MUSEUM OF CONTEMPORARY ART REDEVELOPMENT

MCA
MUSEUM OF CONTEMPORARY ART

MUSEUM OF CONTEMPORARY ART
140 GEORGE STREET, SYDNEY

SEA-WATER HEAT EXCHANGE REPORT

STEENSEN VARMING

AUSTRALIA DENMARK IRELAND UK

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EXECUTIVE SUMMARY

As part of the redevelopment of the Museum of Contemporary Art (MCA) it is proposed to use a sea water heat exchange building cooling system. This type of system is well proven in Sydney and its use will significantly reduce the buildings energy and water consumption when compared to a traditional air cooled alternative. The system is an example of the design initiatives included in the project as part of the MCA's commitment to Ecologically Sustainable Development (ESD) and making the project as 'green' as possible.

Regulatory requirements as defined by the relevant authorities namely the Department of the Environment, Climate Change and Water NSW (DECCW), place a limit on the maximum temperature differential between the intake and discharge of the sea water system. The design of the system ensures that these limits will not be exceeded.

Regulatory requirements also stipulate that only certain pesticides can be used as antifouling agents to prevent fouling of the seawater pipework. The project has therefore been careful to select an agent which is approved and licensed by the appropriate regional and national authority.

It is therefore believed that this design is compliant with the relevant regulatory requirements and will achieve a result that is beneficial to both the environment and the MCA.

INTRODUCTION

The proposed redevelopment of the MCA on Circular Quay is designed with a number of Ecologically Sustainable Development (ESD) initiatives so as to minimise the overall environmental effects resulting from day to day operation of the building. One of the ESD initiatives to aid in the conservation of water and energy is a seawater heat exchange system to be used for cooling of the MCA's mechanical plant.

The use of sea water for cooling in an air conditioning system is a tried and proven technology. There are several key examples of this technology in Sydney Harbour - including the Sydney Opera House, the AMP Building and Workplace 6.

This report has been prepared for submission to the Department of Planning as part of a section 75W modification application and will address the following points:

- Rational for using a seawater heat exchange system
- Regulatory requirements
- Operational parameters
- Design and installation details

RATIONAL FOR USING SEA WATER HEAT EXCHANGE

The key drivers for the selection of a sea water heat exchange system for the MCA's proposed redevelopment are outlined below:

- **ENERGY & CO2 REDUCTIONS**
  The use of the sea water exchange system allows heating and cooling to be done at higher energy efficiencies than a traditional cooling tower & boiler system, thus producing lower CO2 emissions. The key reasons for this are that the system provides the ability to balance the buildings internal heating and cooling loads against each before having to exchange heat with the environment, then, once it does need to exchange heat with the environment, sea water is a more suitable temperature than air for doing this (higher temperature in winter and lower temperature in summer).

- **WATER USAGE REDUCTION**
  The use of a sea water heat exchange system achieves significant water savings when compared to a conventional cooling tower arrangement.

- **REDUCED RISK OF LEGIONNAIRES DISEASE**
  The environment in a cooling tower provides a fertile breeding ground for various water borne diseases, in particular legionnaire's disease. To prevent contamination cooling towers require strict water treatment regimes. The use of a sea water heat exchange system removes this risk as the system operates as a closed loop system.

- **AESTHETIC CONSIDERATIONS**
  The Museum of Contemporary Art is in a prominent position on Circular Quay. As such it forms an integral part of the harbour view for which Sydney is renowned. The use of a sea water heat exchange system removes the need for cooling towers on the upper levels of the MCA and is more in keeping with the redevelopment design and commitment to ESD. It also provides an opportunity for the MCA to educate its visitors about ESD initiatives such as this.

REGULATORY REQUIRMENTS

As per advice provided by the Department of the Environment and Climate Change NSW, now known as the Department of the Environment and Climate Change and Water NSW (DECCW), the MCA redevelopment project does not require an environment protection licence under the Protection of the Environment Operations Act 1997 (POEO).

DECCW also state that:

"the heat exchange system must be operated in accordance with the general environment protection provisions of the POEO Act and in accordance with the provisions of the Pesticides Act 1999."

To meet these two criteria DECCW determine that:

a) the difference in temperature between the intake and the discharge must be less than two degrees Celsius
b) any pesticide used must be used in accordance with a permit issued pursuant to Part 7 of the Schedule for the Agricultural and Veterinary Chemicals Code Act 1994

Both the Sydney Harbour Foreshore Authority and NSW Maritime have provided Landowners Consent for the proposed MCA seawater heat exchange system.

SYSTEM DESCRIPTION

The proposed MCA seawater heat exchange system is comprised of the following key elements:

- A harbour water intake basket below minimum low tide level
- Pipework to and from the building plantroom where pumps and heat exchangers will be located
- A discharge point located below the minimum low tide level

The use of an anti fouling agent will prevent marine growth in the system.

Appendix A of the report contains mechanical services drawings for the seawater system design.

1.1 OPERATING PARAMATERS

The system will absorb or reject heat into the sea water via the heat exchangers depending on the balance of the heating and cooling loads within the building. The maximum rate of exchange will occur in the summer and will result in an overall heat rejection of less than 2621 kW. The design flow rate in this scenario will be 328 l/s.

In both situations the temperature difference across the heat exchangers will be limited to less than 2 degrees by controlling the flow rate of the sea water pumps. The discharge has been designed so that this temperature difference will be further reduced upon mixing with water in the harbour.

1.2 DESIGN AND INSTALLATION DETAILS

The system has changed slightly since the previous planning submission in December 2008. The key point of difference is the heat exchangers are now located within the new building rather than under the promenade. This was done to improve the buildabilty and reduce the costs of the installation.

For further details of the installation refer to Appendix A – Mechanical Services Drawings M1006, M1007 and M4003.

1.2.1 SEA WATER INTAKE

The intake from the harbour will incorporate an angled mesh basket set out from the intake foot valve. This will act to screen / filter the sea water entering the pipe and will prevent debris / marine life such as fish entering the pipeline. The foot valve serves to prevent lose of water if the system is shut down. For ease of servicing and inspection this will be able to be rotated up and accessed from a maintenance platform under the promenade.

1.2.2 SEA WATER DISCHARGE

The seawater discharge will be located under the promenade below the minimum low tide level. It will incorporate a venturi nozzle to induce a high degree of mixing which will minimise both the velocity of water discharging into the Harbour and further reduce the outlet temperature.

1.2.3 PIPEWORK ROUTE

The intake and discharge for the proposed sea water system will be located under the Circular Quay promenade directly in front of the existing MCA building. To prevent recirculation of the same water the intake and discharge will be separated an approximate distance of 25m.

The seawater system pipework will travel underground from the harbour traversing the area of West Circular Quay to the existing MCA building where it will run through a short section of sub floor cavity

and enter a basement plantroom in the new building where the pumps and heat exchangers will be located.

1.2.4 CONSTRUCTION MATERIALS

The sea water heat exchange system will be constructed out of ABS pipework (recognised as the optimal pipework for these kind of systems) with various equipment and fittings constructed out of stainless steel. The sea water heat exchanges which will come into direct contact with sea water will be constructed out of titanium

For further details of ABS pipework please refer to Appendix C – ABS Pipework Properties

1.2.5 ANTIFOULING AGENT

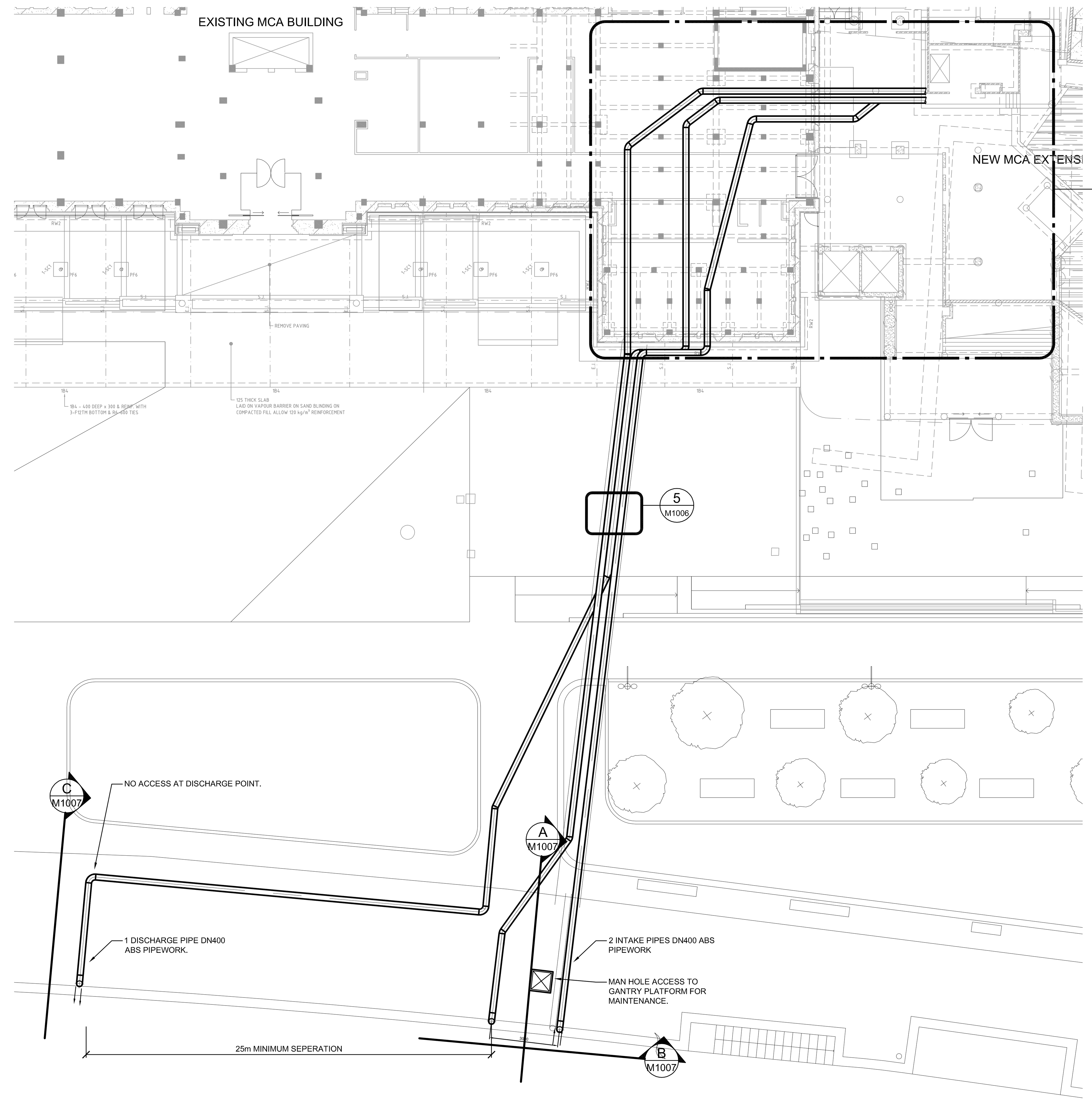
In order to prevent fouling of the pipes it is proposed to use an anti fouling agent called Mexcel. This acts to prevent algae from attaching to the surfaces of the pipes. This product is already in use in several of the existing installations in the Sydney Harbour. The selection of this agent has been made in order to meet the Authority and client requirements for the system and is already in use in existing installations in Sydney Harbour. For further information on this antifouling agent please refer to:

Appendix D – Mexcel Material Safety Data Sheet
Appendix E – Mexcel APVMA Permit
Appendix F – Mexcel case studies (Sydney Opera House & Sydney Star Casino)

CONCLUSION

By ensuring that the design of the MCA sea water heat exchange system ensures a temperature differential of less than 2 degrees and through the use of an anti fouling agent product which is licenced for use in NSW we believe that this system fully complies with the regulatory requirements as stipulated by DECCW and will provide a positive environmental benefit to the MCA's proposed redevelopment.

APPENDIX A – MECHANICAL SERVICES DRAWINGS



SEA WATER PIPEWORK PLAN
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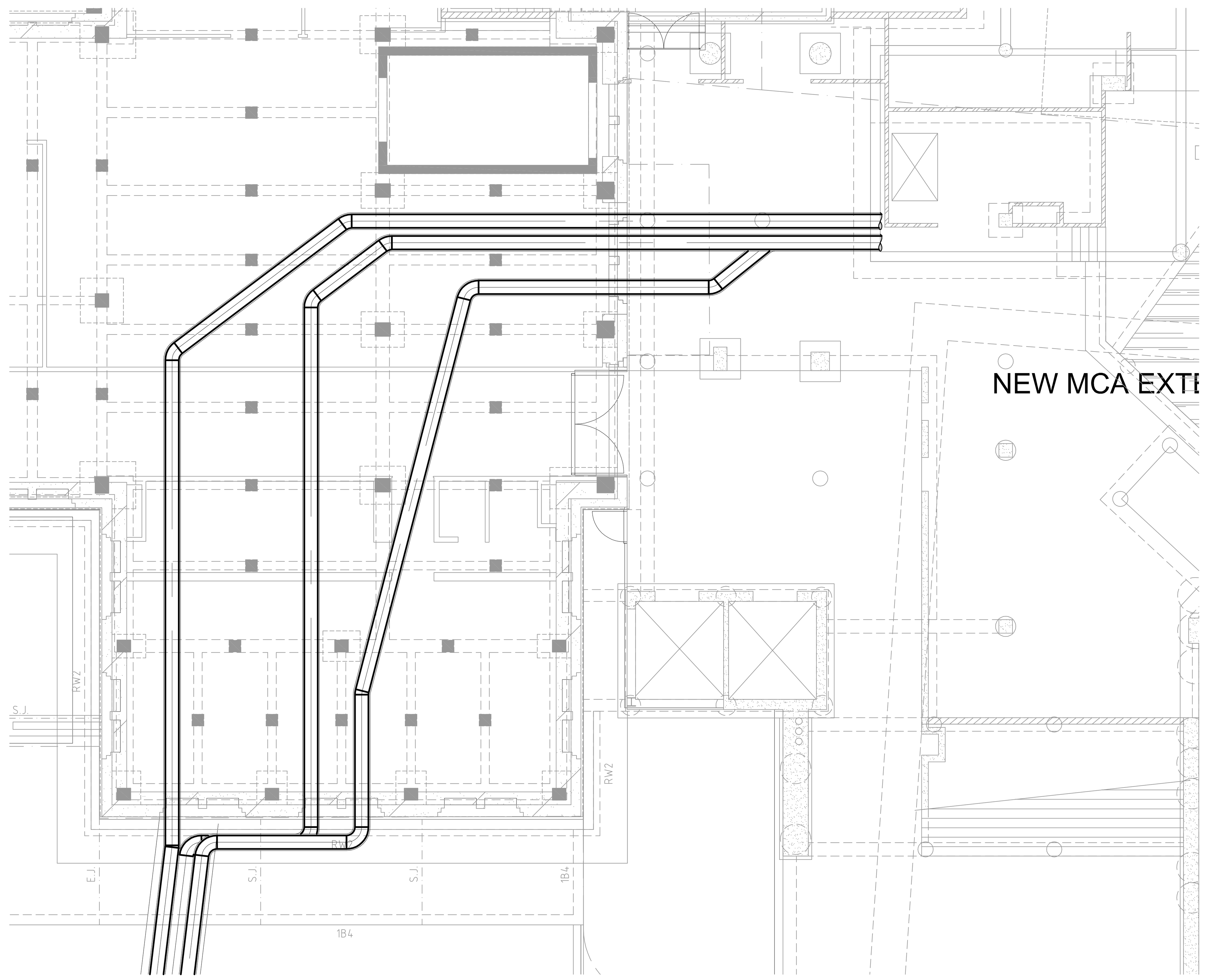

