

Caprari Pumps Australia Pty Ltd

PRODUCT APPRAISAL REPORT No PA 1325 Issue 2

Precast Concrete Sewage Pumping Stations DN 2000 and 3000

AS/NZS 1170.0:2002 - Structural design action - General principles

AS 3735-2001 - Concrete structures for retaining liquids

**AS 3735 Supp 1-2001 - Concrete structures for retaining liquids -
Commentary (Supplement to AS 3735-2001)**

AS 4100:1998 - Steel Structures

AS 3600:2009 - Concrete Structures

Publication Date: 22 May 2015



WATER SERVICES
ASSOCIATION OF AUSTRALIA

Document History

The following information indicates the changes made to this document.

Date	Version	File Location
11/04/2014	Peer Review Draft	U:\PP1 Industry Performance and Regulation\PP1-012 Product Appraisals\Civil Asset Infrastructure\2013\PA 1325 Caprari Pumps Australia Pty Ltd Sewage Pumping Stations\PA 13-25 Caprari-CPC Precast Concrete Sewage Pump Station-final.docx
28/05/2014	Publication Issue 1	U:\PP1 Industry Performance and Regulation\PP1-012 Product Appraisals\Civil Asset Infrastructure\2013\PA 1325 Caprari Pumps Australia Pty Ltd Sewage Pumping Stations\PA 13-25 Caprari-CPC Precast Concrete Sewage Pump Station-final.docx
22/05/2015	Publication Issue 2	U:\PP1 Industry Performance and Regulation\PP1-012 Product Appraisals\Civil Asset Infrastructure\2013\PA 1325 Caprari Pumps Australia Pty Ltd Sewage Pumping Stations\Final\PA 1325 Caprari-CPC PC SPS Issue 2 - Published

Peer Reviewers

Name/Title	Organisation	Date
Carl Radford, Product Appraisal Manager	WSAA	26/05/2014
David Moore, Design Manager	City West Water	12/05/2014
Kevin Claridge, Infrastructure Standards Manager	SA Water	13/05/2014
Mohamed Yoosuf, Senior Standards Engineer	City West Water	21/05/2014

Approvals

Name/Title	Signature	Date
Carl Radford, Product Appraisal Manager	<i>Carl Radford</i>	26/05/2014
Carl Radford, Product Appraisal Manager	<i>Carl Radford</i>	22/05/2015

Overview of WSAA

The Water Services Association of Australia (WSAA) is the peak industry body that supports the Australian Urban Water Industry. Its members and associate members provide water and sewerage services to approximately 20 million Australians and many of Australia's largest industrial and commercial enterprises.

The Association facilitates collaboration, knowledge sharing, networking and cooperation within the urban water industry. It is proud of the collegiate attitude of its members which has led to industry-wide approaches to national water issues.

WSAA can demonstrate success in the standardisation of industry performance monitoring and benchmarking, as well as many research outcomes of national significance. The WSAA Executive retains strong links with policy makers and legislative bodies and their influences, to monitor emerging issues of importance to the urban water industry. WSAA is regularly consulted and its advice sought by decision makers when developing strategic directions for the water industry.

WSAA was formed in 1995 as a non-profit organisation to foster the exchange of information relating to the provision of urban water services between industry, government and the community, and to promote sustainable water resource management.

The Association's main activities focus on four areas:

1. Influencing national and state policies on the provision of urban water services and sustainable water resource management;
2. Promoting debate on environmentally sustainable development and management of water resources and the community health requirements of public water supplies;
3. Improving industry performance and establishing benchmarks and industry leading practices for water service processes; and
4. Fostering the exchange of information on education, training, research, water and wastewater management and treatment and other matters of common interest

Copyright

This document is copyrighted. Apart from any use as permitted under the Copyright Act 1968, no part of this document may be reproduced or transmitted in any form or by any means, electronically or mechanical, for any purpose, without the express written permission of Water Services Association of Australia Limited.

