infrastructure on its website (Ref.3), and*
- (iii) is prepared having regard to the most hazardous substance proposed to be stored in the tanks.*

Arriscar Pty Ltd was engaged by PTA to conduct the Hazard Analysis of the proposed Terminal storage and distribution operations. This report contains details of the study, findings and actions arising from the study.

1.2 Objectives of the study

The objectives of the hazard analysis are:

- Identification of the hazards for all hazardous substances stored and handled at Port Kembla bulk liquids terminal;
- Selection of appropriate and relevant representative scenarios for each potential accident event;
- Quantification of the consequences of potential harmful effects for each event, including the potential for impact on surrounding land uses off-site;
- Quantification of the likelihood of occurrence of each event;
- Estimation of the risks from the facility to surrounding land uses (within and outside the port);
- Using assumptions that are appropriate and justified, with a focus on minimising uncertainty and obtaining the 'cautious best estimate'.

1.3 Scope of the study

The scope of the study covered the following, and covers both Stage 1 and Stage 2 construction:

- Ship to shore transfer of product via two 200mm NB stainless steel (SS) pipe (one line at Stage 1 and the second line at stage 2).
- 16 x 1,250m³ carbon steel storage tanks (10 metres in diameter x 18.2 meters high) and associated pipe work (10 tanks in Stage 1 and 6 tanks in Stage 2).
- 3 x Bulk road tanker load gantries and associated loading pumps (2 gantries in Stage 1 and 1 gantry in Stage 2)
- Fire protection equipment including extension of existing fire water main to cover the bulk liquids terminal.
- Steam/hot water boiler for heating of Tank 1 for viscosity control.

1.4 Facility Location and Surrounding Land Uses

The bulk liquid facility will be located on the northern block of the existing GrainCorp Terminal in Port Kembla, with vehicular access off Tom Thumb Road. A site location map is shown in Figure 1.

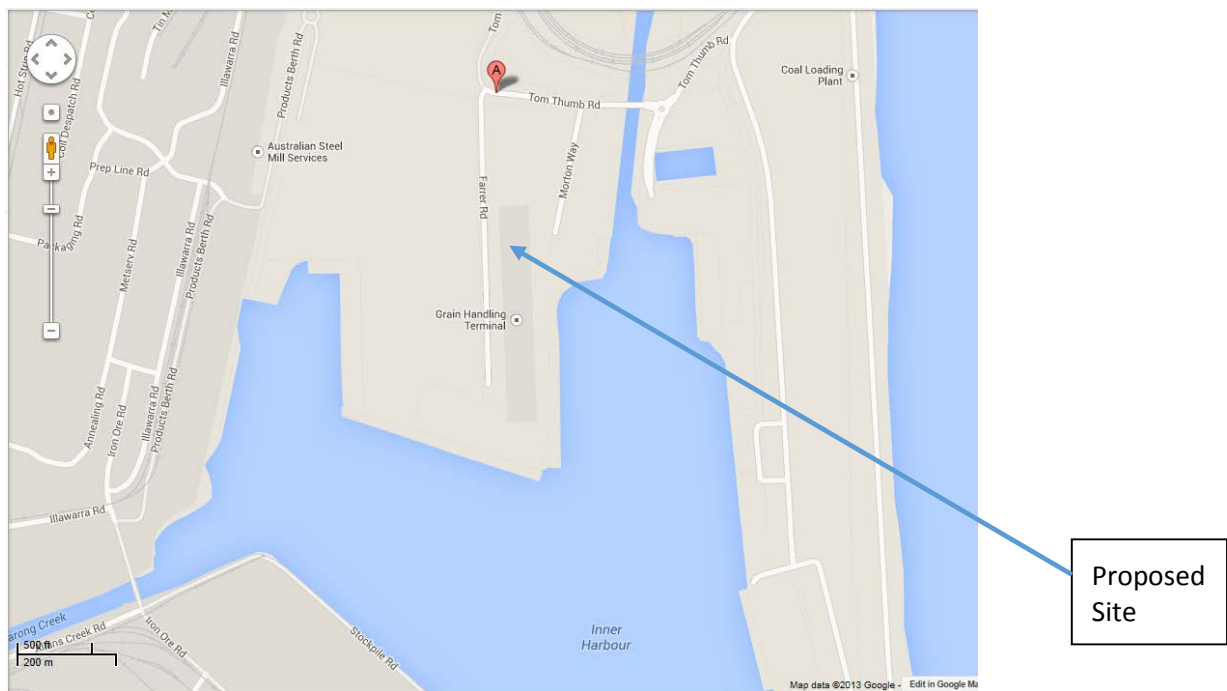


Figure 1: Site Location Map

The proposed terminal site falls entirely within the GrainCorp land (Port uses). The Port Kembla grain terminal with the silos and grain loading facility being the nearest neighbour, 30 metres away.

The nearest residential areas and sensitive land uses are located 1.2 km away from the proposed site.

1.5 Communications

Communication on the Terminal is achieved primarily by use of two-way radios, carried by the operators. Sufficient redundancy exists to provide backup radios in the event of a fault.

Operators also carry mobile phones.

A two-way radio will be provided to the ship crew during ship/shore transfer. An operator is present at the wharf and in communication with the deck operator.

1.6 Security

The site is enclosed by a chain wire fence approximately 2 m high, with barbed wire at the top.

The main vehicle entry/ exit is from Tom Thumb Road.

Visitors to the site must contact the operator via the intercom allowing the operator to identify anyone at this point before granting entry.

1.7 Meteorology

The meteorological data for Kembla Grange weather station was used for the study. Surface wind analysis was processed into six wind speed/ weather stability categories.

The prevailing wind direction is from west/ north west, which occurs approximately 40% of the time. The wind speed is less than 5m/s for most of the time.

The wind/ weather data is listed in Appendix A.

2 PROJECT OUTLINE

2.1 Description of the Proposed Development

The Terminal will store combustible hydrocarbon liquids (Class C1 and C2). No flammables will be stored. The development will be completed in two stages.

Stage 1 Development:

- Construction of 10 x 1,250m³ Carbon Steel Storage Tanks 10mt Diameter x 17.62 meters high and associated Pipe Work. The tanks are designed to API 650 standard.
- Install a 200NB Stainless Steel Shipping Line from the facility to Berth 104. The proposed shipping line will run aboveground from Berth 104 to Tom Thumb Road; from there it will run under Tom Thumb Road to the proposed new facility where it will again rise up above ground.
- Install a 150NB Carbon Steel Fire Ring Main.
- Install site specific fire equipment including fire hydrants and associated equipment.
- Construct bunding for stage 1 tanks.
- Construct 2 x Road Tanker Load Out Gantries
- Install Gantry Load Out Pumps and associated pipe work
- Construction of a Facility Shed to facilitate Steam/Hot water Boiler, Air Compressor and associated equipment.
- Install a small prefab operator office
- Construct road works for stage 1 with entry from Tom Thumb Road on the Northern side.

Stage 2 Development:

- Construction of 6 x 1,250m³ Carbon Steel Storage Tanks 10 meter Diameter x 17.62 meters High and associated Pipe Work.
- Install a second 200NB Stainless Steel Shipping Line from the facility to Berth 104. The proposed Shipping Line will run aboveground from Berth 104 to Tom Thumb Road; from there it will run under Tom Thumb Road to the proposed new facility where it will again rise up above ground.
- Install site specific fire equipment including, extra Fire Hydrants as required along with associated equipment.
- Construct bunding for stage 2 tanks.
- Construct one Road Tanker Load Out Gantry
- Install Gantry Load Out Pumps and associated pipe work
- Construct required road works for stage 2.

2.2 Utilities

The main utilities and services in the terminal are:

- Compressed air system which also provides instrument air (dried) for pneumatically actuated valves.
- There two independent sources from the power grid, to provide redundancy.
- Utilities water is supplied from Sydney Water supply main.
- Independent line supplying water for make-up water to the on-site firewater storage.
- Uninterruptible power supply (UPS) for the PLC, Mixcroloaders and ESD system to enable safe shutdown of the operations in the event of power failure.
- The terminal will share the firewater supply with the existing grain terminal. The system consists of an existing firewater storage tank and a firewater hydrant ring main around the tankfarm. Four (4) existing firewater pumps provide firewater (shared with the grain terminal).
- Foam units are provided which can be connected to a hydrant for foam application.

2.3 Process

Combustible liquid is received from ship into the storage tank via the SS shipping line at approximately 300 tonnes/ hour. The storage is at ambient temperature. Tank 1 will contain a viscous product (Class C2) and to facilitate pumping, steam coils are installed in the tank to heat the tank contents and maintain viscosity.

Load out pumps are located within the bunds of the tankfarm. These pumps transfer product through a piping manifold to the bulk road tanker. Bottom loading into the tanker occurs. The loading operation is controlled by a Microloader (PLC) at each gantry. Loading will be conducted by the driver, who will be trained and accredited by PTA.

An operator is available for any assistance, and during ship/shore transfer.

Radar level transmitters are installed in each tank with high alarm. Each tank is also fitted with an independent level switch for high high alarm.

2.4 Storage of Combustible Materials

The products initially proposed to be stored are distillates, hydrotreated heavy paraffins, solvent-refined residual petroleum oils and diesel fuel. These may vary from time to time depending on market conditions, but no flammable liquids will be stored.

2.5 Road Tankers

In general, road tankers arriving at the site are empty. They are connected to the loading point at the gantry. Once the load quantity is set in the Microloader and the pumps started, the loading operation is automatic, and the pumps are turned off when the preset load limit is reached. A scully protects from overloading the tanker.