2 SEA WATER PIPEWORK UNDER BUILDING
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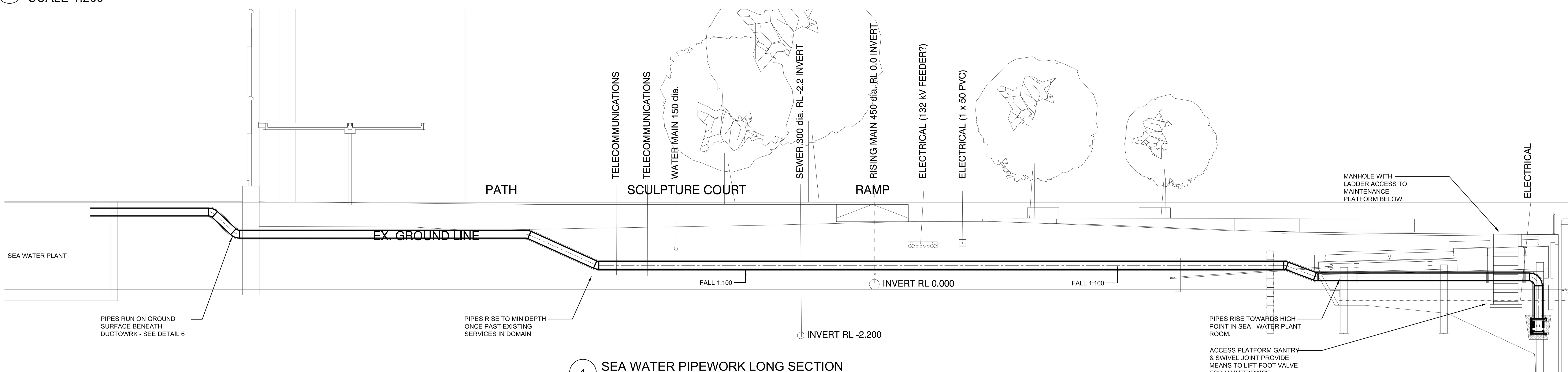

1 SEA WATER PIPEWORK LONG SECTION
SCALE 1:100

NOTES

1. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH MECHANICAL SERVICES SPECIFICAITON AND EQUIPMENT SCHEDULES.
2. DIMENSIONS OF ACCESS PLATFORM TO BE CONFIRMED BY ACCESS CONSULTANT
3. CONTRACTOR SHALL DETERMINE FINAL PIPE ROUTES & DEPTHS ONCE LOCATION OF EXISTING SERVICES HAS BEEN CONFIRMED BY EXCAVATION (FINAL ARRANGEMENT TO BE APPROVED BY SUPERINTENDENT)
4. SYSTEM HIGH POINT TO BE IN SEA WATER PLANTROOM
5. PROVIDE HYDROPHILIC SEAL BETWEEN PIPE AND SLEEVE WHERE IT ENTERS THE BUILDING.

FOR TENDER
THIS IS NOT A WORKSHOP DRAWING
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PROJECT
MCA REDEVELOPMENT
140 GEORGE STREET
CIRCULAR QUAY

SCALE
1:50
DRAWING DESCRIPTION
MECHANICAL SERVICES
SEAWATER PIPEWORK LAYOUT

DRAWING No. & ISSUE
M1006 B

STATUS
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NOTES

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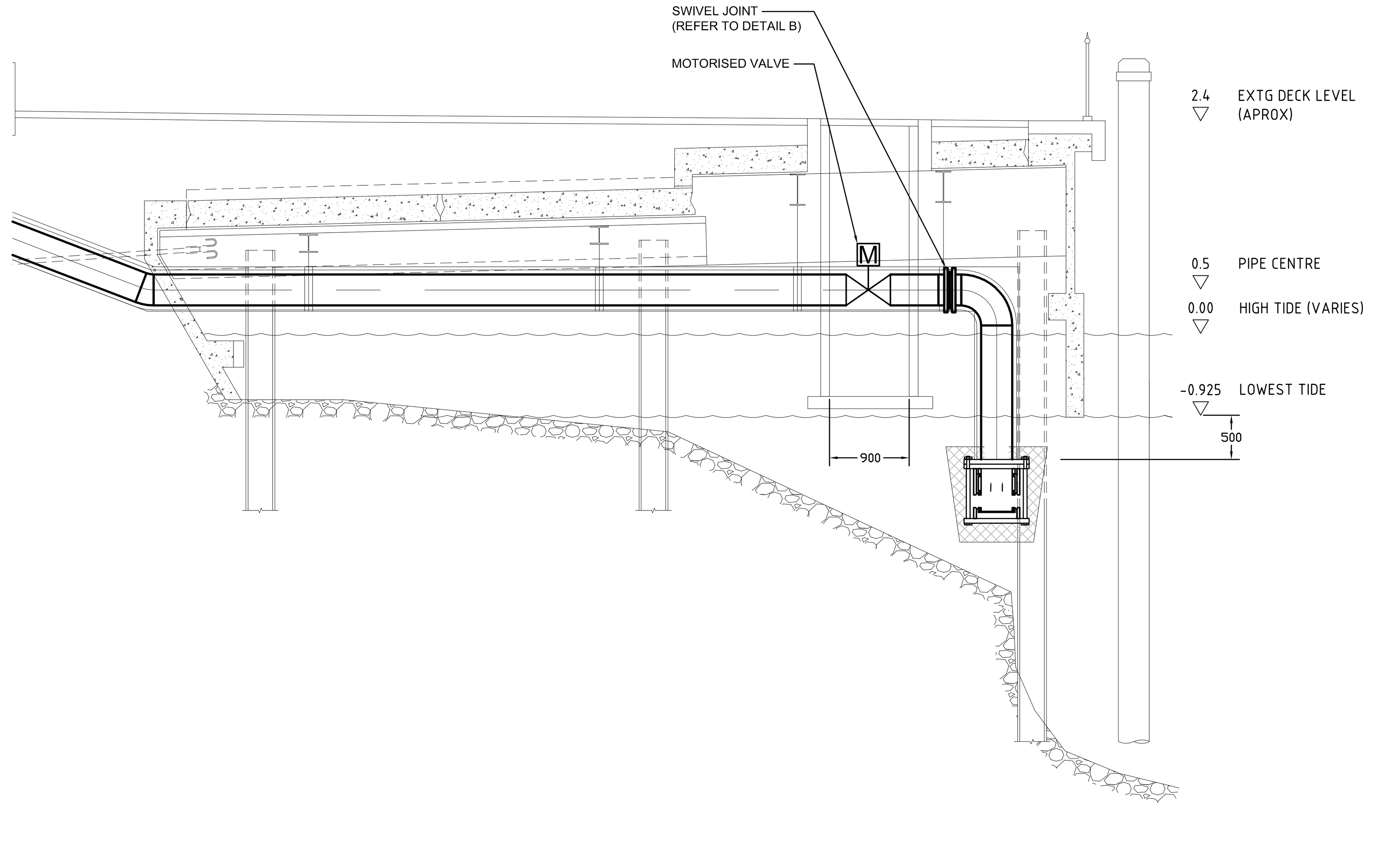
2. DIMENSIONS OF ACCESS PLATFORM & MANHOLE TO BE CONFIRMED BY OH&S CONSULTANT



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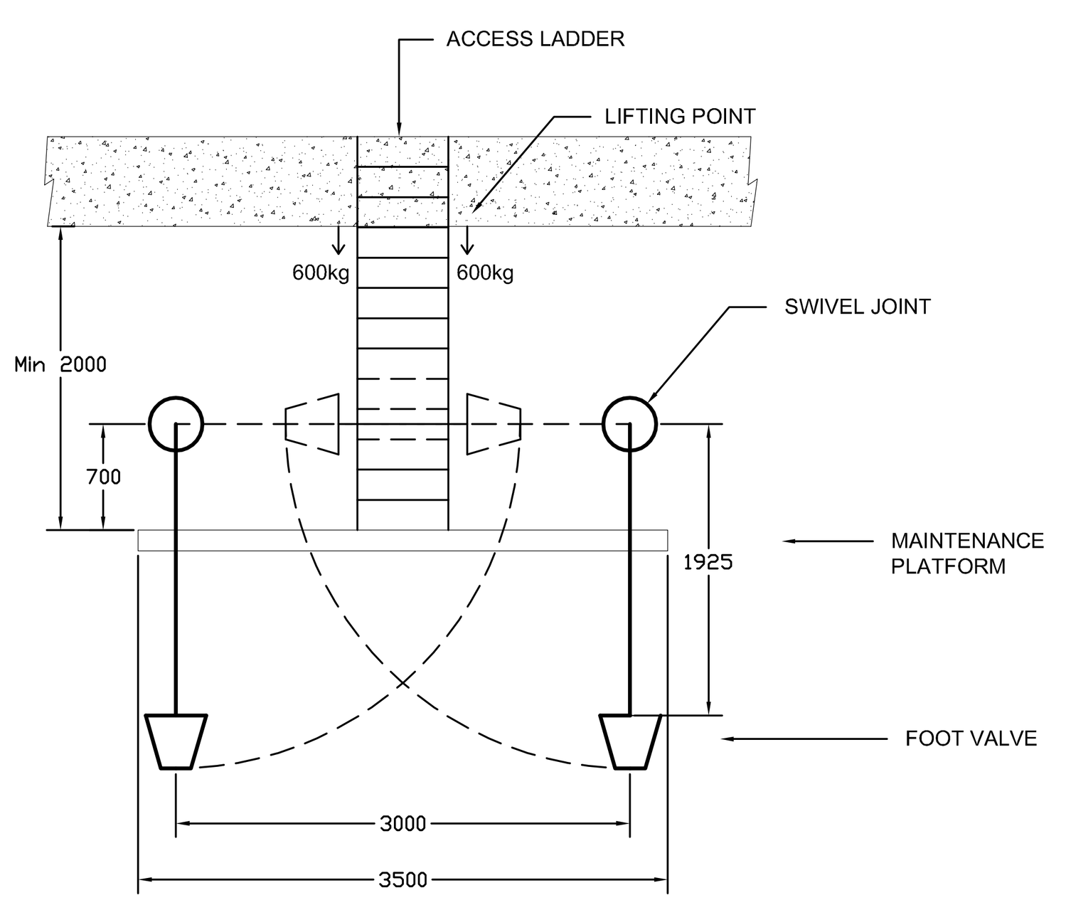

B (M1006) SEA WATER INTAKE SECTION END VIEW
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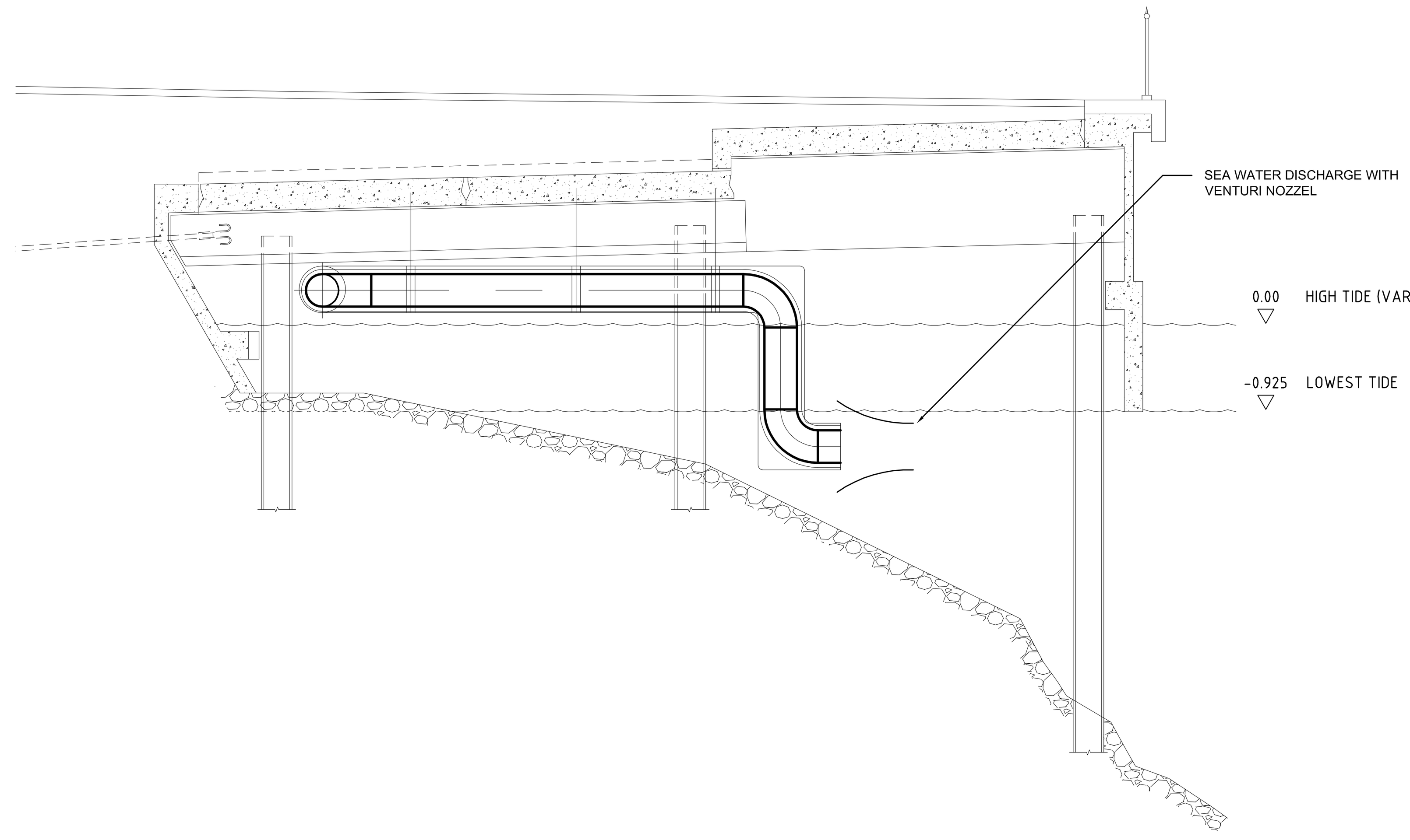
*DIMENSIONS OF ACCESS PLATFORM AND MANHOLE TO BE CONFIRMED BY OH&S CONSULTANT