© Copyright 2015 by WATER SERVICES ASSOCIATION of Australia Limited **All rights reserved.**

CONTENTS

1 EXECUTIVE SUMMARY	6
1.1 Report Recommendations	8
2 MANUFACTURER AND DISTRIBUTORS OVERVIEW	9
2.1 Precast Concrete Manufacturers	9
2.2 Supplier	9
2.2.1 Caprari Pumps S.p.A	9
2.2.2 Caprari Pumps Australia Pty Ltd	9
2.3 Distributors	10
3 THE PRODUCT	10
4 SCOPE OF THE APPRAISAL	15
5 APPRAISAL CRITERIA	15
5.1 Quality Assurance Requirements	15
5.2 Performance Requirements	15
5.2.1 Product Manufacturing Standards	15
6 COMPLIANCE WITH APPRAISAL CRITERIA	16
6.1 Compliance with Quality Assurance Requirements	16
6.1.1 Premixed concrete plant suppliers	16
6.1.2 Precast concrete manufacturers	17
6.1.3 Supplier	17
6.1.4 Sub suppliers	17
6.1.4.1 Flexible Sealant Supplier	17
6.1.4.2 Elephant Foot Ferrule and Bolt (SS316) Supplier for Integrated range	17
6.1.5 Access covers suppliers	17
6.2 Compliance with Performance Requirements	17
6.2.1 Component materials	17
6.2.1.1 Concrete	17
6.2.1.2 Angaston Marble Calcareous aggregate	18
6.2.1.3 Concrete testing	19
6.2.1.4 Reinforcement and Formwork	19
6.2.1.5 Additional Reinforcement (Four Reinforced Pillars)	20
6.2.1.6 SWIFTLIFT – Unique and Patented Lifting	20
6.2.1.7 Jointing material for riser segments and cover slab	20
6.2.1.8 Attachments	20
6.2.1.9 Concrete specials, special linings and epoxy coating options	21
6.2.1.10 Protective Coatings to Caprari-CPC Pump Chamber	21
6.2.1.11 Wet-well and valve pit access covers	21
6.2.1.12 Mechanical Electrical fit-out and other related accessories	22
6.2.2 General design requirements	22
6.2.2.1 Structural integrity	23
6.2.2.2 Model CapCpc-System 2 - 2000 mm diameter pump wet-well	24
6.2.2.3 Model CapCpc-System 3 - 3000 mm diameter pump wet-well	24
6.2.2.4 Precast concrete cover slabs	24
6.2.2.5 External Valve Chamber	25
6.2.2.6 Cover to reinforcement for corrosion protection	25
6.2.2.7 Precast Concrete Packaged Pump Station – Buoyancy Check	25

6.2.3 Product type testing	26
6.2.4 Review of the documentation and guidance for designers, installers and operatives	27
7 WSAA NETWORK REQUESTS	27
8 FITTING INSTRUCTIONS, TRAINING AND INSTALLATION	31
8.1 Backfill Requirements.....	31
9 PRODUCT MARKING	32
10 PACKAGING AND TRANSPORTATION	32
11 PRODUCT WARRANTY	32
12 WATER AGENCY EXPERIENCE WITH THE PRODUCT OR FIELD TESTING REPORT	32
13 DISCUSSION.....	33
14 LIFE EXPECTANCY	34
15 FUTURE WORKS	34
16 REPORT RECOMMENDATIONS	34
17 DISCLAIMER.....	35
17.1 Issue of Report	35
17.2 Limits on Reliance on Information and Recommendations.....	35
17.2.1 Disclaimer of liability	35
17.2.2 Need for independent assessment	35
17.3 No Updating	36
17.4 No Warranty	36
APPENDIX A – TECHNICAL MANUAL AND SPECIFICATION	37
APPENDIX B - QUALITY CERTIFICATIONS	38
APPENDIX C – FYFE PTY LTD DESIGN VERIFICATION STATEMENT	46
APPENDIX D – FYFE PTY LTD'S RPEQ LETTER	49
APPENDIX E – TYPICAL DIAGRAMS FOR A RANGE OF CAPRARI-CPC PRECAST PUMP STATIONS	50
APPENDIX F – DIMENSIONS AND WEIGHTS OF PRECAST BASE, INCREMENTS, COVER SLAB AND CONCRETE CORING	59
APPENDIX G – FEATURES OF CAPRARI-CPC PRECAST PUMPING STATION	67
APPENDIX H - WSAA PRODUCT SPECIFICATION	69
APPENDIX I - SUPPLIER CONTACTS	70
APPENDIX J – PACKAGING AND TRANSPORTATION	72
APPENDIX K – LETTER SUBMITTED BY REID CONSTRUCTION SYSTEMS	74

1 EXECUTIVE SUMMARY

Issue 2 of this Product Appraisal Report replaces and updates PA 13/26 Issue 1 published on 29 May 2014.