Traffic on the site is one-way, and hence potential vehicle accident risk is eliminated. Speed limits apply on the site.

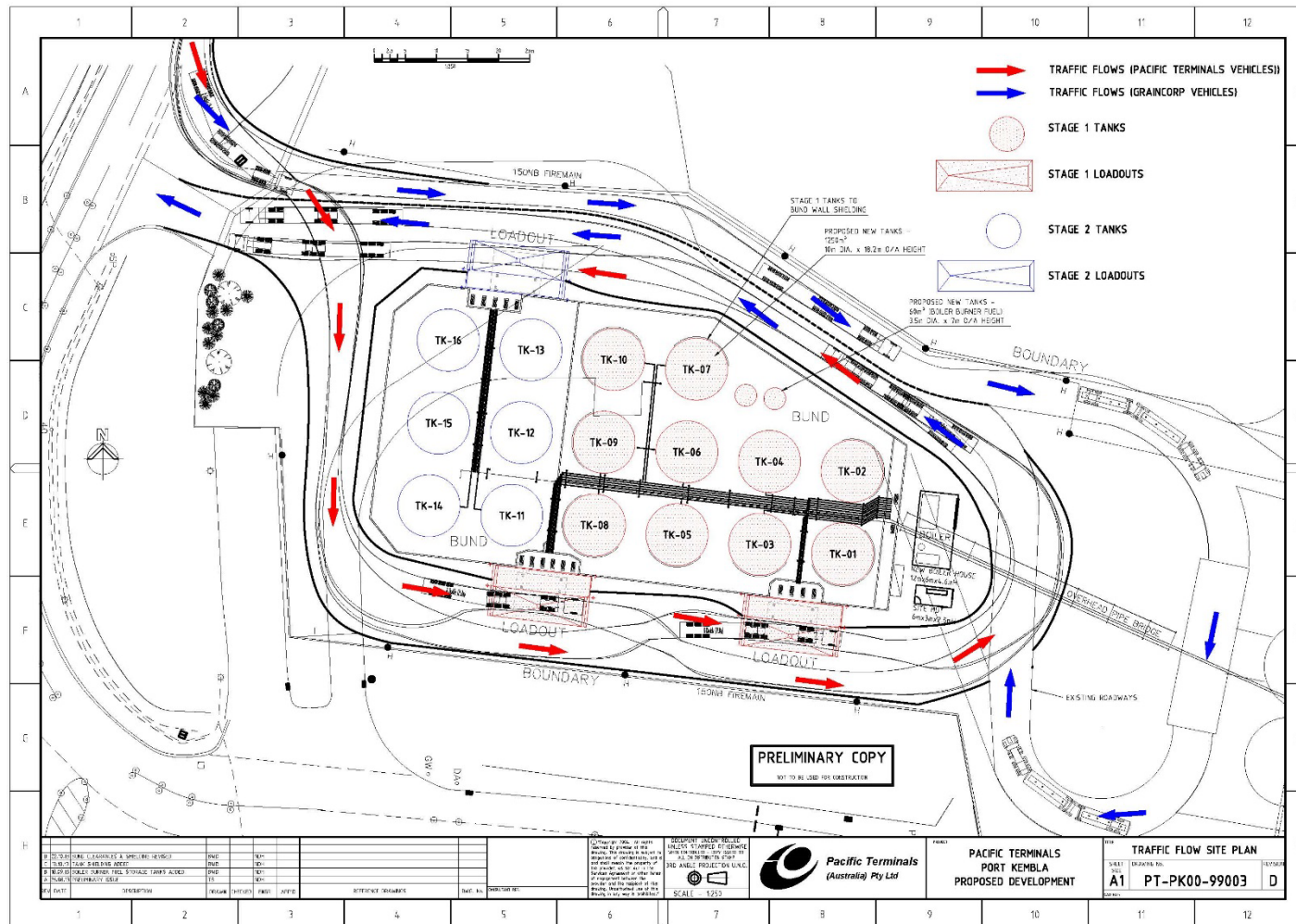


Figure 2: Layout of Proposed Bulk Liquids Terminal

3 HAZARD ANALYSIS METHODOLOGY

3.1 Introduction

The purpose of this hazard analysis was to identify accident events that can result in fires, assess the risk to people in the facility and surrounding land uses, and evaluate the effectiveness of the control measures that are in place to mitigate these risks, with respect to the risk criteria in HIPAP No.4 (Ref.3).

3.2 Overall Approach

In order to ensure that all relevant hazards have been considered and quantified, the risk assessment has included a Quantitative Risk Assessment (QRA) for the loss of containment and fire scenarios.

The approach consisted of the following steps:

1. A hazard identification and evaluation of safeguards to generate a list of accident scenarios that may have an impact on land use safety.
2. An analysis of the consequences of the accident events in terms of thermal radiation impacts. This also forms an input to the Fire Safety Study (FSS).
3. An estimate the frequency of the incidents (leak frequency and ignition probability)
4. An assessment of risk using the consequence distances and the corresponding incident frequencies, superimposed on the site layout in the form of risk contours.
5. Evaluation of risk with respect to established risk criteria in HIPAP No.4 (Ref.).

4 HAZARD IDENTIFICATION

4.1 Introduction

This section contains an overview of the hazard identification process and incident scenario selection for the Port Kembla Terminal. A hazard identification and safeguards evaluation Table is provided in Table 1.

4.2 Hazard Identification

The first step of the risk assessment was hazard identification. The activities involved in hazard identification included:

- A review of materials stored, handled and processed on the facility. None of the materials are classified as “Class 3 Flammable”.
- A desktop review of process and storage information (e.g. P&IDs, etc.) to identify the distribution and location of tanks in the facility.
- A hazard and operability study (HAZOP) for the proposed development (Ref.4).
- A review of historic loss of containment events in bulk liquids storage terminals (OGP Ref.5)

The hazards identified in the facility have been screened for potential impact on land use safety.

The consequences from accident events could result in the following final events:

- Fires (pool fires in the bund) from leaks into the bund;
- Tank roof fires. This is unlikely for combustible liquids storage in fixed roof tanks as described by AS 1940-2004 (Ref.6).
- Pump seal leak and fire
- Road tanker loading hose failure and pool fire at the loading gantry

There are no explosion events or toxic gas events in the facility.

4.2.1 Corrosion

The distillate products to be stored are clean liquids and non-corrosive. Therefore, the chance of internal corrosion is negligible. The tanks are externally painted with a corrosion resistant surface coating, and inspected regularly.

All pipework is painted with a corrosion resistant paint, or made of stainless steel (unpainted), and inspected externally on a regular basis.

The chance of a major failure of tanks and pipework due to corrosion is considered negligible.

4.2.2 Mechanical Failure

The site is protected by a security gate, and normally there is no vehicular access directly to the storage tanks.

The system does not require frequent maintenance, and any crane access to the site is rare. Even then no heavy objects are moved in the tankfarm, and hence the chance of a mechanical damage due to impact is low.

The pipework has minimum flanged connections, and is mostly welded. No instruments are provided on the piping.

4.2.3 Failure of Flange Gaskets

A gasket failure would vary from a weeping leak to a small section of gasket being blown away (typically the section between two adjacent bolts). The maximum possible hole size for such failures was postulated as 9 mm, based on the distance between bolts and the gasket thickness.

4.2.4 Tanker Loading Hose Failure

The likelihood of this incident is low due to the following reasons:

The hoses are pressure tested to 1.5 times the maximum operating pressure.

Terminal provided hoses are used and not tanker's hoses. The Terminal hoses are regularly inspected for integrity.

There has been no reported cases in Australia, of a petroleum product hose failure or failure of the joint between the rubber hose and the metal casing in the last 20 years.

4.3 Operational Failures

The following Operational failures have been identified:

- Overfilling of tank when product is received from ship
- Road tanker overfill
- Tanker drive-away while connected

These operational scenarios have been discussed and assessed in detail in Table 1.

4.4 Fires

The only type of incident that could occur at the facility is a pool fire. The probability of ignition is very low. High energy ignition source such as welding would be required to ignite a potential spill as the flash point of the materials are high ($> 65^{\circ}\text{C}$), and no vapour would be generated from the spill even under hot summer conditions.

4.5 List of Incident Scenarios

Table 2 provides a list of incident scenarios modelled in the hazard analysis.

Table 1: Hazard Identification and Evaluation of safeguards

Hazardous Event	Causes	Possible Consequences	Prevention/Protection Measures
1 Leak of product from tanks, pipework	Corrosion failure Impact Overpressure	Product spill. Bund fire if ignited. Thermal radiation impact	Product non-corrosive. Corrosion resistant surface coating on tanks and pipework. Integrity inspections Tank vent sized for transfer flows Ignition control (permit to work system, no smoking on site) High flash point material, hard to ignite Fire protection system including portable foam
2 Tank overfilling during ship/ shore transfer	Human error Level transmitter failure	Product leak into bund through vent and bund fire if ignited Thermal radiation impact	Independent high high alarm Regular calibration and maintenance of level sensors Ignition control (permit to work system, no smoking on site) High flash point material, hard to ignite Fire protection system including portable foam
3 Tank top fire	Internal explosion, roof failure and ignition	Potential for escalation of fire to other tanks	Tank top fire is not considered possible for fixed roof tanks containing combustible liquids. No vapour above the liquid level. This is supported by AS 1940-2004.