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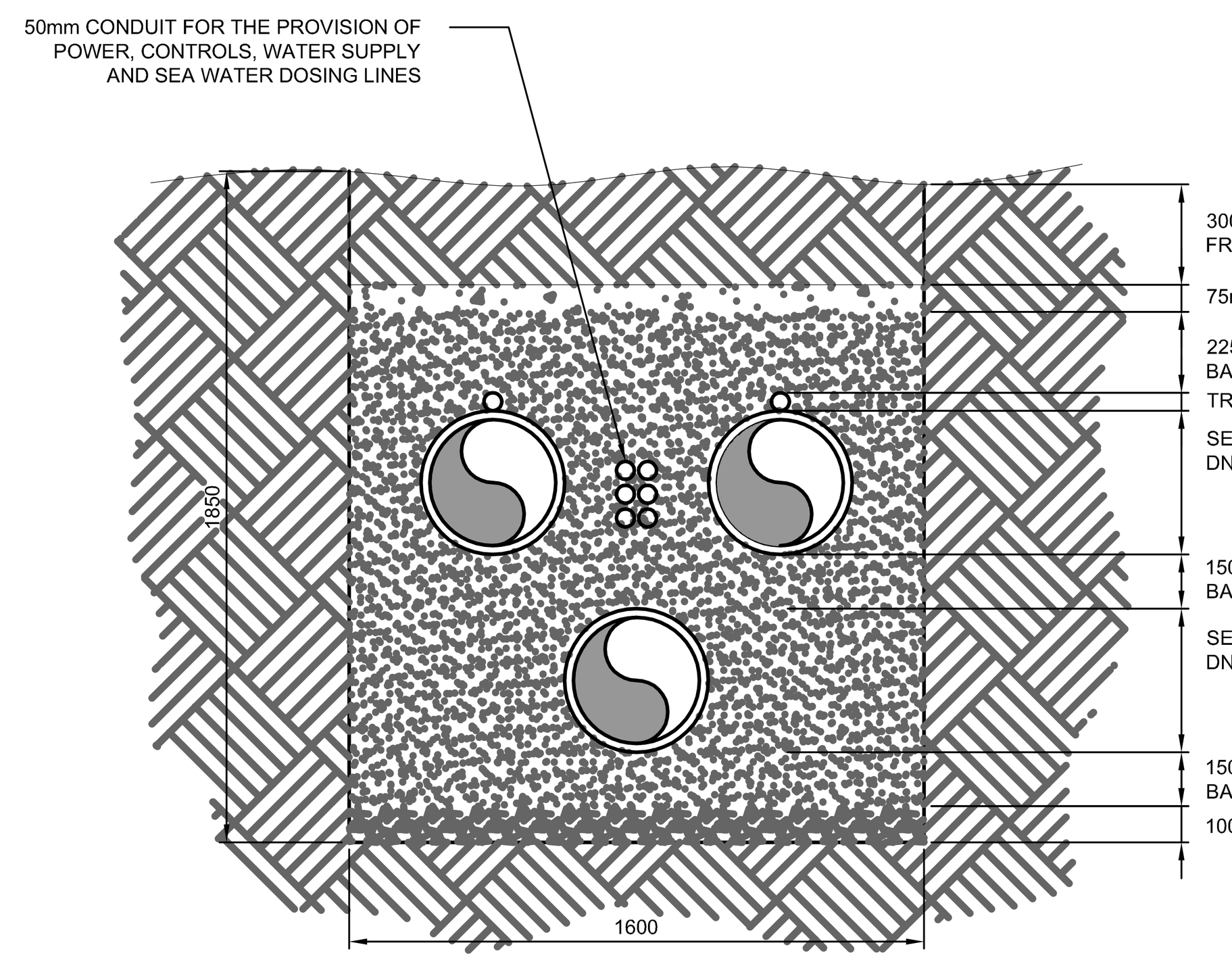

5 SEA WATER TRENCH DETAIL
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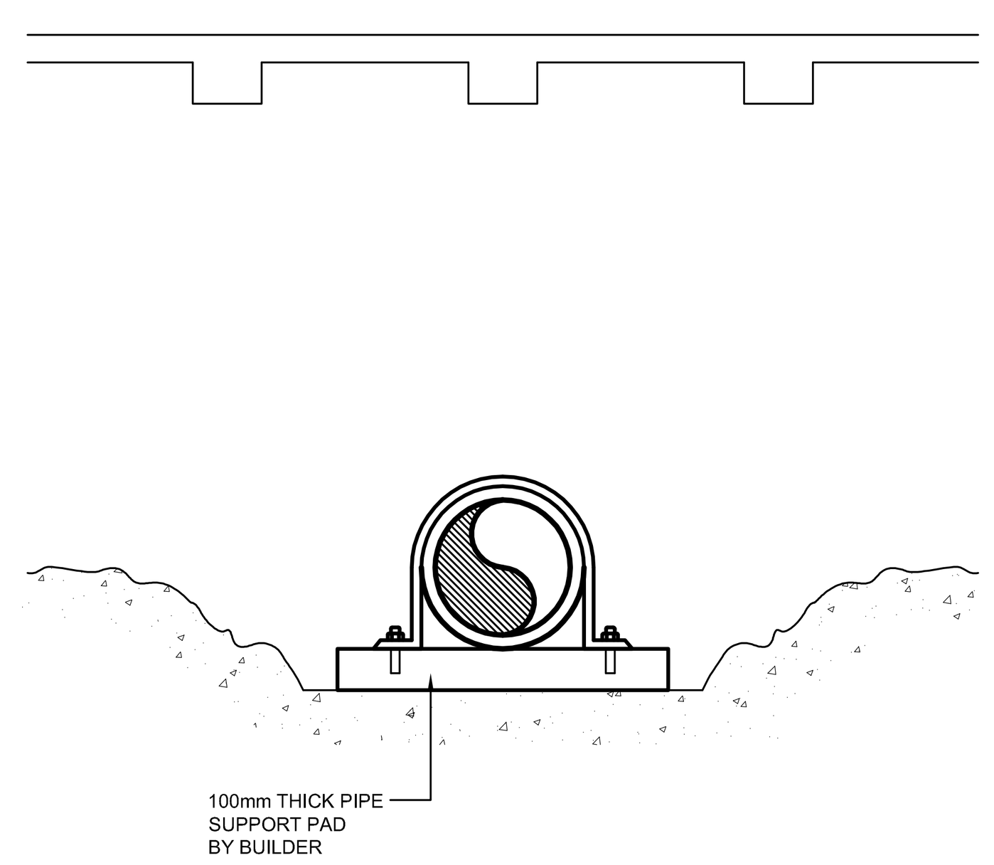
*TRENCHING, BACK FILLNIG AND CONCRETE PAD BY BUILDER



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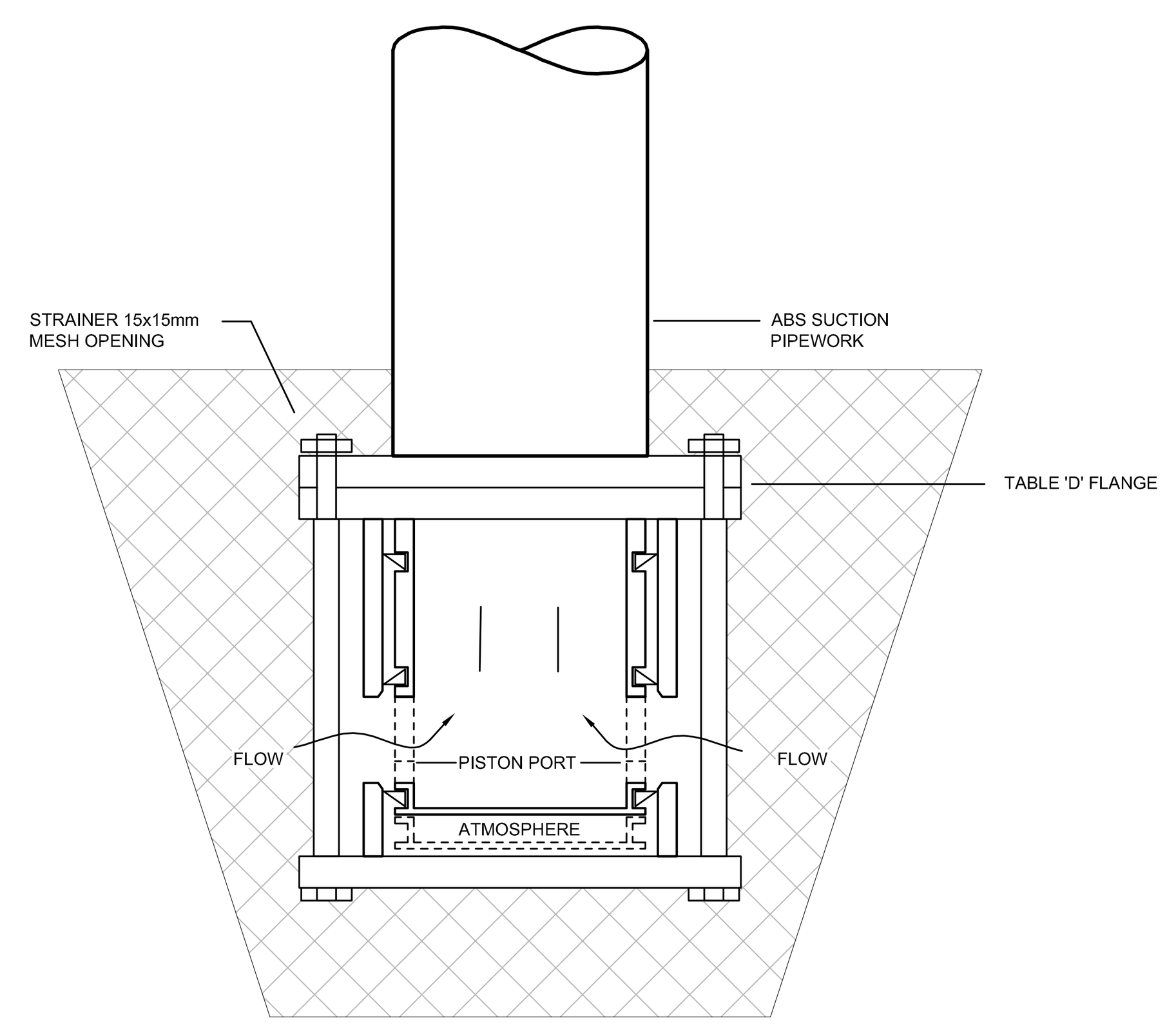
*CONCRETE PAD BY BUILDER



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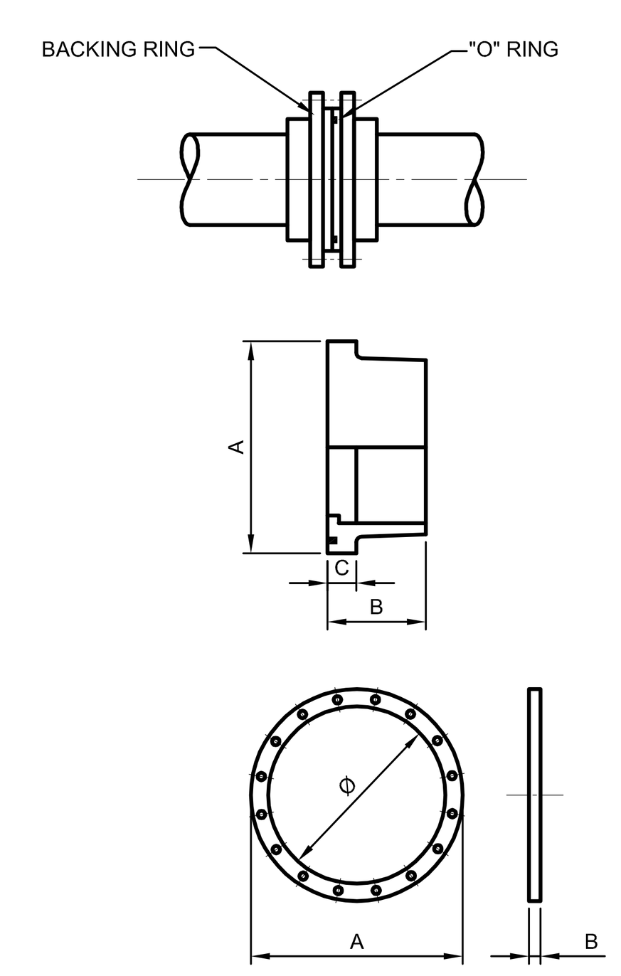
*FOOT VALVE TO BE AS PROVIDED BY QUEENSLAND IRRIGATION SERVICES OR APPROVED EQUAL



8 SWIVEL JOINT DETAIL
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*SWIVEL JOINT TO BE AS PROVIDED BY TRELOAR OR APPROVED EQUAL