The following amendments have been made in Issue 2:

- a) The maximum pipe work size (inlet or outlet) has been increased:
 - For model CapCpc System-2 (2 m dia option) - from 150 mm to 225 mm for D1CL; and 180 mm to 280 mm for PE
 - For model CapCpc System-3 (3 m dia option) - from 200 mm to 300 mm for D1CL; 280 mm to 355 mm.
- b) A new range (i.e. Integrated or Pinned version for 2 m and 3 m options) has been added to the original range; (i) Internal; (ii) Integral; and (iii) Separate versions. The Integrated version will have a valve chamber pinned to a squared up section of wet well with a concrete interlock and using 4Nos. of M20 x 95 Stainless Steel 316 REID Elephant Foot Ferrules with Stainless Steel 316 bolts.
- c) Replacement of Caprari Pumps Australia Pty Ltd's ISO 9001:2008 certificate issued by DNV Business Assurance, as previous certificate expired on 17/04/2015. The updated certificate valid until 17/04/2018 as attached in Appendix B.
- d) Inclusion of FYFE Pty Ltd's (design consultant for Caprari Pumps Australia Pty Ltd) letter confirming that the design drawings and specification are prepared under the direct supervision of a RPEQ (Registered Professional Engineer of Queensland) certified Engineer. Refer to Appendix D.
- e) Amendment to the Appendix I (Supplier Contacts) as two new distributors (Western Irrigation and Malcolm Thompson Pumps) has been added.
- f) Appendix A1 in the Addendum to the Main Report has also replaced with latest edition of 'Technical Brochure for Caprari-CPC Pump Station'. The last page shows the updated sales and service partners of Caprari Pumps Australia Pty Ltd.
- g) Amendment to Appendix A4 of Addendum No. 1 to the main report as it now contains Page No. 1 of FYFE Pty Ltd Engineering Computation showing details of 4Nos. Reid Elephant Ferrules at pump chamber/valve pit interface, Integrated (pinned) version.

Refer to Appendix E for the schematic diagrams of integrated range (2 m and 3 m options), and Appendix A8 in Addendum No. 1 Issue 2 for site photos.

NOTE:

- The full 6-page FYFE Pty Ltd Engineering Computation for Integrated (pinned) version is considered as "Commercial-in-Confidence" document hence included in Addendum No. 2 Issue 2 which is saved in WSAA special folder as reference to the WSAA appraisal team. Supplier's consent is required to access Addendum No. 2 Issue 2.
- Appendices A4 and A8 are included in the Addendum No. 1 Issue 2 to the Main Appraisal Report.

Caprari Pumps Australia Pty Ltd specialises in the supply of packaged precast concrete sewage pumping stations and services for individual council and water agency requirements across Australia.

Founded in 1945, Caprari Pumps S.p.A is an industrial group in the design, manufacture and supply of industrial quality submersible pumps. Caprari Pumps Australia Pty Ltd was established in 2004 as a subsidiary company of Caprari Pumps S.p.A.

Established in 1996, Cooke Precast Concrete Pty Ltd (CPC) is an Australian company that manufactures precast concrete pumping chambers, valve pits and municipal products for commercial, industrial and government authorities.

A partnership from two industry veterans (Caprari and CPC) have created “Caprari-CPC” offering an innovative and robust Concrete Pumping Chamber solution that conforms to all relevant Australian Standards (i.e. AS3600, AS3735 and AS3735 Supp 1) and SA Water’s TS 68 (2010) *Reinforced Concrete Construction for Liquid Retaining Structures and/or aggressive Environments*.

The Australian Standard AS3735:2001 and AS3735 Suppl 1:2001 - *Concrete structures for retaining liquids and its supplements* takes precedence over the requirements of AS 3600:2009 - Concrete structures.

TS 68 have been developed to maximize service life and reduce whole of life costs. Clause 1.3 of TS 68 (Notice to Contractors) states: The aim of the application of this standard (TS 68) is to ensure that concrete structures are built with a life expectancy of 100 years plus.

To meet Clause 7.4.1 of TS 68 conditions, the Caprari-CPC pump chamber is designed with an internal concrete cover of 65 mm which acts as additional barrier protection to the steel reinforcing within and with the optional protective coatings (Megapoxy MC 2 or AGRU HDPE liner) the design life of a sewer pumping station is extended to 100 years plus. Clause 4.4.3 (Table 4.3) of AS3735 specifies a minimum 45 mm internal cover for corrosion protection.

Total wall thickness of the pump chamber is minimum 140mm and external concrete cover is 50mm leaving a central working area of 20mm for steel reinforcement fixing and placement.