Hazardous Event	Causes	Possible Consequences	Prevention/Protection Measures
4 Product spill during tanker loading.	Transfer hose failure Tanker overfill Driveaway while connected	Possible pool fire if ignited. Possible runoff to environment	Driver is constantly in attendance during loading. Pressure tested hoses. Scully system protection to prevent overfill. Microloader software for loading control that stops automatically after preset quantity is reached Mechanical brake interlock of truck to enable loading. Driveaway is possible only after the disconnection of hose. Extinguishers (dry chemical and foam). Site fire protection system.
5 Tanker runs into filling gantry.	Excessive speed Tanker backs into gantry when reversing	Damage to filling gantry and pipework. Potential for pipework leak. Product spill. Fire if ignited.	Speed limit on site. One-way traffic flows. Product hard to ignite. Spill containment at loading gantry.
6 Pump seal failure.	Mechanical failure during transfer operations	Spillage of product. Pool fire if ignited.	Maintenance program include regular inspection of pump system. Pumps located inside the bund and hence spill is collected in the sump within the bund.

Table 2: List of Accident Events

Scenario No.	Scenario	Material	Event Location
1	Release from Tanks 1-10 from small bore fitting failure and bund fire	Distillate	Tankfarm (Tanks 1-10)
2	Tank rupture (Tk1-10) and product release into bund, bund fire	Distillate	Tankfarm (Tanks 1-10)
3	Release from Tanks 11-16 from small bore fitting failure and bund fire	Distillate	Tankfarm (Tanks 11-16)
4	Tank rupture (Tk11-16) and product release into bund, bund fire	Distillate	Tankfarm (Tanks 11-16)
5	Product release from seal failure of Loading Pump No.1 and pool fire at pump slab	Distillate	Loading gantry No.1
6	Product release from seal failure of Loading Pump No.2 and pool fire at pump slab	Distillate	Loading gantry No.2
7	Product release from seal failure of Loading Pump No.3 and pool fire at pump slab	Distillate	Loading gantry No.3
8	Product release from hose failure at Loading gantry No.1 and pool fire	Distillate	Loading gantry No.1
9	Product release from hose failure at Loading gantry No.2 and pool fire	Distillate	Loading gantry No.2
10	Product release from hose failure at Loading gantry No.3 and pool fire	Distillate	Loading gantry No.3

5 HAZARD CONSEQUENCE ANALYSIS

Consequences of pool fires were modelled in PhastRisk 6.7 software. The results are provided in Table 3.

The consequence analysis performed in the previous section has shown that not all the events would contribute to risk. Events such as pump seal leaks have localised effect only.

Table 3: Pool Fire Results

Scenario No.	Scenario	Pool Diameter, m	Flame height, m	Distance to heat radiation, m			
				3 kW/m ²	4.7 kW/m ²	12.6 kW/m ²	23 kW/m ²
1	Release from Tanks 1-10 from small bore fitting failure and bund fire	6.8	10.5	34	28	18.5	14
2	Tank rupture (Tanks 1-10) and full bund fire	51.9	43.2	182	150	100	76
3	Release from Tanks 11-16 from small bore fitting failure and bund fire	6.8	10.5	34	28	18.5	14
4	Tank rupture (Tanks 11-16) and full bund fire	39.7	35.9	147	121	80	61
5	Product release from seal failure of Loading Pump No.1 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
6	Product release from seal failure of Loading Pump No.2 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
7	Product release from seal failure of Loading Pump No.3 and pool fire at pump slab	2	4.4	12.4	10.7	8	6.2
8	Product release from hose failure at Loading gantry No.1 and pool fire	10	13.8	48	26	20	15.7
19	Product release from hose failure at Loading gantry No.2 and pool fire	10	13.8	48	26	20	15.7
10	Product release from hose failure at Loading gantry No.3 and pool fire	10	13.8	48	26	20	15.7

6 FREQUENCY ANALYSIS

Incident frequencies were estimated as follows:

1. Generic leak frequencies from atmospheric tanks from statistical data, as applicable to the petroleum industry. This value tends to be conservative as the database includes flammable products as well as non-desulphurised products (corrosive).
2. Ascribing an ignition probability to the spill.

6.1 Product Loss of Containment Events

The OGP database (Ref.5) provides the most recent statistics on petroleum products releases from storage equipment (atmospheric storage and pressure vessels).

Based on the OGP data, the following frequencies were used for diesel tanks:

Table 4: Failure frequency data

Equipment	Release scenario	Frequency/ equipment-year
Atmospheric storage tank	20mm hole from small bore connection leaking into bund	2.6E-03
Atmospheric storage tank	Tank rupture and product release into bund	3.0E-05
Pump seal failure	9 mm equivalent hole leaking into bund	0.05
Tanker filling hose	Product release in loading gantry	1.0E-05

6.2 Probability of Ignition

The probability of ignition was based on the information in the comprehensive review by the Energy Institute (Ref.7).

The probability of ignition of flammable materials (gas or liquid) suggested in Ref.5 varies from 0.01 to 0.1. However, given that distillate is combustible and not flammable and that conventional spark type ignition sources would not ignite the material, the ignition probability can be reduced by one order of magnitude. Therefore, value of 0.003 has been used in this study.

7 RISK ASSESSMENT

7.1 Risk Criteria

The individual fatality risk imposed by a proposed industrial activity should be low relative to the background risk. This forms the basis for the following individual fatality risk criteria adopted by DOP for New South Wales in Table 5 below.

Table 5: Individual Fatality Risk Criteria

Land Use	Risk Criterion [per million per year]
Hospitals, schools, child care facilities and old age housing developments	0.5
Residential developments and places of continuous occupancy, such as hotels and tourist resorts	1
Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres	5
Sporting complexes and active open space areas	10
Industrial sites	50

7.2 Individual Risk of Fatality

The contours for individual risk of fatality for risk levels of 0.5, 1, 10 and 50 chances in a million per year for the site are presented in Figure 4. The contours represent the risk of fatality from fires in the terminal.

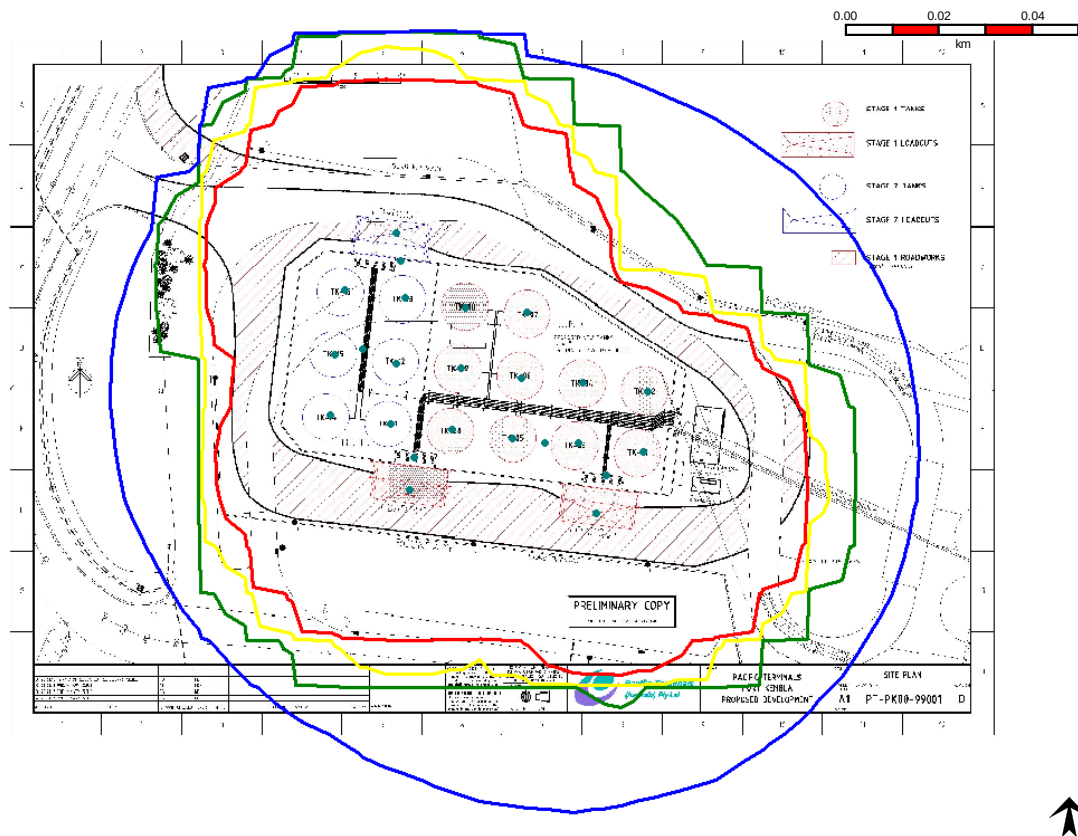
The following conclusions were arrived at:

The 0.5×10^{-6} pa contour does not reach sensitive land uses, and lies entirely within the Port.

The 1×10^{-6} pa contour does not reach residential areas and lies entirely within the Port.

The 1×10^{-5} pa contour does not reach active open space areas and lies entirely within the Port. The Port is a restricted access area for the public.

The 5×10^{-5} pa contour falls within the GrainCorp land and does not encroach on other industries.



— 1.E-07 pa; — 1.E-06 pa; — 1.E-05 pa; — 5.0E-5 pa

Figure 4: Risk Contours for Risk of Fatality

7.3 Risk of Injury/ Incident Escalation

HIPAP 4 also specifies risk criteria for specified thermal radiation intensities at residential areas, as listed in Table 6.

Table 6: Injury/ Escalation Risk Criteria

Impact	Risk Criterion [per million per year]
4.7 kW/m ² thermal radiation intensity at residential areas	50
12.6 kW/m ² thermal radiation intensity at residential areas	10
23 kW/m ² thermal radiation intensity at adjoining industries	50

The thermal radiation impact distances for the various incident scenarios are summarised in Table 4 above. The maximum distances to the specified heat radiation intensities are:

4.7 kW/m ²	150m
12.6 kW/m ²	100m
23 kW/m ²	76m

The maximum distance to 4.7 kW/m² is 150m (full bund fire for Tanks 1-10 tankfarm), which does not reach residential areas.