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STATUS

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PROJECT
MCA REDEVELOPMENT
140 GEORGE STREET
CIRCULAR QUAY

SCALE
AS SHOWN

DRAWING DESCRIPTION
MECHANICAL SERVICES
SEAWATER PIPEWORK ROUTE

DRAWING No. & ISSUE
M1007 A

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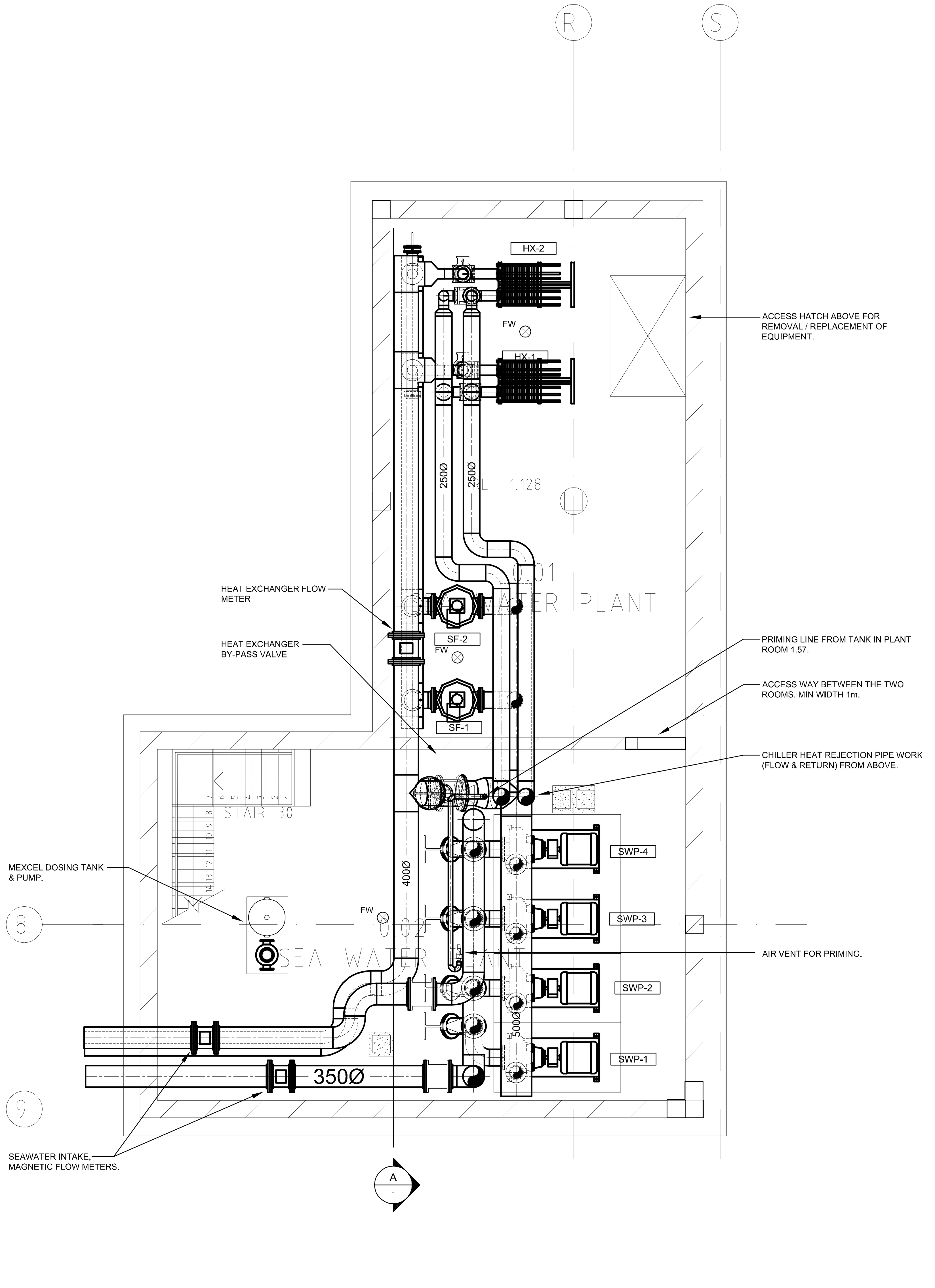

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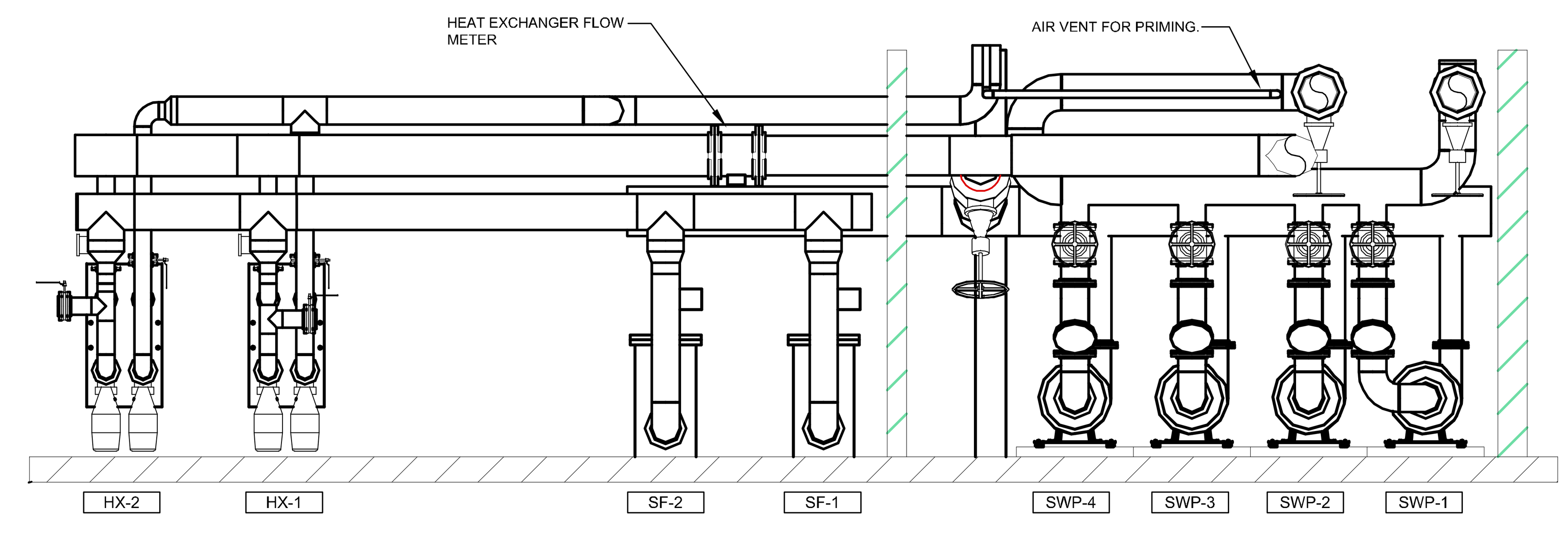

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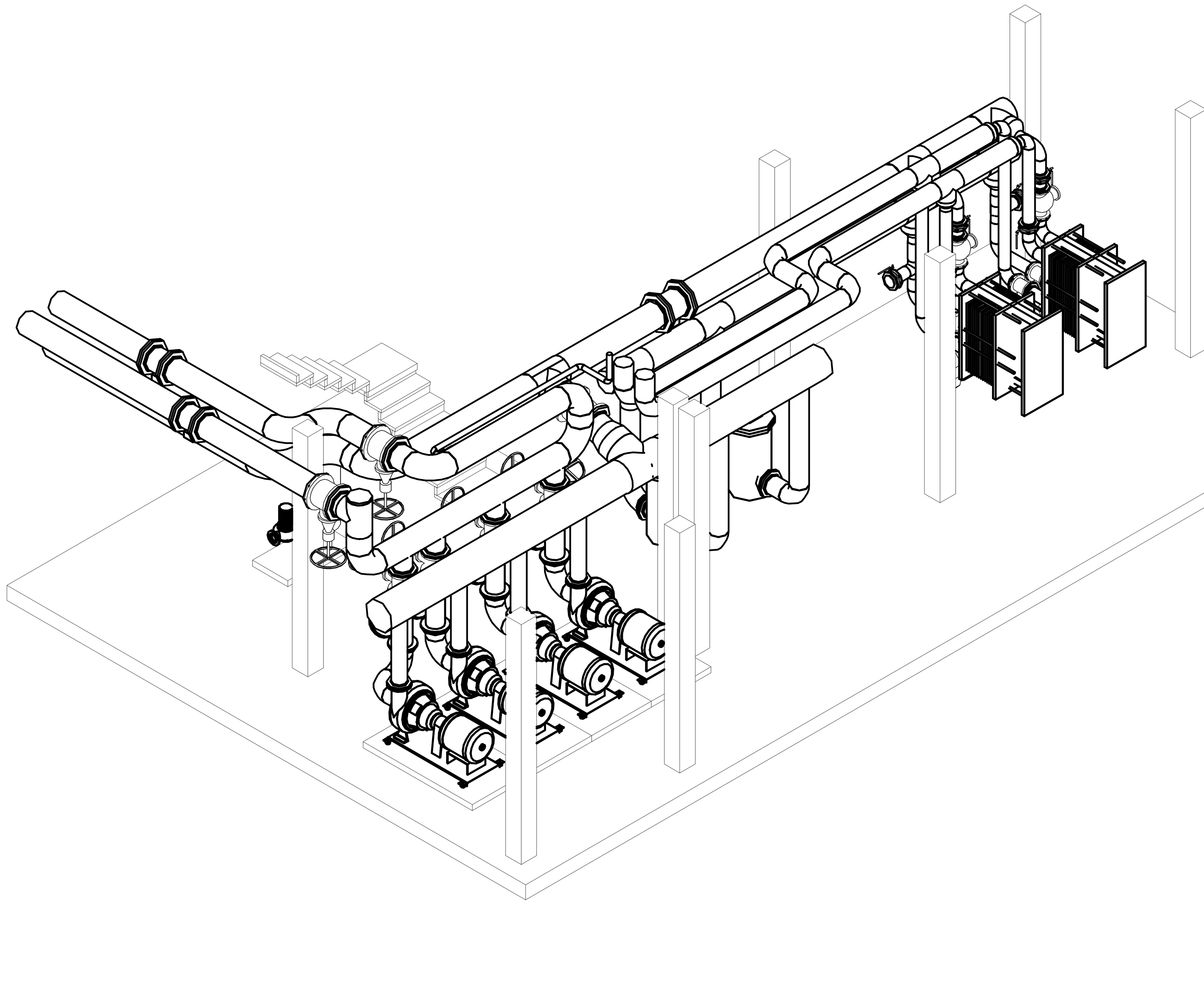

NOTES

FOR TENDER
THIS IS NOT A WORKSHOP DRAWING
NOT FOR CONSTRUCTION. IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE CONSTRUCTIONAL DIMENSIONED WORKSHOP DRAWINGS IN ACCORDANCE WITH THE RELEVANT SECTIONS IN THE SPECIFICATION

ISSUE	DATE	DETAILS
A	02.03.10	FOR TENDER

AMENDMENTS

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	TRAFFIC CONSULTANT CBHK CONTACT: JOSH HOLLIS SUITE 1801 ZENITH TOWER 821A PACIFIC HWY CHATSWOOD NSW 2067 PHONE: 02 9411 2411 FAX: 02 9411 2422 EMAIL: joshua.hollis@cbhk.com.au	STRUCTURAL, CIVIL & FACADE ENGINEER SDA CONTACT: ANDREW SIMPSON STUDIO 1 84 MULLENS STREET BALMAIN NSW 2041 PHONE: 02 9810 6911 FAX: 02 9810 6922 EMAIL: andrew@simpsondesign.com.au	SIGNAGE & WAYFINDING CONSULTANT DOT DASH CONTACT: MARK TATARINOFF STUDIO 9 LEVEL 3 35 BUCKINGHAM STREET SURRY HILLS 2010 PHONE: 02 9698 3920 FAX: 02 9698 2611 EMAIL: markt@dotdash.com.au	SECURITY CONSULTANT SCI CONTACT: DANIEL PAUL 21 SYLVIA PLACE, FRENCHS FOREST NSW 2086 PHONE: 02 94513619 FAX: 02 9451 3617 EMAIL: danielp@securityinternational.com.au	QUANTITY SURVEYOR PAGE KIRKLAND GROUP CONTACT: NIALL MCSWEENEY THE PODIUM BUILDING 1 MARKET STREET SYDNEY NSW 2000 PHONE: 02 9283 7311 FAX: 02 9283 7322 EMAIL: niall.mcsweeney@pagekirkland.com	PROJECTION / CINEMA SPECIALIST DBLUX CONTACT: ALAN BUTTERFIELD 37 WELLINGTON STREET WATERLOO NSW 2017 PHONE: 02 9699 2639 FAX: 02 9699 2639 EMAIL: dblux@mac.com	PCA CONSULTANT BLACKETT MAGUIRE + GOLDSMITH CONTACT: TONY HEASLIP SUITE 2.01 22-36 MOUNTAIN SREET ULTIMO NSW 2007 PHONE: 02 9211 7777 FAX: 02 9211 7774 EMAIL: Tony@bmplusg.com.au	MECHANICAL & ESD ENGINEER STEENSEN VARMING CONTACT: RICHARD CRAMPTON 160 SAILORS BAY ROAD NORTHBRIDGE NSW 2063 PHONE: 02 9967 2200 FAX: 02 9967 2992 EMAIL: richard.crampton@steensenvarming.com.au	LIFT ENGINEER JIM CAMPBELL & ASSOCIATES CONTACT: PETER WARD GROUND FLOOR 48 CHANDOS STREET ST LEONARDS NSW 2065 PHONE: 02 9437 0577 FAX: 02 9437 0583 EMAIL: p.ward@jcalifts.com.au	LANDSCAPE ARCHITECT GOVERNMENT ARCHITECTS OFFICE CONTACT: BARBARA SCHAFFER MCKELL BUILDING 2-24 RAWSON PLACE SYDNEY NSW 2000 PHONE: 02 9372 8428 FAX: 02 9372 8366 EMAIL: barbara.schaffer@services.nsw.gov.au	LAND SURVEYOR DENCON SURVEYING CONTACT: STEVE DENNING SUITE 1/10 EAST PARADE PO BOX 50 EASTWOOD NSW 2122 PHONE: 02 9874 3212 FAX: 02 9804 7901 EMAIL: dencon@ozemail.com.au		

STATUS

FOR TENDER

DESIGNED UNDER A QUALITY SYSTEM CERTIFIED AS COMPLYING WITH ISO 9001 BY AN ACCREDITED CERTIFICATION BODY

STEENSEN VARMING
CONSULTING ENGINEERS & MANAGERS
160 Sailors Bay Road, Northbridge NSW AUSTRALIA 2063 T +61 2 9967 2200 F +61 2 9967 2992
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sva@steensenvarming.com.au www.steensenvarming.com.au
Part of the Varming International Alliance - Australia - United Kingdom - Ireland

B1 0 10 20 30 40 50 60 70 80 90 100 USE FIGURED DIMENSIONS IN PREFERENCE TO SCALING
CHECK ALL DIMENSIONS ON SITE
200MM
300MM ON ORIGINAL

DO NOT SCALE DRAWINGS .USED FIGURED DIMENSIONS ONLY.
VERIFY ALL DIMENSIONS ON SITE .DIMENSIONS ARE
TO FINISHED SURFACE UNLESS OTHERWISE NOTED.
IF IN DOUBT, PLEASE ASK .