Similarly the 12.6 kW/m² distance of 100m falls within the Port area. Therefore no risk contour was developed.

The grain handling terminal is located more than 76m from the bulk liquids terminal. Therefore, 23 kW/m² thermal radiation would not reach the adjacent industrial facility (grain handling terminal).

8 REFERENCES

- 1 State Environmental Planning Policy (Port Botany and Port Kembla) 2013 (Ports SEPP), Department of Planning & Infrastructure, NSW.
- 2 Hazardous Industry Planning Advisory paper No.6, "Hazard Analysis Guidelines", Department of Planning & Infrastructure, NSW, January, 2011.
- 3 Hazardous Industry Planning Advisory paper No.4, "Risk Criteria for Land Use Safety Planning", Department of Planning & Infrastructure, NSW, January, 2011.
- 4 Arriscar Pty Ltd, Hazrad and Operability Study of Pacific Terminals Port Kembla Bulk Liquids Facility, Report J00048-AUS-02, Revision A, October 2013.
- 5 International Association of Oil and Gas Producers, OGP Risk Assessment Data Directory, Storage Incident Frequencies, Report No.434-3, March 2010.
- 6 Standards Australia, AS-1940, Storage and Handling of Flammable and Combustible Liquids, 2004.
- 7 IP Research Report – Ignition Probability review, Model Development and Lookup Correlations, Energy Institute, London, January 2006.

Appendices

Appendix A Port Kembla Meteoreological Data

Wind speed/ Weather Stability Data for Port Kembla

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
B3	0.0066	0.0112	0.0233	0.0141	0.0058	0.0071	0.0173	0.0098	0.0055	0.0080	0.0065	0.0106	0.0415	0.0505	0.0114	0.0058
D1.5	0.0058	0.0119	0.0110	0.0063	0.0055	0.0058	0.0101	0.0064	0.0023	0.0053	0.0047	0.0081	0.0345	0.0615	0.0141	0.0054
D5	0.0034	0.0048	0.0136	0.0123	0.0031	0.0048	0.0145	0.0074	0.0052	0.0050	0.0043	0.0057	0.0162	0.0104	0.0023	0.0024
D9	0.0007	0.0001	0.0103	0.0023	0.0002	0.0000	0.0012	0.0008	0.0007	0.0016	0.0008	0.0021	0.0113	0.0035	0.0005	0.0009
E3	0.0027	0.0045	0.0094	0.0057	0.0024	0.0029	0.0070	0.0039	0.0022	0.0032	0.0026	0.0043	0.0168	0.0204	0.0046	0.0024
F1.5	0.0089	0.0153	0.0317	0.0191	0.0079	0.0096	0.0235	0.0133	0.0075	0.0108	0.0089	0.0144	0.0564	0.0685	0.0154	0.0079

Proposed Port Kembla Bulk Liquids Terminal

Hazard and Operability Study

For Pacific Terminals Australia Pty Ltd

29 October 2013

Doc. No.: J-000048-AUS-02

Revision: 0



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Issue	Date	Changes
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Notation

Abbreviation	Description
API	American Petroleum Institute
AS	Australian Standard
CS	Carbon Steel
ESD	Emergency Shutdown
HAZOP	Hazard and Operability Study
HIPAP	Hazardous Industry Planning Advisory Paper
kPag	Kilo-Pascals gauge
L/min	Litres per minute
LAH	Level Alarm High
LAHH	Level Alarm High High
LSHH	Level Switch High High
LT	Level Transmitter
m	metres
m ³	Cubic metres
mm	millimetres
NB	Nominal Bore
NRV	Non-Return Valve
P&ID	Piping & Instrumentation Diagram
PAL	Pressure Alarm Low
PHA	Preliminary Hazard Analysis
PLC	Programmable Logic Controller
PSV	Pressure Safety Valve
PT	Pressure Transmitter
PTA	Pacific Terminals Australia
PTW	Permit to Work
SEPP	State Environmental Planning Policy

Abbreviation	Description
SS	Stainless Steel
TAH	Temperature Alarm High
Te/h	Tonnes per hour
TI	Temperature Indicator
TPSV	Tank Product Shutoff Valve
UPS	Uninterruptable Power Supply

1 INTRODUCTION

1.1 Background

Pacific Terminals Australia Pty Ltd (PTA) operates seven bulk liquid terminal storage sites in Brisbane, Fremantle, Melbourne, Devonport and Adelaide. The facilities store and distribute the products on behalf of its customers.

PTA is proposing to build a new bulk liquids terminal to store combustible liquids at a site in Port Kembla, NSW. The site is owned by GrainCorp Ltd, the parent company of PTA. The tanks will store combustible liquids (not flammable) of flash point above 65°C, categorised as Class C1 and C2 liquids.

Details of the development are provided in the Preliminary Hazard Analysis (PHA) study (Ref.1).

The State Environmental Planning Policy SEPP PBPK 2013 (Ref.2) applicable to Port Botany and Port Kembla states that development for the purposes of bulk liquid storage tanks may be approved under the complying development provisions, subject to meeting a number of criteria. One of the criteria is to prepare a Hazard and Operability (HAZOP) study of the development and operations.

"A hazard and operability study that is prepared in accordance with the Hazardous Industry Planning Advisory Paper (HIPAP) No 8, HAZOP Guidelines (ref.3), dated January 2011 and published by the Department of Planning and Infrastructure on its website".

Arriscar Pty Ltd was engaged by PTA to facilitate the HAZOP study of the proposed Terminal storage and distribution operations. This report contains details of the study, findings and actions arising from the study.

1.2 Objectives of the study

The objectives of the HAZOP are:

1. Identify the reaction of plant and equipment system to process perturbations and deviations;
2. Assess whether the reaction of the system, or equipment will produce effects which are harmful to the personnel, environment, physical asset and business continuity policy of the Company;
3. Investigate the operability of the process;
4. Identify availability and maintainability issues;
5. Evaluate the adequacy of existing engineering and procedural safeguards
6. Recommend corrective actions, which will mitigate or eliminate adverse effects.

1.3 Scope of the study

The scope of the study covered the following, and covers both Stage 1 and Stage 2 construction:

- Ship to shore transfer of product via two 200mm NB stainless steel (SS) pipe (one line at Stage 1 and the second line at stage 2).
- 16 x 1,250m³ carbon steel storage tanks (10 metres in diameter x 18.2 meters high) and associated pipe work (10 tanks in Stage 1 and 6 tanks in Stage 2).
- 3 x Bulk road tanker load gantries and associated loading pumps (2 gantries in Stage 1 and 1 gantry in Stage 2).

- Fire protection equipment including extension of existing fire water main to cover the bulk liquids terminal.
- Steam/hot water boiler for heating of Tank 1 for viscosity control.

1.4 Definitions

Various terms with special meanings are used in conducting a HAZOP study. Key terms relevant to this report are listed below:

Term	Definition
Consider	Recommendation should be implemented unless an acceptable justification or an effective alternative is adopted
Investigate	Solution to the identified problem could not be developed within the time available in the workshop, and that further effort outside the meetings is necessary to identify possible solutions.
Node	The part of a process that is subjected to examination by guideword-parameter combinations, where the parameters are investigated for deviations from the design intent. A Node generally connects one vessel or equipment to another, including the equipment.
Recommendation/ Action	These are suggested actions to prevent, detect or mitigate the potentially hazardous scenario identified, or to obtain further information before the particular deviation can be properly assessed. It is qualified by the terms "Consider", "Review", "Investigate". If no qualification is provided, the Recommendation is mandatory.

1.5 Reference Documentation

The main reference documents for the HAZOP study are:

- Project Brief to NSW Ports Port Kembla Operations Proposed Bulk Liquid Storage Facility, Leathwaite Planning Group, August 2013 (Ref.4).
- P&IDs for the PTA Port Kembla Bulk Liquids Terminal (Full list is provided in Appendix A)

2 PROJECT OUTLINE

A layout diagram of the facility is shown in Figure 1.

2.1 Process

Combustible liquid is received from ship into the storage tank via the SS shipping line at approximately 300 tonnes/ hour. The storage is at ambient temperature. Tank 1 will contain a viscous product (Class C2) and to facilitate pumping, steam coils are installed in the tank to heat the tank contents and maintain viscosity.

Load out pumps are located within the bunds of the tankfarm. These pumps transfer product through a piping manifold to the bulk road tanker. Bottom loading into the tanker occurs. The loading operation is controlled by a Microloader (PLC), one for each gantry. Loading will be conducted by the driver, who will be trained and accredited by PTA.

An operator is present for any assistance, and during ship/shore transfer.

Radar level transmitters are installed in each tank with high alarm. Each tank is also fitted with an independent level switch for high high alarm.

2.2 Storage of Combustible Materials

The products initially proposed to be stored are distillates, hydrotreated heavy paraffins, solvent-refined residual petroleum oils and diesel fuel. These may vary from time to time depending on market conditions, but no flammable liquids will be stored.

2.3 Road tankers

In general, road tankers arriving at the site are empty. They are connected to the loading point at the gantry. Once the load quantity is set in the Microloader and the pumps started, the loading operation is automatic, and the pumps are turned off when the preset load limit is reached. A scully protects from overloading the tanker.

Traffic on the site is one-way, and hence potential vehicle accident risk is eliminated. Speed limits apply on the site.

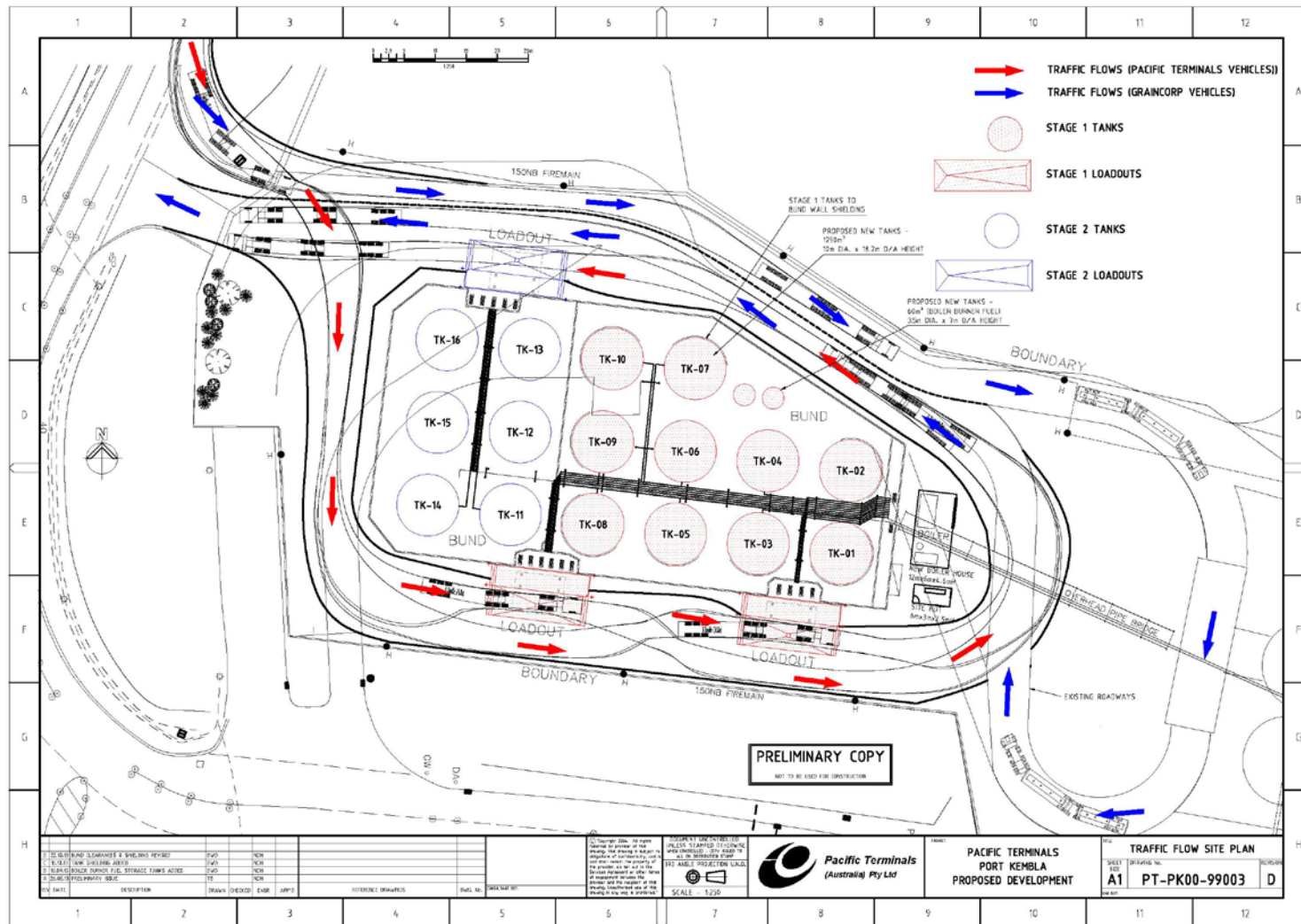


Figure 1: Layout of Proposed Bulk Liquids Terminal

3 BASIS OF HAZOP STUDY

3.1 Methodology Overview

The following steps were involved in the HAZOP process:

1. Select a P&ID and describe an overview of its contents.
2. Select a process line or a plant section in the P&ID for review, e.g. import pipeline from ship to tank. The line/ plant section may spread over more than one P&ID.
3. Describe main features of facility, layout, safety measures, and operating conditions. The designer normally does this.
4. Agree intended operation, operating and design conditions.
5. Select a guideword. The guideword can be a combination of a parameter and a deviation (e.g. Level Low), or a single guideword where the parameter and the deviation are already concatenated (e.g. High Pressure). The latter was used in the HAZOP study.
6. Identify possible causes of the deviation and the consequences (immediate and ultimate)
7. Identify the relevant safeguards and decide if they are adequate
8. Develop a solution towards additional safeguard where appropriate and record the minute
9. Repeat steps 5 to 8 until all guidewords are exhausted
10. Repeat steps 2-9 for other lines/ plant sections on selected P&ID (Nodes)
11. Repeat steps 1-10 for other P&IDs.

3.2 HAZOP Guidewords

The guidewords to be used are listed in Table 1 below:

Table 1: HAZOP Guidewords

Guideword Description	
Parameter	Deviation
Flow	High, Low, No, Misdirected, Reverse
Level	High, Low, None
Pressure	High, Low
Temperature	High, Low
Composition	Change in concentration, Multiphase flow, Reactions
Contaminants	Solid, Liquid, Gaseous
Instrument & Control Systems	Adequacy, effectiveness, interlocks, Function Testing
Maintenance	Access, isolation, draining, venting, other

The overview guidewords are listed in Table 2.

Table 2: HAZOP Overview Guidewords

Overview Guideword	Parameters
Materials of Construction	Tanks, valves, piping, pumps
Loss of services	Power, Instrument air, cooling water, steam
PLC failure	I/O cards, control cards, total system
Electrical systems	Area classification, earthing
Loss of communications	2-way radios
Vibration	Acoustically induced, displacement, alignment
Noise	Rotating machinery
Hot surfaces	Ignition sources
Commissioning	Sequence, interlocks bypass
Startup	Sequence
Shutdown	Planned, Emergency
Loss of containment	Corrosion, Erosion, Impact
Environmental impact	Spills, emissions, waste disposal
PPE	PPE Requirements, location

3.3 HAZOP Node Listing

A total of 5 nodes were reviewed in the HAZOP sessions. These are listed below. Marked up P&IDs are shown in Appendix C.

Table 3: List of Nodes Covered

Node No.	Description	P&ID No.
1	Line from ship to Tank 01 (Note 1)	PT-PK00-08001, Rev F
2	Tanker loading line from Tank 02 to loading gantry (Hose 02) (Note 2)	PT-PK00-080001 (Rev F) /080003 (Rev E)
3	Steam line from boiler to Tank 01	PT-PK00-08003, Rev E
4	Pigging line	PT-PK00-08001, Rev F
5	Line from sump to slops tank	PT-PK00-08001, Rev F

- Notes:
1. Lines from ship to other tanks are identical
 2. Tanker loading lines from other tanks to loading gantry are identical

3.4 HAZOP Sessions

The HAZOP study workshop was conducted at the TPA offices in the Port of Brisbane on 9th October 2013. Personnel from Port Kembla attended the sessions. The following persons were present.

Table 3: HAZIOP Study Participants

Wayne Alexander	Project Manager	N.D. Harley & Associates
David Campbell	Electrical Supervisor	Commpower
Neville Grundy	National Assets Manager	Pacific Terminals Australia
Neil Harley	Design Engineer	N.D. Harley & Associates
Mark Jelbart	Port Kembla Terminal Manager	GrainCorp
Daniel Kadwell	Maintenance Supervisor	GrainCorp
Phil Neville	National Operations Manager	Pacific Terminals Australia
Raghu Raman	HAZOP Facilitator/ Scribe	Arriscar Pty Ltd
Mark Thompson	Terminal Operator	Pacific Terminals Australia

The minutes of the HAZOP study are presented in Appendix B. Minutes were recorded on-line in MS Word.

4 HAZOP FINDINGS AND CONCLUSIONS

4.1 HAZOP Findings

The HAZOP team made a total of 17 recommendations. A summary of recommendations provided in Table 4 with detailed nodal context in Appendix B.

Table 3: Summary of Recommendations

No.	Recommendation	Responsibility
1	Procedure to set ship pump discharge pressure low when starting transfer and check flow before raising pump pressure, should form part of ship/shore transfer checklist	PTA
2	Confirm with ship if minimum flow recycle exists on ship's pump to prevent deadheading	PTA
3	During ship/shore transfer, Terminal Operator to monitor both LT indications on the screen for possible discrepancy, and take action.	PTA
4	Consider configuring Tank 01 TAH on the temperature sensors in the PLC, to indicate possible overheating	Design Engineer
5	Consider configuring 'boiler fault' alarm on the PLC. Details of fault can be accessed in boiler room.	Design Engineer
6	Provide driver training and certify for competence to be able to load by driver himself.	PTA
7	Driver training required if temporary probes are used for overfill protection instead of Scully system.	PTA
8	Show LAL interlock on P&ID, or add a note in P&ID 08003, Rev E.	PTA
9	Consider configuring TAH on tank 01 interlocked to stop Microloader	Design Engineer
10	Consider installing a local TI at Tank 01 and monitoring as part of routine surveillance.	Design Engineer/ PTA
11	Consider providing a drain point upstream of the steam condensate strainer to clear any blockage in the line.	Design Engineer
12	Add a note in P&ID 08001 Rev F indicating that barred T is provided in the pigging line.	Design Engineer
13	Consider installing an NRV at the inlet of the slops tank	Design Engineer
14	Slops tanks integrity to be included in the rest of tanks integrity management program even though it is used infrequently.	PTA
15	Consider configuring PAL on the PT at the instrument air receiver	Design Engineer
16	Check with vendor as to what is provided on the status of actuated valves in the PLC and if this is acceptable for operations.	PTA/ Design Engineer
17	Add a note in site layout drawings on ESD station locations	Design Engineer

4.2 Conclusions

The facilitator arrived at the following conclusions at the end of the HAZOP study:

The facility design conforms to good industry standards and compliant with API 650-2013 (tank design) and AS 1940-2004 for bulk flammable/ combustible liquids storage. In some cases the design exceeded the code requirements, especially in the areas of overfill protection and emergency shutdown.