PROJECT
MCA REDEVELOPMENT
140 GEORGE STREET
CIRCULAR QUAY

SCALE
1:50

DRAWING DESCRIPTION
MECHANICAL SERVICES
PLANTROOM LAYOUT 0.01

DRAWING No. & ISSUE
M4003 A

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APPENDIX B – DECC LETTER OF ADVICE

Our reference : SR883: DOC09/7674
Contact : Mark Villa ☎ (02) 9995 6814

26 March 2009

Mr B Fairweather
Senior Engineer
Steensen Varming (Australia) Pty Limited
160 Sailors Bay Road
NORTHBRIDGE NSW 2063

Dear Mr Fairweather

HARBOUR WATER HEAT EXCHANGE SYSTEM
MUSEUM OF CONTEMPORARY ARTS EXTENSION

I refer to your electronic correspondence of 3 February 2009 seeking information on the approval requirements of the Department of Environment and Climate Change (DECC) for a heat exchange system utilising water from Sydney Harbour, and the use of antifouling water treatment products. I apologise for the delay in replying.

The *Protection of the Environment Operations Act 1997* (the POEO Act) provides for the licensing of certain activities and works. The activities for which an environment protection licence is required are set out in Schedule 1 of the POEO Act. The POEO Act also permits, but does not require, a licence to be issued to control the carrying out of non-scheduled activities for the purpose of regulating water pollution resulting from any such activity (water pollution regulation licence). Generally, water pollution regulation licences are not issued for the operation of cooling systems.

The project, as described in your correspondence, is not a scheduled activity and will not require an environment protection licence. However, although the project does not require licensing under the POEO Act, the heat exchange system must be operated in accordance with the general environment protection provisions of the POEO Act, and in accordance with the provisions of the *Pesticides Act 1999*.

The provisions of the POEO Act include a prohibition on the pollution of waters. Any thermal waste, being any liquid which, after being used in, or in connection with, any activity, is more than two degrees Celsius hotter or colder than the water into which it is discharged, is prescribed matter for the purposes of the definition of water pollution.

PO Box 668, Parramatta NSW 2124
Level 7, 79 George St, Parramatta NSW
Tel: (02) 9995 5000 Fax: (02) 9995 6900
ABN 30 841 387 271
www.environment.nsw.gov.au

The *Pesticides Act* provides that pesticides must be used in accordance with the instructions on an approved label for the pesticide or in accordance with a permit issued pursuant to Part 7 of the Schedule to the *Agricultural and Veterinary Chemicals Code Act 1994* of the Commonwealth (the Agvet Code). DECC notes that the Australian Pesticides and Veterinary Medicines Authority (APVMA) has issued a permit under the Agvet Code, Permit Number PER11158, for Mexel 432 Dispersant.

Permit PER11158 allows the indicated supplier to possess and to supply Mexel 432 Dispersant to persons who can use the product under permit. The permit also allows a stipulated person to use the product in the manner specified in the permit in the designated jurisdictions. NSW is a designated jurisdiction. You should ensure that the premises at which the product is to be used is one of the selected treatment sites referred to in the permit.

In relation to your other enquiries, the APVMA assesses and registers pesticides before they are permitted to be used in NSW. DECC regulates the use of pesticides in NSW from the point of sale onwards. DECC does not approve specific products for use in industrial or commercial operations, but does provide advice to authorities such as the APVMA during the pesticide assessment and registration process. The APVMA may be able to provide you with a list of products suitable for your proposal that are registered for use in NSW. Contact details for the APVMA can be found on its website at http://www.apvma.gov.au/index.asp.

Provided an approved product is used in accordance with the instructions on the product label and / or with the conditions of any permit applicable to that product, and in compliance with the provisions of the POEO Act and the *Pesticides Act,* you do not require further approval from DECC to use the product.

Should you require any further advice in this matter, please contact Mark Villa on 02 9995 6814.

Yours sincerely

GILLIAN REFFELL
Head Metropolitan Infrastructure Unit
Environment Protection and Regulation

APPENDIX C – ABS PIPEWORK PROPERTIES

ABS Material

CONTENTS

ABS Material

INTRODUCTION

Because of a unique balance of properties, modern ABS copolymers are being used on an ever increasing scale for the manufacture of many industrial and domestic products.
The material is very tough and resilient, has high impact strength, good chemical resistance and is non toxic and taint free. These advantageous properties have attracted engineers in many industries to the use of ABS piping systems rather than traditional materials, which do not have these distinctive benefits.
ABS piping systems are replacing many failed piping systems made from other materials.
The Eurapipe ABS system comprises a range of matched pressure pipes and fittings, joined together by a wide variety of methods including cold solvent cement welding or our rubber ring joint system.

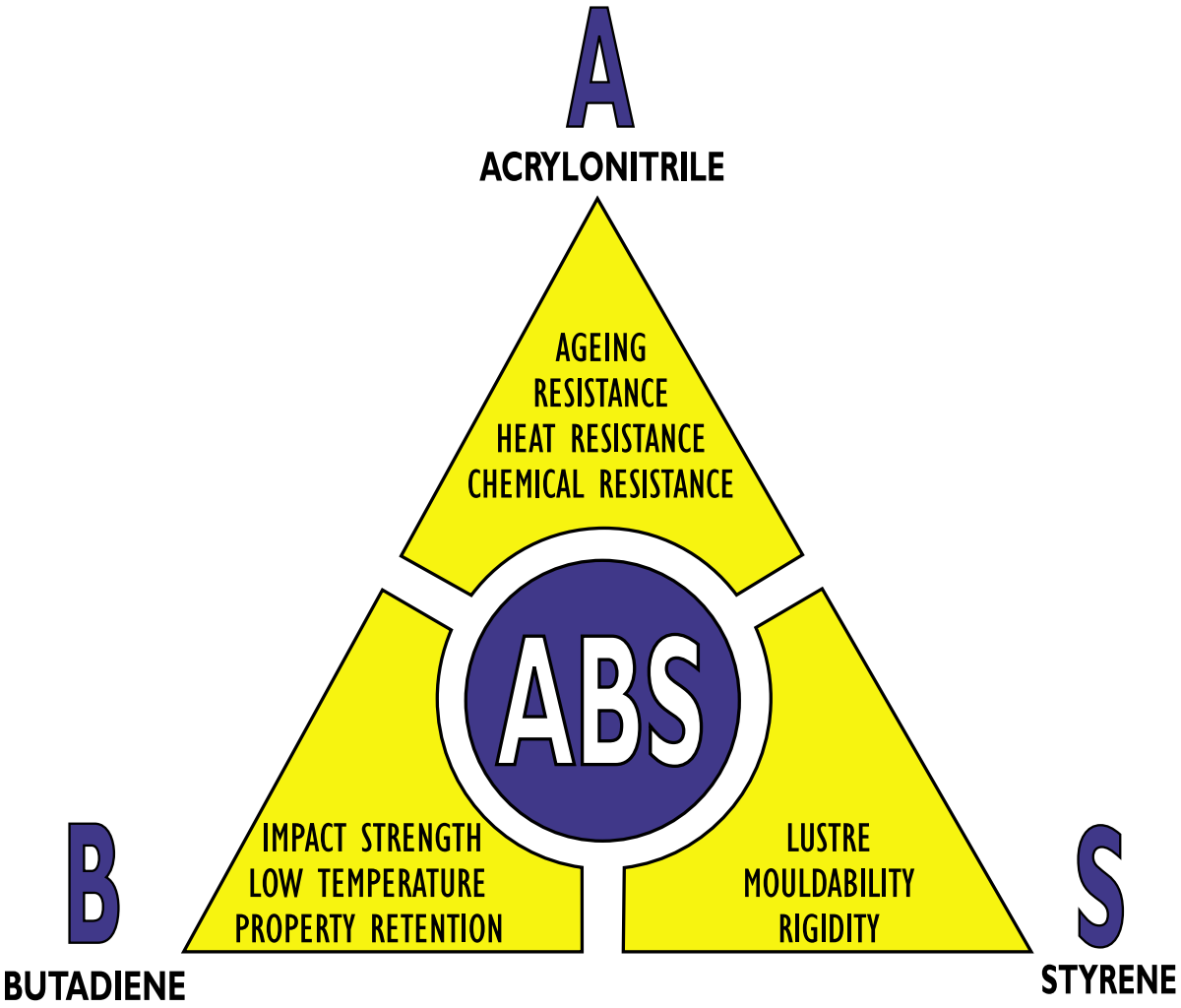
THE MATERIAL

Acrylonitrile - Butadiene - Styrene (ABS) identifies a family of engineering thermoplastics with a broad range of performance characteristics.
The copolymeric system is alloyed to yield the optimum balance of properties suited to the selected end use.

ACRYLONITRILE - imparts chemical resistance and rigidity.

BUTADIENE - endows the product with impact strength, toughness and abrasion resistance.

STYRENE - contributes to the lustre, ease of processing and rigidity.



ABS Material

MATERIALS PROPERTIES

The formulation used by Eurapipe has been developed in conjunction with polymer manufacturers to optimise performance in respect to tensile strength, chemical resistance, ductility, resistance to weathering, heat stability, low toxicity, taint free and ease of processing from raw material to finished product.
ABS is tough and strong over the recommended temperature range of -30°C to +60°C.

The outstanding properties of ABS are:

✔ High impact strength and ductility, which combine to give exceptional toughness.

✔ Good chemical resistance.

✔ Abrasion resistance.

✔ High strength solvent weld jointing which allows efficient system assembly and modification.

✔ Rubber Ring jointing methods, allowing compatible systems jointing techniques.

✔ Nontoxic and non-taint properties.

✔ Withstands aggressive ground waters.

✔ High strain tolerance for buried applications.

✔ Good resistance to ultraviolet light.

✔ Lower celerity and extreme tolerance to water hammer surges.

Property*	Reference Temperature	S.I.Unit	Other Units
Ultimate tensile strength (strain rate 50mm/min) ASTM D638 Type I	20 °C	40 MPa	5800 lbf/in^2
Elongation at break	20 °C	50%	50%
Instantaneous Flexural Modulus	20 °C	2200 MPa	319 072 lbf/in^2
Compressive strength	20 °C	42 MPa	6100 lbf/in^2
Izod impact strength (notched) ASTM D256 (method A)	23 °C	340 J/m notch	6.4 ft lb/in notch
Specific gravity		1.05 x 10^3 Kg/m^3	65.5 x 10^{-3} lb/ft^3
Vicat softening point ASTM D1525		95 °C	203 °F
Coefficient of thermal expansion		10.1 x 10^{-5} m/m°C	5.6 x 10^{-5} ft/ft°F
Maximum operating temperature		60 °C	140 °F
Poisson's ratio		0.35	
Thermal conductivity		0.2 W/m°C	1.3 BTU/ft^2/in/°F
Specific heat		1.47 KJ/Kg°C	0.35 BTU/lbm/°F
Volume resisitivity		3.5 x 10^{16} Ω cm	
Dielectric constant		3.20 @ 60 Hz 3.12 @ 10^3 Hz 2.90 @ 10^6 Hz	

*Test pieces machined from moulded specimens yielded to the above mentioned typical properties

ABS Material

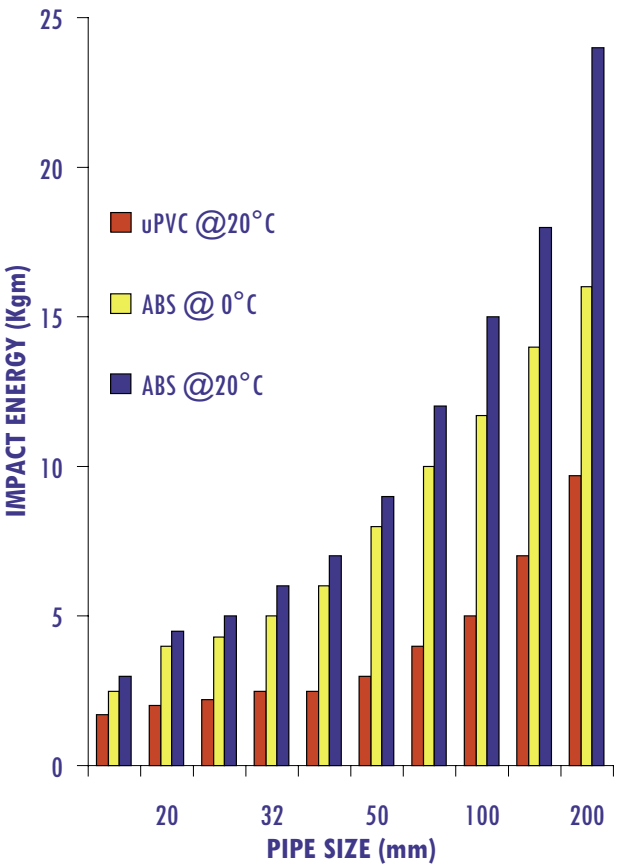
IMPACT STRENGTH

ABS is a relatively ductile thermoplastic, which exhibits very high impact strength compared to other thermoplastics such as uPVC particularly at low temperatures. It is for this reason ABS is used in demanding applications requiring exceptionally high impact strength material such as construction site safety helmets.

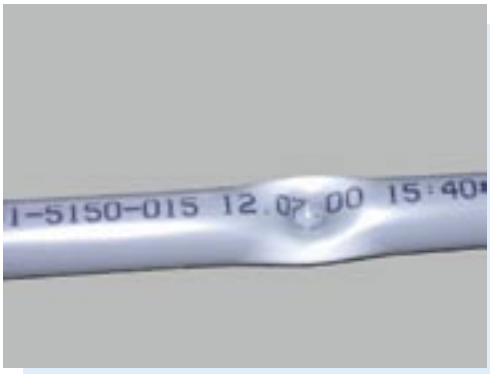
As part of the Eurapipe Quality Assurance programme, sample lengths of pipe are routinely impact tested at 0˚C as required by AS 3518.

ABS is unique in retaining high levels of impact strength at sub zero temperatures and is significantly superior to most other thermoplastics used in pipe systems.

The graph shows the relatively small reduction in impact strength of ABS between 20°C and 0°C compared with another thermoplastic pipe systems.



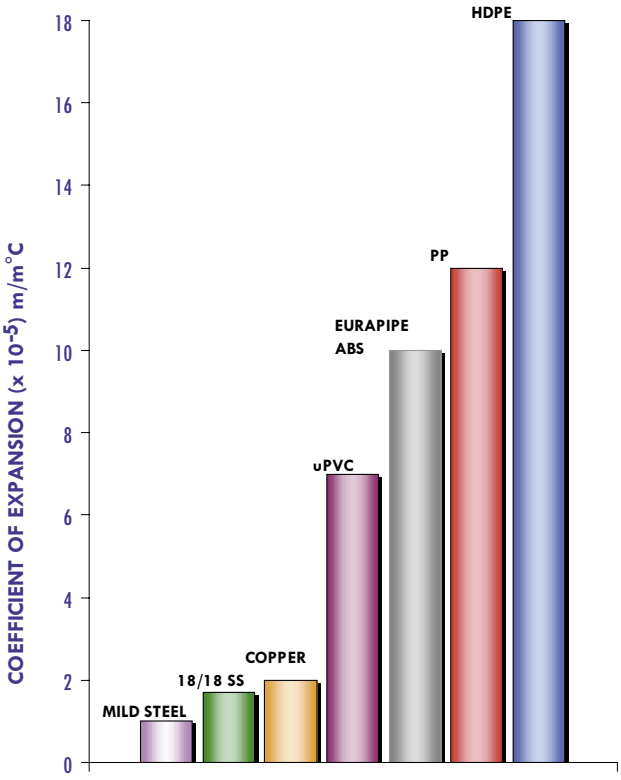
MODE OF FAILURE



ABS is a relatively ductile material and the mode of failure resembles that of soft copper. Failure is by ductile distortion and tearing, the localised nature minimising the loss of pipe contents.

In contrast, crack propagation and hazardous material fragmentation accompany the failure of brittle material.

ABS Material



THERMAL EXPANSION

All thermoplastics expand at a greater rate than metals as shown in the diagram above.
Expansion need not cause undue concern in design or installation of an ABS piping system provided that due recognition is taken at the design stage. The reduced flexural modulus of ABS over that of steel results in reduced loads on supports and equipment arising from thermal strains.
The linear coefficient of thermal expansion of ABS is 10.1 x 10^{-5} m/m °C.

TOXICITY AND TAINT

ABS is **free** from heavy metal stabilisers such as **lead** which are often used in the processing of other thermoplastic materials. Therefore, there is **no** possibility of any toxic heavy metals substances being leached from the ABS pipe material into the fluid being conveyed by the pipe.
Eurapipe ABS conforms to AS4020 and has been safely used for many years with potable water, grade I distilled water for medical use, renal dialysis fluid and many foods and beverages.
ABS is regarded as taint free and has been used for conveying potable water, beer, soft drinks, caramel, wines, sauces, chocolate, custard cream and other similar products. It is recommended that food and drink manufacturers test for taste tainting on their own product before installation commences.

RIGIDITY AND STIFFNESS

ABS is classified as a rigid thermoplastic over its working temperature range -30°C to +60°C.
With increased temperature, pipe rigidity decreases thus necessitating more frequent support.

ABS Material

WEATHERING

Eurapipe ABS piping systems are suitable for external installation under extreme conditions without additional surface protection.
When ABS products are exposed to the weather, they will suffer some minor degradation of the exposed surface. The degradation results in a reduction of surface gloss, and shift in surface colour to light grey. The degradation is confined to the exposed surface only.
The effect of long-term exposure to sunlight over prolonged periods has minimal effect on the physical properties of ABS systems.
Because of the relatively high flexural modulus of ABS, the stresses induced in a component whilst in service result in smaller strains, therefore minimising the possibility of environmental stress cracking of the exposed surface.

This resistance to failure is further improved by the inherently high impact strength of ABS, particularly at low temperatures, and the ability of the polymer to withstand long term heat exposure with little change to physical properties.

ABRASION RESISTANCE

ABS piping systems have long been successfully employed in applications where abrasion resistance is the prime consideration. The conveying of slurries in the mining, food, power generation and waste water industries is a typical example where ABS has been demonstrated to outlast steel and stainless steel pipes previously employed.
The chemical resistance of ABS combined with impact resistance makes it an ideal choice for such corrosive and erosive environments.
It is these conditions which lead to reduced life of metal pipe systems.
The rubber-like butadiene phase in ABS provides this piping material with outstanding resistance to abrasive media.
Eurapipe sales engineers have the experience to advise on the suitability of ABS pipe for slurry or abrasive applications.
For gravity flow systems the long term low surface roughness enables less steep slopes to be used. Lower slopes can mean reduced building heights which has a great effect on capital costs. Additionally, lower slopes reduce transport velocity, which in turn reduces the wearing of the piping material.

ABS Material

CHEMICAL RESISTANCE

The information given on the following pages is based on the recommendations of the manufacturers of the polymers, field experience and subsequent tests by Eurapipe.
The chemical resistance information has been obtained from numerous sources and it is primarily based on plastic material test specimens that have been immersed in the chemical (not combination of chemicals) and on field experience. Under no circumstances is to be assumed that a mixture of individually acceptable chemicals may be safely used with ABS or any other product.

The effect of the combination of chemicals on the ABS components has to be assessed in conjunction with other factors that have a significant impact upon the lifecycle of the system i.e. temperature, internal pressure, flexural stresses, cyclic loads etc. Any chemical attack is increased when temperature or stress are increased or when temperature or stress are varied.
It is the design engineers responsibility to assess the materials and the exposure under such conditions.
Specific data on industrial chemical applications of ABS can be given by the Eurapipe organisation. Such enquiries are invited for applications not shown here.
Under no circumstances is it to be assumed that a mixture of individually acceptable chemicals may be safely used with ABS or any other product.
Absence of notation indicates the substance has not been tested.

QUICK REFERENCE CHEMICAL RESISTANCE	
Chemical	**Resistance**
Weak acids	Good resistance
Strong acids	Limited resistance
Weak alkalis	Good resistance
Strong alkalis	Good resistance
Aggressive soils	Excellent resistance
Metal salts	Good resistance
Sea water	Excellent resistance
Aromatic hydrocarbons	Poor resistance
Organic solvents	Poor resistance

Unless stated, all concentrations are 100% or saturated aqueous solution. Reference to saturated solutions is at 20°C.

Resistance Key Information

1. RESISTANT=Little or no attack

2. CONDITIONAL RESISTANCE=Some attack, however may still be suitable when used with a higher pipe class or reduced service life.

3. NOT RECOMMENDED=Little or no resistance. Not suitable for use with ABS pipe.

4. REFER TO EURAPIPE

The information given here is based upon various sources available at the time this manual was created. We reserve the right to revise this information from time to time in the light of subsequent research and experience. The information is to be used as a general guide and there is no warranty or representation, either expressed or implied, that this data is free from errors.
We shall not be liable for any damages of any kind that may result from the use of this data.

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Acetamide	CH_3CONH_2	%	1	
Acetic Acid	CH_3COOH	Up to 10 10-20 Over 20 (including Glacial)	1 2 3	1 3
Acetone	CH_3COCH_3		3	3
Acetyl Chloride	CH_3COCl		3	3
Alcohols:				
Allyl	$CH_2=CHCH_2OH$		3	3
Amyl	$CH_3(CH_2)_3CH_2OH$		3	3
Benzyl	$C_6H_5CH_2OH$		3	3
Butyl (Butanol)	$CH_3(CH_2)_2CH_2OH$		3	3
Ethyl (Ethanol)	CH_3CH_2OH	Up to 50% aq. soln.	1	1
Ethyl (Ethanol)	CH_3CH_2OH	95% aq. soln.	3	3
Furfuryl	$C_4H_3OCH_2OH$		3	3
Methyl (Methanol)	CH_3OH		3	3
Iso Propyl (propanol)	$(CH_3)_2CHOH$		3	3
Alum	$Al_2(SO_4)_3K_2SO_4.H_2O$		1	1
Aluminium Chloride	$AlCl_3$		1	1
Aluminum Sulphate	$Al_2(SO_4)_3$		1	1
Ammonia Solution	NH_4OH	35%	1	1
Ammonium Carbonate	$(NH_4)_2CO_3$		1	1
Ammonium Molybdate	$(NH_4)_6Mo_7O_2.H_2O$		1	1
Ammonium Nitrate	NH_4NO_3		1	1
Ammonium Sulphate	$(NH_4)_2SO_4$		1	1
Ammonium Thiocyanate	NH_4SCN		1	1
Amyl Acetate	$Ch_3COO(CH_2)_4CH_3$		3	3
Aniline	$C_6H_5NH_2$		3	3
Aromatic Hydrocarbons			3	3
Barium Bromide	$BaBr_2$		1	1
Barium Carbonate	$BaCO_3$		1	1

1=RESISTANT 2=CONDITIONAL RESISTANCE 3=NOT RECOMMENDED 4=REFER TO EURAPIPE

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Barium Chloride	$BaCl_2$		1	1
Barium Hydroxide	$Ba(OH)_2$		1	1
Battery Acid	H_2SO_4		1	1
Benzene	C_6H_6		3	3
Benzoic Acid	B_6H_5COOH		3	3
Boric Acid	H_3BO_3		1	1
Brake Fluids			3	3
Brine	$NaCl_H2O$	Saturated	1	1
Bromic Acid	$HbrO_3$		1	1
Bromine (Gas + Liquid)	Br_2		3	3
Butane Gas	C_4H_{10}		1	1
Butyric Acid	C_3H_7COOH	20% aqueous	3	3
Calcium Compounds	Refer to respective sodium compound			
Carbon Dioxide	CO_2	40% aq. soln.	1	1
Carbon Disulphide	CS_2	95% sq. soln.	3	3
Carbon Monoxide	CO		1	1
Carbon Tetrachloride	CCl_4		3	3
Castor Oil			1	1
Chlorine Gas Dry	Cl_2		2	3
Chlorine Wet			3	3
Chlorine Aqueous Solution		Up to 3% free chlorine	1	1
		Over 3% free chlorine	4	4
Chlorobenzene	C_6H_5Cl		3	3
Chloroform	$CHCl_3$		3	3
Chromic Acid	CrO_3+H_2O	10% 25%	2 3	3 3
Citric Acid	$HOC(COOH)(CH_2COOH)_2H_2O$		1	1
Cresols	$C_6H_4(OH)CH_3$		3	3
Copper Chloride	$CuCl_2$		1	1
Copper Fluoride	CuF_2		1	1
Copper Sulphate	$CuSO_4$		1	1

1=RESISTANT 2=CONDITIONAL RESISTANCE 3=NOT RECOMMENDED 4=REFER TO EURAPIPE

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Creosote			3	3
Cyclohexane	C_6H_{12}		3	3
Detergents			4	4
Dextrose	$C_6H_{12}O_6H_{12}$		1	1
Dichloroethane	CH_2ClCH_2Cl		3	3
Dichloromethane	$CHCl_2$		3	3
Diethylamine	$(C_2H_5)_2NH$		3	3
Diethyl Ether	$C_2H_5OC_2H_5$		3	3
Ethylene Glycol	$HOCH_2CH_2OH$		1	1
Ferric Chloride	$FeCl_3$		3	3
Ferric Nitrate	$Fe(NO_3)_3$		1	1
Ferrous Chloride	$FeCl_2$	Saturated	1	2
Ferrous Sulphate	$FeSO_4$	40% aqueous	1	1
Formaldehyde (Formalin)	HCHO ($+H_2O$)	10%	1	1
Formic Acid	HCOOH	3%	1	3
Freon	R11, R12, R22, R113, R114		4	4
FruitJuices			1	2
Gelatine			1	1
Glucose	$C_6H_{12}O_6$		1	1
Glycerine	$HOCH_2$-CHOH-CH_2OH		1	1
Hydrochloric Acid	HCl HCl HCl	0-10% 10-30% 30%-37% >37%	1 1 1 3	1 1 3 3
Hydrofluoric Acid	HF HF	0-10% >10%	1 3	2 3
Hydrofluorosilicic Acid	H_2SiF_6		3	3
Hydrogen	H_2		1	3
Hydrogen Peroxide	H_2O_2	1% 3% 5% 10% (30 vol)	1 1 1 3	1 2 3 3

1=RESISTANT 2=CONDITIONAL RESISTANCE 3=NOT RECOMMENDED 4=REFER TO EURAPIPE

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Iodine Solution in KI	I_2		1	3
Kerosene			3	3
Ketones			3	3
Lanolin			1	1
Lead Acetate	$Pb(CH_3OO)_2$		1	1
Linseed Oil			1	3
Magnesium Compounds	Refer to respsective sodium compound			
Mesityl Oxide	$(CH_3)_2C=CHCOCH_3$		3	3
Methane	CH_4		1	3
Methoxyethanol	$CH_3OCH_2CH_2OH$		3	3
Methyl Acetate	CH_3COOCH_3		3	3
Methyl Cyclohexanone	$C_6H_9CH_3O$		3	3
Methyl Ethyl Ketone	$CH_3COCH_2CH_3$		3	3
Methyl Methacrylate	$CH_2C(CH_3)COOCH_3$		3	3
Methylated Spirits			3	3
Milk			1	1
Mixed Acids Limited resistance Dependent on Concentrations			4	4
Molasses		Commercial	1	1
Nickel Sulphate	$NISO_4$	1%	1	1
Nitric Acid	HNO_3	1% 5%	1 2	3 3
Nitrogen	N_2	3	1	1
Oleic Acid	C_8H_{17}-CO=CH-		1	3
Oxalic Acid	HO_2CCO_2H		1	4
Oxygen	O_2		1	1
Ozone	O_3	20PPM Solution Saturated Solution Gaseous	1 3 3	1 3 3