The participants had a good knowledge of the facility design and proposed operations, based on the experience of PTA's other terminals in Australia.

No show-stopper type significant hazard or operability issue was found.

In the opinion of the facilitator, the HAZOP workshop was effective, with excellent team participation. Implementation of the actions arising would further enhance the safety and operability of the design.

5 REFERENCES

- 1 Arriscar Pty Ltd, Preliminary hazard Analysis of Proposed Bulk Liquids Terminal at Port Kembla NSW by Pacific Terminals Australia”, Rev A, October 2013.
- 2 State Environmental Planning Policy (Port Botany and Port Kembla) 2013 (Ports SEPP), Department of Planning & Infrastructure, NSW.
- 3 Hazardous Industry Planning Advisory paper No.8, “HAZOP Guidelines”, Department of Planning & Infrastructure, NSW, January, 2011.
- 4 Project Brief to NSW Ports Port Kembla Operations Proposed Bulk Liquid Storage Facility, Leathwaite Planning Group, August 2013.

Appendices

Appendix A List of P&IDs Covered

No.	P&ID No.	Description	Revision
1	PT-PK00-08001	Wharf to Tanks 1-4	F
2	PT-PK00-08002	Tanks 05-10	F
3	PT-PK00-08003	Loadout Tanks 01- 04	E
4	PT-PK00-08004	Loadout Tanks 05- 10	E
5	PT-PK00-08008	Utility Lines	B

Appendix B Minutes of HAZOP Study

HAZARD & OPERABILITY STUDY RECORD SHEET			
PROJECT: Port Kembla Terminal	Team Members:	Wayne Alexander; David Campbell; Neil Harley; Neville Grundy; Mark Jelbak; Daniel Kedwell; Phil Neville; Mark Thompson	Facilitator/ Scribe Dr Raghu Raman
Date:	9 th October 2013		

Node: 1	P&ID No: PT-PK00-08001, Rev F	Design temperature: 40°C
Description: Line from ship to Tank 01	Equipment ID: Tk 01	Design pressure: Atmospheric
300 te/hour pumping rate, 1250 m ³ tank		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. High Flow	Ship pumping rate exceeds 300 te/h	Potential to pressurise tank	Free vent sized for the fill rate. Emergency vent to backup for air displacement. LT on tank and LI in control room for monitoring fill rate		
2. Low Flow	Cold product (high viscosity). Ship pump problems. Manual valve not fully open (flow throttled)	Takes longer to fill the tank.	LT on tank and LI in control room for monitoring fill rate Product heated in the ship to control viscosity (60°C)		
3. No Flow	Incorrect valve line up	Ship's pump dead heading. Increase in line pressure upstream of isolation.	Procedure: Ship pump discharge pressure set low when starting transfer and flow checked before raising pump pressure.	1. Procedure to set ship pump discharge pressure low when starting transfer and check	PTA

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
				flow before raising pump pressure, should form part of ship/shore transfer checklist	
	TPSV fails closed during full flow transfer	Ship's pump dead heading. Increase in line pressure upstream of isolation. Transfer hose could be overpressurised.	Ship pump dead head pressure less than the design pressure of hose and transfer pipeline (minimum flow recycle). Dedicated instrument air receiver for the TPSVs and low pressure alarm.	2. Confirm with ship if minimum flow recycle exists on ship's pump to prevent deadheading	PTA
4. Reverse Flow	Hose failure	Reverse flow from tank and product spill	Check valves on the line to prevent back flow (1 in the line to tank and 1 in import line)		
5. Misdirected Flow	Valve line up error	Product in incorrect tank. Potential for overflow from receiving tank	Valves in the lines to non-receiving tanks are isolated and locked. Signposting of valves in the piping manifold to indicate destination tank. Operator training. Destination tank level rise monitoring.		
6. High Level	LT incorrect indication on tank Delayed action when set level is reached and flow continues Incorrect calibration of LT radar	Potential to overfill tank. Product overflow into the bund.	Product transfer plan – parcel size is determined to ensure adequate ullage in the tank. Independent LSHH and alarm. Manual tank dips during transfer, can detect LT incorrect indication.	3. During ship/shore transfer, Terminal Operator to monitor both LT indications on the screen for possible discrepancy, and take action.	PTA

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
7. Low/No Level	Not applicable				
8. High Pressure	Blocked vent Blocked isolation	Tank pressurised	Emergency vent 150mm free vent line, low potential for blockage Maintenance on tank roof under PTW		
	Isolated line and solar heating	Line pressurised. Potential for leak through flanges.	Thermal relief valve relieving back to the tank		
9. Low Pressure	Inadequate pump head	Increased transfer time	Spare pumps on ship for changeover Shore-ship communication		
10. High Temperature	Tank 01 temperature control on steam flow fails	Overheating of product and potential to vaporise product	Maximum steam pressure (i.e. temperature) less than flash point of product (base oil). Multiple temperature probes and one sensor failure would not affect control	4. Consider configuring Tank 01 TAH on the temperature sensors in the PLC, to indicate possible overheating	Design Engineer
11. Low Temperature	Steam failure (boiler trip) Tank 01 temperature control on steam flow fails	High viscosity problem Product loadout operating problem. No safety issue.	Temperature checked prior to loadout.	5. Consider configuring 'boiler fault' alarm on the PLC. Details of fault can be accessed in boiler room.	Design Engineer
12. Change in Composition	Wrong product directed into Tank 01	Product out of spec. Operating problem.	Lines labelled. Valve line up checked and confirmed before transfer.		
13. Contaminants	Steam coil failure in the tank	Product overheat	Temperature monitoring/ TAH Level monitored and LAH/ LAHH		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
		Tank filled with condensate and product spill to bund	Condensate return low alarm on boiler Provision for draining tank to sump and pump to slops tank		
14. Maintenance	No issues identified.		Drain to sump/ pump to slops or vacuum tanker. Valves isolated/ locked out, access stair for manway. Spiral stairs access to roof, hand rails on roof.		

Node: 2	P&ID No: PT-PK00-080001 (Rev F)/080003 (Rev E)	Design temperature: 40°C
Description: Tanker loading line from Tank 02 (Hose 02)	Equipment ID: Tk 02, Pump 02, Tanker	Design pressure: -
Pump 02: 950 L/min;		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. High Flow	No issues identified				
2. Low Flow	Valve partially closed Partial blockage in pump strainer Gravity feed (pump failure)	Longer fill time. Microloader trips out.	Strainer maintenance Valve lineup procedure	6. Provide driver training and certify for competence to be able to load by driver himself.	PTA
3. No Flow	Pump failure Tank empty Strainer blockage	No filling occurs. Microloader trips out.	Strainer maintenance Operator intervention		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
4. Reverse Flow	Not applicable		2 check valves in series		
5. Misdirected Flow	Load directed to incorrect compartment	Off spec product Potential to overfill compartment Potential to overpressurise tanker compartment	Connections to tanker made by driver based on manifest. Sign posting of all loading lines, identifying the product.	6. Provide driver training and certify for competence to be able to load by driver himself.	
6. High Level	Incorrect load specified Microloader fault	Compartment overfill and product spill through vapour vent	Overfill protection (Scully system or temporary high level probe, interlocked to shut microloader. Drainage and collection sump (for minimum 1 compartment load) at loading gantry.	7. Driver training required if temporary probes are used for overfill protection instead of Scully system.	PTA
7. Low/No Level	Tank 01 empty	Loss of suction to pump and pump damage	Tank inventory checked daily and tank locked out if inadequate inventory. LAL on tank LT cuts out microloader. Also acts as permissive to prevent pump start if tank level is low.	8. Show LAL interlock on P&ID, or add a note in P&ID 08003, Rev E.	PTA
8. High Pressure	Blocked isolation and pump running against closed head	Potential to overpressurise tanker loading hose Pump damage (positive displacement pump)	Internal relief for pump to prevent running against closed head.		
9. Low Pressure	See low level				

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
10. High Temperature	Steam heating problems and higher temperature in the tank (Tank 01 only)	High temperature product into the tanker compartment and potential for compartment failure.		9. Consider configuring TAH on tank 01 interlocked to stop microloader	Design Engineer
11. Low Temperature	Loss of heating in the tank	High viscosity product, difficult to pump into tanker compartment	Temperature monitoring of product. Enough heat in the tank to minimise cooling rate and steam can be restored by this time.		
12. Change in Composition	Pumped from wrong tank Incorrect hose connected to tanker	Off spec product	Dedicated tank and pump for Tank 01 Signposting of loading lines Driver inductions		
13. Contaminants	No issues identified				
14. Instruments & Control	No issues identified				
15. Maintenance	No new issues identified.				