1=RESISTANT **2=CONDITIONAL RESISTANCE** **3=NOT RECOMMENDED** **4=REFER TO EURAPIPE**

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Petrol			3	3
Phenol	C_6H_5OH		3	3
Potassium Compounds Refer to respective Sodium compounds				
Propane	C_3H_8		1	1
Pyridine	C_5H_5N	Trace	3	3
Soap solutions (aqueous)			1	1
Sodium Acetates	$Na(CH_3COO)$		1	1
Sodium Borate	$Na_2B_4O_7$		1	1
Sodium Carbonate	$NaCO_3$		1	1
Sodium Chlorate	$NaClO_3$		1	1
Sodium Chloride	NaCl		1	1
Sodium Chromate	Na_2CrO_4		1	1
Sodium Cyanide	NaCN		1	1
Sodium Ferrocyanide	$Na_4F_e(CN)_6$		1	1
Sodium Fluoride	NaF		1	1
Sodium Hydrogen Carbonate	$NaHCO_3$		1	1
Sodium Hydrogen Sulphate	$NaHSO_4$		1	1
Sodium Hydrogen Sulphite	$NaHSO_3$		1	1
Sodium Hydroxide	NaOH	Saturated	1	1
Sodium Hypochlorite	NaOCl	>3% available chlorine	3	3
Sodium Iodide	NaI		1	1
Sodium Nitrate	$NaNO_3$		1	1
Sodium Permanganate	$NaMnO_4$		3	3
Sodium peroxide	Na_2O_2		3	3
Sodium Persulphate	$Na_2S_2O_8$		1	1
Sodium Phosphate	$Na_4P_2O_7$		1	1
Sodium Salicylate	$NaC_7H_5O_3$		1	1
Sodium Silicate	$NaSiOl_{3.9}H_2O$		1	1

1=RESISTANT 2=CONDITIONAL RESISTANCE 3=NOT RECOMMENDED 4=REFER TO EURAPIPE

ABS Material

Chemical or Agent	Formula	Concentration (%W/V)	Working temperature	
			20°C	50°C
Sodium Sulphate	Na_2SO_4		1	1
Sodium Sulphite	Na_2SO_3		1	1
Sodium Sulphide	Na_2S		1	1
Sodium Thiosulphate	NaS_2O_4		1	1
Stannic Chloride	$SnCl_4$		1	3
Stannoous Chloride	$SnCl_2$		1	3
Sulphur Dioxide (Gas) Dry Wet	SO_2		 1 1	 2 2
Sulphuric Acid	H_2SO_4	Under 30% 30%-50% 50%+	1 1 3	1 2 3
Toluene	$C_6H_{3=5}CH_3$		3	3
Trichlorobenzene	$C_6H_3Cl_3$		3	3
Trichloroethylene	$Cl_2C=CHCl_3$		3	3
Triethanolamine	$N(CH_2CH_2OH)_3$		1	3
Triethylene Glycol (Trigol)	$HOCH_2O)_2CH_2CH_2OH$		1	2
Turpentine			3	3
Uric Acid	$CO(NH)_2COC_2CO(NH)_2$		1	2
Urine			1	1
Vegetable Oils			1	2
Vinegar			1	2
Water Chlorinated Deionized Distilled Fresh Sea	H_2O		1 1 1 1 1 1	1 1 1 1 1 1
Wines			1	2
Xylene	$C_6H_4(CH_3)_4$		3	3
Zinc Orthophosphate	$Zn_3(PO_4)_2$		2	2
Zinc Stearate	$Zn(C_{18}H_{35}O_2)_2$		1	1

1=RESISTANT 2=CONDITIONAL RESISTANCE 3=NOT RECOMMENDED 4=REFER TO EURAPIPE

APPENDIX D – MEXCEL MSDS

integra
WATER TREATMENT SOLUTIONS

Material Safety Data Sheet

Product Name:	**Mexel 432**
Issued Date:	**14th May 2009**
Issued by:	**INTEGRA WATER TREATMENT SOLUTIONS**
Reference No:	**Version 14.05.2009**
Replaces:	**Version 08.03.2004**
	Classified as hazardous according to criteria of Worksafe Australia

1. IDENTIFICATION OF THE SUBSTANCE /PREPARATION AND COMPANY

Company Name:	Integra Water Treatment Solutions
Address:	Unit B , 195 Port Hacking Rd Miranda NSW 2228
Telephone:	Tel : (02) 9574 0000
	Fax : (02) 9574 0011
	Emergency No : (02) 9574 0000
Other Information:	This information summarises our best knowledge on the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.
Product Use:	Cooling water mico-organism control and deposit control agent.

2. HAZARDS IDENTIFICATION

R36:	Irritating to eyes.
R38	Irritating to skin.
S25:	Avoid contact with eyes.
S 36/37/39:	Wear suitable protective clothing, gloves and eye/face protection.
S46	If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.
S51:	Use only in well ventilated areas.
S61:	Avoid release to the environment.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical : Polyamine emulsion

Ingredients:	Name	CAS	Proportion	Hazard Symbol	Risk Phrase
	Octadecyl polypropylene polyamine	94021-90-6	10-30%		R36 R38
	Water	7732-18-5	Balance		

4. FIRST AID MEASURES

Inhalation:	Remove the source of contamination or move the victim to fresh air. Ensure airways are clear and have qualified person give oxygen through a face mask if breathing is difficult. If symptoms develop seek medical attention.
Ingestion:	If swallowed, give 2 glasses of water to drink. IMMEDIATELY call a physician. Never give anything by mouth to an unconscious person.
Skin:	Wash affected skin areas thoroughly with soap and water. Remove and wash contaminated clothing thoroughly. Do not take clothing home to be laundered. Discard contaminated shoes, belts and other articles made of leather.
Eye:	IMMEDIATELY flush eye(s) with copious amounts of water for approximately 15 minutes holding eyelid(s) open. Take care not to rinse contaminated water into the non-affected eye. Seek immediate medical attention.

Advice to Doctor:	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Specific Hazards:	Extinguishing Media: Water, foam, carbon dioxide or dry chemical. Combustion products: Carbon dioxide, carbon monoxide, and oxides of nitrogen. Fire-fighters use self contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Spills & Disposal:	Prevent spillage from entering drains or water courses. Wear full protective clothing including face shield, face mask and gauntlets. Stop leak if safe to do so, and contain spill. Sweep up and shovel or collect recoverable product into labelled containers for recycling or disposal, and dispose of promptly. After spills, wash area, preventing runoff from entering drains. If a significant quantity of material enters drains, advise emergency services. This material may be suitable for approved landfill. Dispose of only in accordance with all regulations. Advise laundry of nature of contamination when sending contaminated clothing to laundry. See FIRST AID PROCEDURES Section for further information. Protective clothing made of the following material should be worn to avoid skin contact: Plastic rain jackets and pants. - Butyl rubber, Nitrile or other impervious material. Caution: Slippery when wet. For small spills: Absorb onto vermiculite or other non combustible absorbent material. Sweep up and shovel or collect recoverable product into labelled containers for recycling or disposal. After spills, wash area, preventing runoff from entering drains. Confirm with appropriate water authority for large spills. Discharge, treatment and disposal may be subject to federal, state or local laws and these should be consulted before discharge.

7. HANDLING AND STORAGE

Storage:	Store away from oxidizing agents. Store in a dry place avoiding iron containers. In use avoid contact with chemical listed as hazardous reactions. Keep in a cool dry place (0 to 30C). Keep away from sources of ignition. Freezing will affect the physical condition and may damage the material.

8. EXPOSURE CONTROLS , PERSONAL PROTECTION

Exposure Limits:	Use local exhaust if misting occurs. Natural ventilation is adequate in absence of mists. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. Use this general information to help develop specific control measures. Ensure that control systems are properly designed and maintained and comply with occupational, environmental, fire, and other applicable regulations.
Personal Protective Equipment:	Equipment: If engineering controls are not effective in controlling airborne exposure then a half face piece respirator with a replaceable organic vapour filter should be used. Reference should be made to Australian Standards AS/NZS 1715, Selection, Use and maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices, in order to make any necessary changes for individual circumstances. Safety glasses or goggles should be worn as described in Australian Standard AS/ANZ 1337 - Eye Protectors for Industrial Applications. Butyl, neoprene or nitrile gloves are recommended when using this product. Suitable workwear should be worn to protect personal clothing. When large quantities are handled

the use of plastic aprons and rubber boots is recommended.

9.	PHYSICAL AND CHEMICAL PROPERTIES
Appearance:	White emulsion thick liquid
Boiling Point:	Approx 100C
Melting Point:	Not applicable, solid at normal temperatures.
Specific Gravity:	0.09 to 1.0 at 20C approx
pH Value:	10.5 to 11.5
Vapour Pressure:	Negligible
Flash Point:	>100C
Flammability:	Does not ignite
Solubility:	Limited solubility

10.	STABILITY AND REACTIVITY
Hazardous Reaction:	Stable, no hazardous polymerisation will occur. Conditions to avoid: Reacts with oxidising materials and may cause exothermic reaction.

11.	TOXICOLOGICAL INFORMATION
Toxicology Information:	No data available but low in mammal population. Rainbow trout 96hr test 11mg/L Daphnia magna 48hr test 3.4 mg/L
Inhalation:	Inhalation may irritate the nose, throat and lungs.
Ingestion:	Ingestion may produce gastrointestinal irritation, nausea and diarrhoea. Harmful if swallowed.
Skin:	May cause irritation.
Eye:	Causes irritation to the eyes. Will cause discomfort such as stinging pain, watering and redness of the eyes.
Chronic Effects:	Long term exposure may result in dermatitis.

12.	ECOLOGICAL INFORMATION
Environment Protection:	This substance is hazardous to the environment and care should be taken to avoid discharge into rivers and water ways. Other ecological information. Do not allow it to enter water ways. The effects of this product on aquatic organisms are rapidly and significantly mitigated by the presence of dissolved organic carbon in the aquatic environment.

13.	DISPOSAL CONSIDERATIONS
Disposal:	For large quantities notify your local waste management authority for specific regulations. Refer to spills and disposal section.

14.	TRANSPORT INFORMATION

integra
WATER TREATMENT SOLUTIONS

Material Safety Data Sheet

Product Name:	**Mexel 432**
Issued Date:	**14th May 2009**
Issued by:	**INTEGRA WATER TREATMENT SOLUTIONS**
Reference No:	**Version 14.05.2009**
Replaces:	**Version 08.03.2004**
	Classified as hazardous according to criteria of Worksafe Australia

UN Number:	3082
Class:	9
HazChem Code:	2X
Packaging Group:	III
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S
	Classified as a dangerous goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (6th Edition).
Storage and Transport:	Store in tightly closed containers in a cool area separate from normal work areas. The storage area should have adequate independent ventilation and have no sources of heat or sparks. Not to be loaded with Class 4.2, 5.1, 5.2, 7

15.	**REGULATORY INFORMATION**
Poison Schedule	Not scheduled
Packaging & Labelling	As required by the ADG Code and Standard for the Uniform Scheduling of Drugs and Poisons

16.	**OTHER INFORMATION**
Abbreviations:	ACGIH- American Conference of Government Industrial Hygienists OSHA- Occupational Safety and Health Information TLV- Threshold Limit Value NOHSC- National Occupational Health and Safety Committee
Contact Person/ Point:	Normal Working Hours – Unit B , 195 Port Hacking Rd Miranda NSW 2228 Tel : (02) 9574 0000 Fax : (02) 9574 0011 Emergency No: (02) 9574 0000

…… END OF MSDS

APPENDIX E – MEXCEL PERMIT

Australian Government
Australian Pesticides and
Veterinary Medicines Authority

Contact Telephone: (02) 6210-4701
Contact Facsimile: (02) 6210-4721

INTEGRA WATER TREATMENT SOLUTIONS
PO Box 818
CARINGBAH NSW 1495

ATTN:RALPH ARRUZZA

ISSUE OF PERMIT: 11158.
EFFECTIVE FROM 15 DECEMBER 2008 TO 30 SEPTEMBER 2009.

Mexel 432 / Sites within Australia / Seawater Cooling Systems

The APVMA has issued the above permit.

Please note the **DETAILS** and **CONDITIONS** of the permit. A copy of this permit has also been sent to the appropriate State Co-ordinators for their information.

Yours sincerely

for Paul Thomas
15 December, 2008

18 Wormald Street Symonston ACT 2609
PO Box 6182 Kingston ACT 2604 Australia
T +61 2 6210 4700 F +61 2 6210 4874
www.apvma.gov.au
ABN: 19 495 043 447

Australian Government

Australian Pesticides and Veterinary Medicines Authority

PERMIT TO ALLOW RESEARCH USE AND SUPPLY OF AN AGVET CHEMICAL PRODUCT

PERMIT NUMBER –PER11158

This permit is issued to the Permit Holder in response to an application granted by the APVMA under section 112 of the Agvet Codes of the jurisdictions set out below. This permit allows a Supplier (as indicated) to possess the product for the purposes of supply and to supply the product to a person who can use the product under permit. This permit also allows a person, as stipulated below, to use the product in the manner specified in this permit in the designated jurisdictions. This permit also allows the Permit Holder, the Supplier (if not one and the same) and any person stipulated below to claim that the product can be used in the manner specified in this permit.

THIS PERMIT IS IN FORCE FROM 15 DECEMBER 2008 TO 30 SEPTEMBER 2009.

Permit Holder:
INTEGRA WATER TREATMENT SOLUTIONS
3a/2 Resolution Drive
CARINGBAH NSW 2229

Supplier:
Integra Water Treatment Solutions

Persons who can use the product under this permit:
System operators at the 10 selected treatment sites

CONDITIONS OF USE

Product to be used:
MEXEL 432 DISPERSANT
Containing:17 g/kg N-COCO-ALKYLTRIMETHYLENEDIAMINES
117 g/kg N-OLEYL-1,3-DIAMINOPROPANE as its only active constituent.