Node: 3	P&ID No: PT-PK00-08008	Design temperature: 170°C
Description: Steam line to Tank 01	Equipment ID: Boiler, Steam coils	Design pressure: 700 kPag

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. High Flow	TIC loop failure on T01 Steam valve stuck open	Tank overheating	Product flash point > maximum steam temperature.	10. Consider installing a local TI at Tank 01 and monitoring as part of routine surveillance.	Design Engineer / PTA
2. Low Flow	TIC loop failure on T01 Steam valve stuck closed	Tank product cooled. High viscosity, pumping problems	Rate of cooling low due to tank inventory and sufficient time to restore functionality	As per Low Temperature in Node 2 above.	
3. No Flow	Blocked strainer in steam trap Steam trap failure and condensate buildup in the line	As above		11. Consider providing a drain point upstream of the steam condensate strainer to clear any blockage in the line.	Design Engineer
4. Reverse Flow	No issues identified				
5. Misdirected Flow	Not applicable				
6. High Level	Not applicable				
7. Low/No Level	Not applicable				
8. High Pressure	Blocked strainer in steam trap	Line pressurised to maximum steam pressure	Line is designed for maximum steam pressure. No safety issue.		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
	Steam trap failure and condensate buildup in the line				
9. Low Pressure	See low/ no flow				
10. High Temperature	No new issues identified				
11. Low Temperature	Not applicable				
12. Change in Composition	Wet steam	Set temperature in tank not achieved. Potential for increased corrosion	Steam traps designed for the case of slight increase in wetness of steam		
13. Contaminants	Demin plant malfunction	Potential for increased scaling/ corrosion due to poor quality of boiler feedwater	Daily checklist for boiler provided by vendor Boiler maintenance contract		
14. Instruments & Control	No new issues identified				
15. Maintenance	No new issues identified				

Node: 4	P&ID No: PT-PK00-08001 Rev F	Design temperature: Ambient
Description: Pigging line	Equipment ID: Pig, Site compressed air system	Design pressure: 700 kPag

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. High Flow	No issues identified		Maximum flow limited by compressed air supply pressure (limited to 700 kPag by PSV in air receiver)		
2. Low Flow	Low pressure in compressed air supply	Unable to pig the line	Multiple air compressors on site (9 off)		
3. No Flow	Pig jammed in the line	Operational delays. Upstream of pig cannot be overpressured as air pressure is limited to 700 kPag.	Recovery procedures Pipeline bends design for smooth flow of pig		
4. Reverse Flow	Not applicable				
5. Misdirected Flow	Valve to tank not isolated	Pig stuck in the line to storage tank	Barred T in design to ensure pig flow direction	12. Add a note in P&ID 08001 Rev F indicating that barred T is provided in the pigging line.	Design Engineer
6. High Level	Not applicable				
7. Low/No Level	Not applicable				
8. High Pressure	Inadequate venting of line before hatch is opened	Residual pressure in pigging line when hatch is opened.	Vent lines on either side of the pig receiver signal. Both opened to make sure all air is vented.		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
	Local PI faulty and shows no pressure while residual pressure is present	Potential for injury (exposure to stored energy)	Residual pressure, if any, will be released and the hatch bolts are undone before hatch itself is opened.		
9. Low Pressure	See Low flow				
10. High Temperature	Not applicable				
11. Low Temperature	Not applicable				
12. Change in Composition	No issues identified				
13. Contaminants	Pig disintegrated	Inadequate pigging. Product deposit on pipework	Pig material selection (foam pig not used)		
14. Instruments & Control	Pig sensors failure	Operational delays. No adverse effect.			
15. Maintenance	Isolation/ Access	Inadequate isolation/ access may lead to incidents during maintenance	Review showed that adequate isolation valves are provided for process isolation and access platforms are provided for maintenance.		

Node: 5	P&ID No: PT-PK00-08001, Rev F	Design temperature: Ambient
Description: Sumps to slops tank	Equipment ID: Slops tank	Design pressure: Atmospheric

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. High Flow	No issues identified		Portable air driven pump to pump from sump		
2. Low Flow	No issues identified		Normally no flow		
3. No Flow	As above				
4. Reverse Flow	Portable pump stoppage	Reverse flow up to pump discharge point		13. Consider installing an NRV at the inlet of the slops tank	Design Engineer
5. Misdirected Flow	Not applicable		Deliberately directed flow		
6. High Level	Tank cleaning, > 5000L will be pumped to slops tank	Overfill of slops tank and flow into bund	Monitoring of slops tank level through the local level glass and communication between operators to stop pumping		
7. Low/No Level	Normal case				
8. High Pressure	Blocked vent	Potential to overpressure the tank	200mm vent for small filling rate (approx. 150-200 L/min) Vent inspection and maintenance		
9. Low Pressure	Not applicable				

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
10. High Temperature	Not applicable				
11. Low Temperature	Not applicable				
12. Change in Composition	No issues identified				
13. Contaminants	Tank contents cannot be used		Slops tank contents drained into oily waste road tanker for disposal.		
14. Maintenance	Valves frozen due to infrequent use	Fails to operate when required		14. Slops tanks integrity to be included in the rest of tanks integrity management program even though it is used infrequently.	PTA

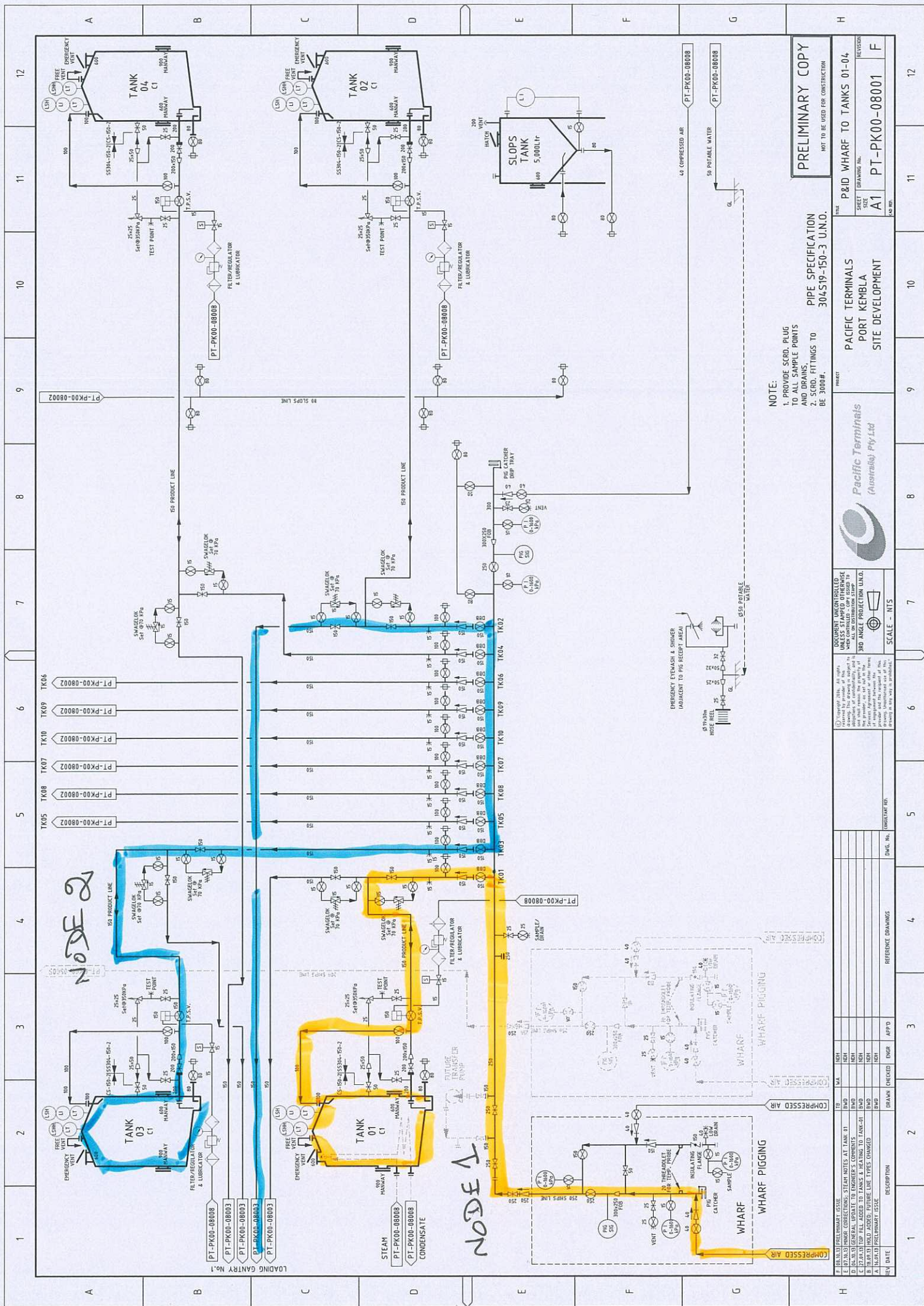
Overview	Description: The entire Terminal
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Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
1. Materials of Construction	Corrosion	Potential for loss of containment	Product non-corrosive. Carbon steel tanks, SS lines, CS pumps & impellers		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
2. Loss of services - Power	Power supply failure	Loading stops. Controlled stop of ship unloading.	UPS for instruments on site. Two supply points from the grid for redundancy. Diesel pumps for firewater.		
3. Loss of services - Instrument air	Compressor failure Leakage from air receiver Line rupture	All actuated valves close. Operations stop.	Multiple compressors Air supply line NRV to prevent back flow from receiver	15. Consider configuring PAL on the PT at the instrument air receiver	Design Engineer
4. Loss of services - Cooling water	Not applicable				
5. Loss of services - Steam	Covered in Node 4				
6. PLC system failure (single card, rack, total system)	I/O failure	Status of valves/ tank levels unknown	Shows last position and raises fault alarm	16. Check with vendor as to what is provided on the status of actuated valves in the PLC and if this is acceptable for operations.	PTA/ Design Engineer
7. Electrical systems - Area classification	Not required				
8. Electrical systems - Earthing	Tanks, pumps, cable trays		Earthing provided for all the equipment		

Guideword	Causes	Consequences	Safeguards	Recommendations	Responsibility
9. Loss of communications	Radio failure	Cannot communicate with ship	Maintenance of radios. Spares held. Hourly visual contact of operator with deckhand		Operations
10. Vibration	Not applicable				Process Control
11. Noise	No issues identified				
12. Startup			Commissioning procedures developed		
13. Shutdown (planned, emergency)	Site emergency	Need to shutdown Terminal in an emergency	ESD stations provided in Terminal at each gantry, control room, Near Tanks 7 and 10 due to longer distance from control room.	17. Add a note in site layout drawings on ESD station locations	Design Engineer
14. Loss of containment	Driveaway while connected	Product spill at gantry	Locking bar across the hose connection nozzles locks the brakes		
15. Safety showers/eye wash station			Provided near pig receiving area and one for each gantry and shown in drawings 08001 and 08003		

Appendix C Nodes marked P&IDs



NOTE:
1. PROVIDE SCRD. PLUG
TO ALL SAMPLE POINTS
AND DRAINS.
2. SCRD. FITTINGS TO
BE 3000#.