Directions for Use:

Situation	Purpose	Rate
Once through seawater based cooling systems	To prevent corrosion, biofilm formation and attachment of sea water organisms	Mexel 432 to be dosed at 6 mL/cubic m of flow for one hour three times per week

Critical Use Comments:
Dose into the seawater cooling intake via mechanical dosing pump.

Withholding Period:
NOT REQUIRED WHEN USED AS DIRECTED

Jurisdiction:
NSW, QLD, SA, TAS, VIC, NT, WA only.

Additional Conditions:
Supply:
The supplier must supply the product in a container that complies with the requirements of section 18(1) of the Agricultural and Veterinary Chemicals Code Regulations. Attached to this container must be a label which is identical in content and format to the label in Attachment 1.

The supplier must supply the product in a container which must:
(a) be impervious to, and incapable of chemical reaction with, its contents when under conditions of temperature and pressure that are likely to be encountered in normal service; and
(b) have sufficient strength and impermeability to prevent leakage of its contents during handling, transport and storage under normal handling conditions; and
(c) if its is intended to be opened more than once-be able to be securely and readily closed and reclosed; and
(d) have sufficient excess capacity to prevent it from breaking if its contents expand during handling, transport or storage; and
(e) enable all or any part of its contents to be removed or discharged in such a way that, with the exercise of no more than reasonable care, the contents cannot:
(i) harm any person; or
(ii) have an unintended effect that is harmful to the environment.

Trial records:
The permit holder must maintain records of the trials performed under this permit. Specifically details must include the date and location where the trials were conducted, rates and frequency of application, total amount of product used and the names and addresses of the persons conducting the trial. These details must be maintained for a minimum period of two years from the date of expiry of this permit and must be made available to the APVMA upon request.

Maximum Number of Treatment Sites:
10

Issued by

Delegated Officer

ATTACHMENT 1

READ SAFETY DIRECTIONS BEFO~~ OPENING OR USING

MEXEL 432

DISPERSANT

ACTIVE CONSTITUENT 17 g/kg N-Coco-alkyltrimethlyenediamines
117 g/kg N-Oleyl-1,3- diaminopropane

FOR THE TREATMENT OF SEAWATER COOLING SYSTEMS TO PREVENT CORROSION, BIOFILM FORMATION AND ATTACHMENT OF SEAWATER ORGANISMS.

DIRECTIONS FOR USE	Apply at $6ml/m^3$ of flow for one hour, three times per week as maximum. Reduced dosage will depend on the severity of the problem. Ensure discharge water contains less than 0.5mg/L of product.
STORAGE AND DISPOSAL	KEEP OUT OF REACH OF CHILDREN. Store in a closed, original container in a cool well ventilated area. Do not store for long periods in direct sunlight. Triple or preferably pressure wash containers before disposal. Replace cap and return clean containers to recycler or designated collection point.
SAFETY DIRECTIONS	Very dangerous. This product is strongly alkaline. Corrosive. Attacks eyes, nose and throat and skin. Do not swallow. Avoid contact with eyes and skin. Do not inhale vapour. If clothing becomes contaminated with product, remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. After use and before eating, drinking or smoking, wash hands, arms and face with soap and water. When opening the container and using the product, wear chemical resistant clothing buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, goggles, chemical resistant footwear and a halfpiece respirator. After each day's use, wash gloves, goggles, contaminated clothing and respirator, and if rubber wash with detergent and warm water.
FIRST AID	If poisoning occurs, contact a doctor or Poisons Information Centre (Phone 131 126). If swallowed do NOT induce vomiting. Give a glass of water.

ADDITIONAL INFORMATION IS LISTED IN THE MATERIAL SAFETY DATA SHEET.

Integra Water Treatment Solutions (ABN 36 457 470 048)
3a/ 2 Resolution Drive
Caringbah NSW 2229
Tel (02) 9524 3244
Fax (02) 9524 7226

NSW • ACT • SA • VIC • QLD

Correct Shipping Name :
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.

In Case of Transport Emergency :
DIAL 000 FOR POLICE OR FIRE BRIGADE

For Specialist Advice In Case of an Emergency :
PHONE (1800) 03 3111

NETT CONTENTS : 25LTS	U.N No. : 3082
BATCH No.:	CLASS : 9
PACKING GRP : III	HAZCHEM CODE : 2X

Australian Pesticides &
Veterinary Medicines Authority

2 November 2005

Ralph Arruzza
Technical Director
Minstring P/L & Nambone P/L T/As Integra Water Treatment
Unit 4a/2 Resolution Drive
CARRINGBAH NSW 2229

Dear Mr Arruzza

ISSUE OF PERMIT: PER8846.
EFFECTIVE FROM 2 November 2005 until 2 November 2006.

Mexel 432 / Cooling systems / Prevent biofilm and corrosion and attachment of freshwater organisms

The APVMA has issued the above permit.

Please note the **DETAILS** and **CONDITIONS** of the permit. A copy of this permit has also been sent to the appropriate State Co-ordinators for their information.

Please also note that analysis of treated waters leaving the cooling equipment and before re-entry into the main turbine flow is required to clarify the level of loss caused by deposition onto the internal surfaces of the cooling system. This should be ensured by sampling at the pits of representative power stations after the cooling equipment but before re-entry to the draught water.

This information will be required to progress your application for registration of the product for this use. Note that DEH also requires representative analyses of concentrations of Mexel 432 in receiving waters to show that there is no build-up when mixing and dilution are poor.

Renewal of this permit will be considered only if there has been satisfactory progress towards registration including obtaining the above analytical results.

Yours sincerely

Colin Byrnes
Manager Fungicides
Pesticides Program

APPENDIX F – MEXCEL CASE STUDIES

Sea Water Cooling Systems in Sydney Harbour

Introduction

Once- through sea water systems are prone to colonisation by marine organisms which reduce the efficiency of the system by reduction of flow and the blockage of heat exchangers. The deposits, both marine and inorganic silt, also increase the corrosion potential from under deposit phenomena.

It has been traditional to apply chlorine to control the marine growths. The usage of an oxidising biocide has the disadvantage that it will kill organisms but leave them where they are therefore encouraging under-deposit corrosion. Chlorine and other oxidising agents also increase the corrosion potential of the water to susceptible metals. The use of chlorine is now also been limited with discharge limits being regularly reviewed and set at lower levels.

A number of sites in the Sydney Harbour are currently been treated with excellent success. Typically high growth is found in the spring and summer periods were the systems are operating at peak performance.

For the purpose of the report two sites were chosen due to

- Prominent Sydney locations that meet appropriate use scenarios.
  1. A building on the harbour with good tidal exchange (Sydney Opera House).
  2. A building on the harbour with poor tidal exchange.

- Exposure to passing marine traffic and marine life.

- Ease of access to conduct testing and provide comparison with previous treatments.

- 6 month performance history during in peak marine growth period.

- Unable to establish a trial application on a power station facility. As a result we were able to provide studies two out of the three appropriate use scenarios.

Mexel 432 Treatment

The ideal treatment for seawater cooling would be based upon an agent that would control the marine growth while at the same time being acceptable for discharge to the APVMA. The treatment must also not be aggressive to the metallurgy of the system and ideally the chemical would be easy and safe to handle.

Previous experience overseas had shown that the problem could be approached in an entirely different manner by the application of a product that

would basically act as a dispersant to ensure that surfaces were kept clean and free from silt and marine growth. The product does not kill the organisms but just stop them from settling so that they would pass through the system – preferably at the larval stage.

After considerable research into the dispersants a filming product was produced and used successfully in seawater once through systems. This product, Mexel 432,was also seen to give good corrosion protection properties due to it's affinity for filming onto surfaces and searching beneath deposits to loosen them and promote removal via the flow of the water through the pipe-work and heat exchangers.

Mexel 432 based upon a polyamine is low in toxicity, easy to handle and unlike many other dispersants. Dosing rates are low with only 2 ppm of amine (6 ppm of product) being needed in the water for one hour at least three times per week. This develops and maintains a corrosion resistant and repellent film on the inner surfaces of the system.

In some system around the world the product is dosed more frequently, sometimes daily, to ensure control.

Approval to Use Mexel32.

The current acceptance for use for the Mexel 432 may be used for the protection of sea water cooling systems to prevent bio-film formation and attachment of seawater organisms.

The Mexel 432 dosage has been set at 6ml/cubic metre of flow for one hour typically for three times per week. The critical use comments on the permit state that it should be ensured that less than 0.5 mg/litre of product is contained in the discharge water.

The Treatment on Sites from October 04 to March 05

SITE 1 – Sydney Opera House

System Details

The inlet pipe is 450 mm in diameter, 30 metre long, which leads to a pit 30. From the pit 3 individual 250 mm inlet pipes approx 100 metres each to three shell and tube condensers. Dosage was made into the pit

Each exchanger has individual outlets of 50 metres in length and 250 mm in diameter. Discharge is back into the harbour below sea level. Flow is dependant on how many pumps are working so can be 80 litres/second or 160 or 240 litres/second. To ensure treatment of each system all units operate at the time of dosage. Dosage 5.2 litres continuously metered by pump over one hour per dose.

Dosages of the systems are Monday, Wednesday and Friday between 7.30 – 8.30 am. These times allow ease of monitoring chemical levels.

Previous treatment – Chlorine unable to control tube worm. Mussel growth was limited, however, regular manual cleaning was required to ensure flow through the exchangers and pit screens.

General Observations and Comments

Treatment with Mexel 432 was commenced on October 2004 by ***integra*** applying the product at 6ppm for one hour three times per week.

During the 6-month period a few adjustments were necessary to the dosing system in order to ensure that a suitable residual (2-ppm amine/ 6-ppm product) of product was tested at the entrance to the heat exchangers.

To allow film to develop higher dosage rates were used to establish amine levels of 2-ppm amine at the exchangers. Dosage was then reduced to the calculated levels based on flow. Some fouling was also present to treatment commencing.

It was possible to test 10 metres prior to discharge. Water samples were taken on regular testing with no residual found in the water phase. Scrapings were taken from the inside of the pipe-work and tested for amine residual/ film. Regular testing also found no amine residuals.

During the trial screens and the strainers showed a distinct decrease in fouling and the requirement for manual cleaning. Apart from a small amount of brown algae and some sea grass that had floated into the circuit, the screens were seen to remain clean. Live fish and other marine life were found to live without effect in the pit were the Mexel 432 was being dosed.

Inspection of the heat exchangers after 6 months showed that the condenser tubes were clean, as was the tube plate. The end plate gasket and the second pass entry and receiving chambers were evenly covered with a loose deposit of tubeworm. This was loose and easily removed by light brushing.

Product Advantages

- Reduced corrosion on the metallurgy in the system.
- No effect on surrounding marine life.
- Reduction of mechanical cleaning and frequency of system.
- Reduce handling, chemical stability concerns.
- Remove requirement to discharge chlorine into harbour.

Summary

Mexel 432 offers a number of advantages over the oxidising program previously used. The product has provided corrosion protection as well as an

effective dispersant and good control of sea growths and other deposition effects.

Dosage rates were typically 8 ppm to achieve 2-ppm amine (6-ppm product at the exchanger inlets. This was due to the initial filming of the system and removal existing marine growths. The existing growths increasing the surface area and as result requiring a higher concentration product to form the initial filming. Product dosage did not exceed 2-ppm amine at the exchanger face, which ensured residual amine was not detected at the discharge.

As a result, dosage and frequency may need to be varied to establish a clean system. The controlling factor should be no amine levels a point of discharge.

SITE 2 – Sydney Star City Casino

System Details

The inlet pipe is 900mm in diameter and 260 metre long. The outlet pipe is 180 metres long with discharge into the harbour into a low flow area. The discharge pipe is exposed at low tide. The flow rate is 700 litres/second to plate heat exchanges. Based on the given flow rate, dosage 15 litres continuously metered by pump over one hour per dose.

Dosage is into the pit prior to the inlet pipe-work.

The system was previously treated with a liquid chlorine/bromine program, which did not give satisfactory results. Marine growth was uncontrolled and the program was monitored by regular videos taken by professional divers.

Prior to Mexel 432, an alternative product, Seatreat 6, was used. This program also failed to gain control, as the pipe-work was reduced from 900-mm diameter to 300-mm diameter due to mussel growth.

As a result of not being able to gain complete control due to treatment practices, it has been regular practice to mechanically pressure clean the pipe-work in the cooler months.

Treatment with Mexel 432 was commenced in October 2004, after the Seatreat 6 program was aborted and the pipe-work cleaned.

Dosages of the system were Saturday 3-4 p.m., Tuesday 5-6 p.m., and Thursday 11-12 am. These times were to coincide with peak periods of load on the Casino.

General Observations and Comments

Similar to the Opera House, it was necessary to adjust he dosage rate up to 8 ppm of product to achieve 2 ppm of amine at the exchanger. This would have been due to film forming on the pipe-work and possibly the increase in surface

area due to Marine growth. Discharge points were tested to ensure no amine levels were present.

Observations after six months showed minor mussel growth. The growth varied in thickness with the maximum amount being 50 mm. There was also minor presence of tubeworm. The worm present was easily removed. No fouling was found on the screens prior to the heat exchangers or in the heat exchangers themselves.

It was evident with from the use of the Mexel 432, that the treatment regime was able to control marine growth well in comparison to previous treatment practices.

Although the growth was not significant it gave the Casino engineering team the confidence that the system would last to the regular cleaning period and that there would be a reduced cleaning time require to remove the growth on the pipe-work.

In this particular case dosing on a more frequent basis may have eliminated the need for cleaning of the system. This was not conducted due to the limitations of thee permit.

It was possible take samples at the point of discharge. Water samples were taken on regular testing with no residual amine found in the water phase. It was not practical to sample the immediate area.

Product Advantages

- Reduction of mechanical cleaning and frequency of system.
- Operate through critical periods with fear of shutdown.
- Cost effective compare to other treatment practices.
- No impact on local environment.

Summary

Mexel 432 offers a number of advantages over other programs previously used. The product has provided corrosion protection as well as an effective dispersant as well as good control of sea growths and other deposition effects.

Dosage rates were typically 8 ppm to achieve 2-ppm amine (6-ppm product at the exchanger inlets. This was reduced once filming of the system was achieved and removal existing marine life in the system.

Consideration should be give to allow the frequency of dosage as well as the variation in the concentration actually dosed as long as the amine level does not exceed 0.5 ppm of product.