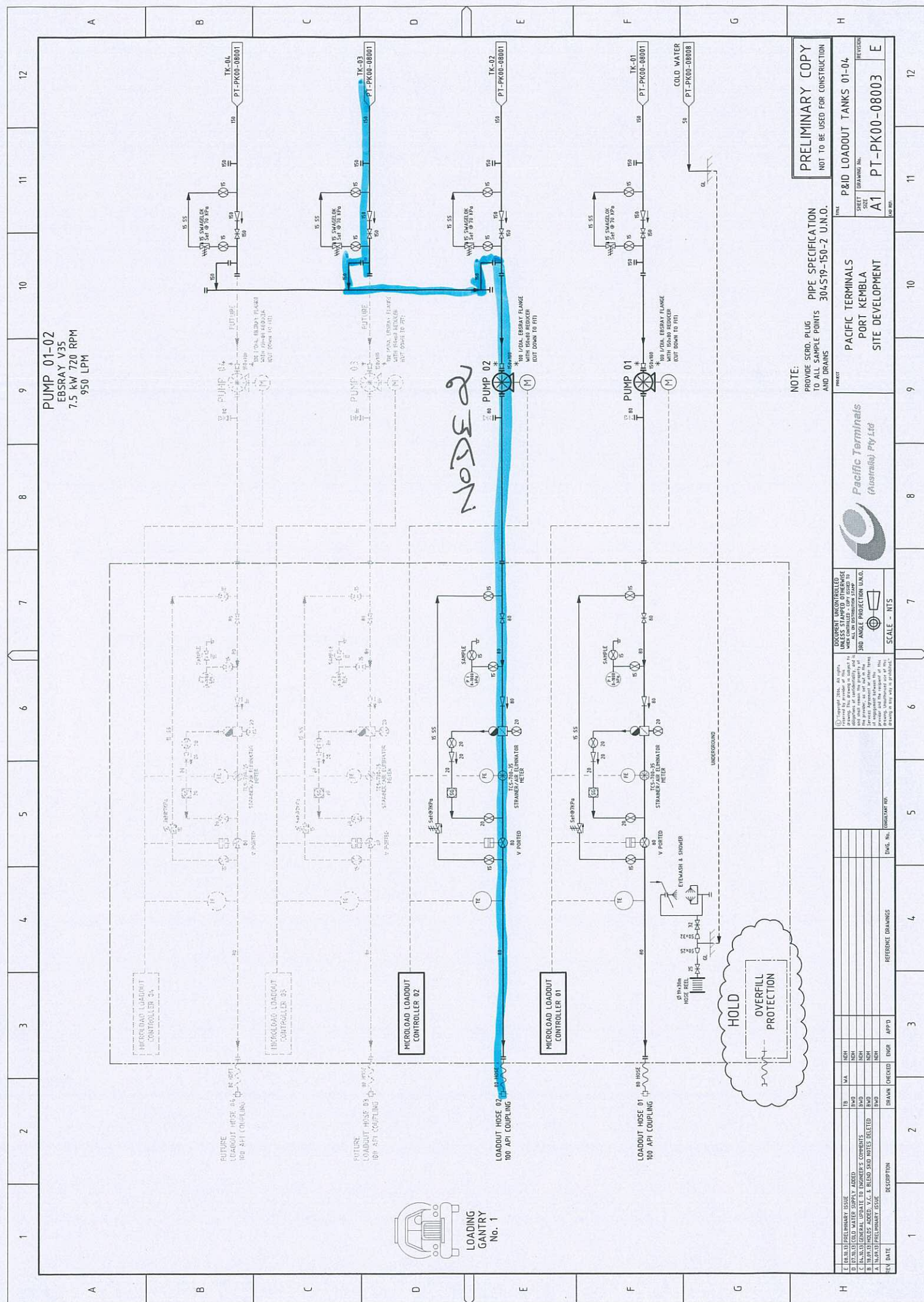
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Pacific Terminals
(Australia) Pty Ltd

PACIFIC TERMINALS
PORT KEMBLA
SITE DEVELOPMENT

SHEET SIZE A1	DRAWING No.		REVISOR
	PT-PK00-08001		F



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NOTE: PROVIDE SCRD. PLUG TO ALL SAMPLE POINTS AND DRAINS

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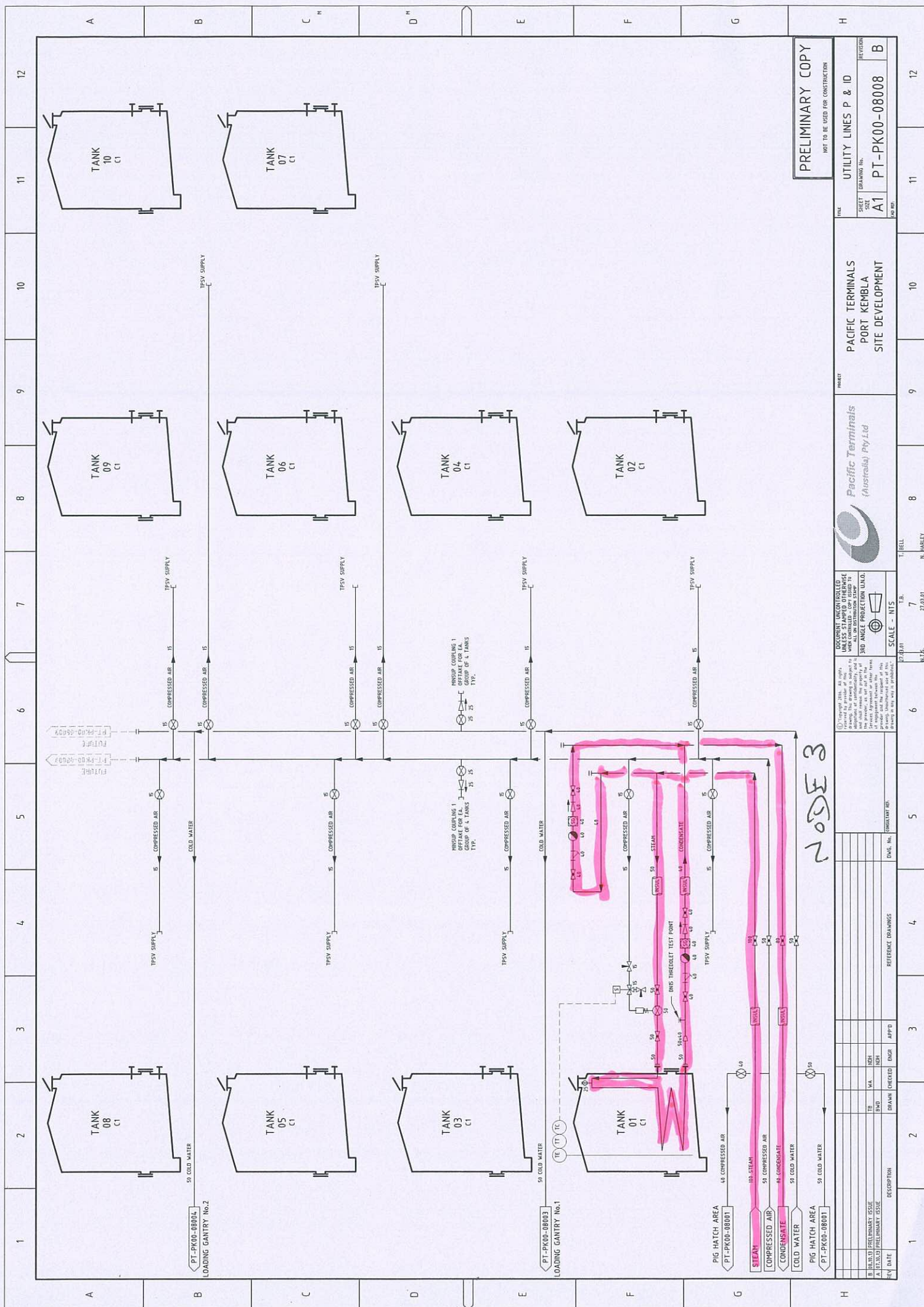
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BY ADDING
AN ENGINEER'S COMMENT

13	PRELIMINARY ISSUE
13	COLD WATER SUPPLY
13	GENERAL - IRRIGATE T

	E	08.10.
	D	07.10.
	C	06.10.
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