All precast chambers are made from a minimum 50 MPa concrete with Angaston Marble calcareous aggregate. The properties of Angaston Marble are unique in Australia, providing the highest possible resistance to sulphate attack endemic in sewers.

Poly lining (AGRU Grip HDPE lining) can be set into the concrete at the time of casting to meet the emerging requirements of Water and Government Authorities in aggressive conditions, which may increase the life span of the pump chamber to 100 plus years. Epoxy Coating is also an option that is offered to further enhance durability.

Caprari-CPC Pump Station is designed with 15 m overall depth in line with Australian Standards AS 3600 and AS 3735 to withstand poor soil conditions and high water tables.

The pump chamber has four substantial reinforced columns at 90 degrees, which run right through the main chamber length, and is also designed throughout all the increments, providing added strength to the pump chamber and houses the unique and patented ‘SwiftLift Rod’.

The ‘SwiftLift rod’ in the main chamber is one metre in length and the anchor is embedded into the reinforced column and has a lifting rating of 5 tons each. The key advantage in lifting the primary chamber is that personnel do not have to enter the pit itself to locate and attach to the ‘SwiftLift’ as is the case in previous designs.

Lifting points are located on top of the products promoting easier craneage. Installation and removal of lifting clutches in the other designs, the lifting points are on the outer wall of the increments and what often occurs whilst lifting the segments the chains put pressure on the external wall and the segment upper edges and surrounding area around the lifting point is damaged requiring patching and repair after installation.

Caprari-CPC Pump Station is available through a network of suppliers of water and wastewater pump systems, comprising over 400 staff, spread across 12 branches in VIC, SA & NT, NSW, WA and TAS.

Caprari Pumps Australia Pty Ltd (Caprari) has submitted for WSAA appraisal their range of mould formed Precast Concrete Sewage Pumping Stations with integral and external valve chamber. The pumping stations are available in two sizes; 2 m and 3 m diameters up to a maximum depth of 15 m. Within the 2 m range pump chamber an internal or integral valve chamber design is an available option, if preferred. However for the purposes of this

appraisal WSAA has elected to assess the performance of this product up to a maximum depth of 10 m.

The Caprari-CPC range of Precast Concrete Sewage Pumping Stations comprises modular segments known as a base casting, standard increments, integral or external valve chamber and cover slab. To affect a water tight joint between joint segments Caprari specify a flexible mastic joint sealant. The manufacture of these components is carried out at an accredited concrete precast plant (i.e. CPC) with JAS-ANZ third party Quality Management System, accreditation to ISO 9001:2008.

The project consultant and/or Water Agency are responsible for determining the suitability of the station design for the local ground conditions.

A range of options and accessories (offered at fit out) are outlined in this Appraisal to demonstrate product versatility but are not intended to be included in the appraisal. The project constructor will need to ensure that the specifications for covers, pumping equipment, electrical controls and cubicle comply with relevant project documentation based upon the individual council or Water Agency standards. Each station can be designed to accommodate a multipart cast iron cover, concrete infill cover, or fabricated aluminium cover. Safety grates and aluminium hand rails are also an option.

Caprari-CPC has dedicated steel moulds for their range of precast concrete sewage pumping stations.

FYFE Pty Ltd has provided structural calculations and associated drawings for the Caprari-CPC range of Precast Concrete Sewage Pumping Stations. FYFE's calculations and associated drawings consist of the following requirements:

- a) An exposure Classification of D (severe/extreme) has been used for all wall surfaces;
- b) 80 kN vehicle loading has been assumed;
- c) The capacity of the cantilever covers slab extension;
- d) Liquid depth 2 m in normal operating range. Calculations for full immersion have been taken into consideration;
- e) Floatation calculation for an empty chamber with overall depth of 15m, with ground water level 1.5 m below surface level; and
- f) A buoyancy re-check with ground water table at the surface level

The requirements of this appraisal have now been met with respect to general design requirements, product type testing, auditing of production quality control systems, review of documentation and guidance for designers, installers and operatives and the products are seen as 'fit for purpose'.

1.1 Report Recommendations

It is recommended that WSAA members and associates, subject to any specific requirements of the member or associate, accept or authorise the Caprari-CPC range of Precast Concrete Sewage Pumping Stations, as detailed in this report for use in sewerage networks provided pipeline design, installation, acceptance testing and commissioning are in accordance with relevant WSAA Codes, WSAA Member Integrated Codes, and the manufacturer's requirements.

Water Agencies considering installing a Caprari-CPC Precast Concrete Sewage Pumping Station at depths greater than 10 m are advised to consult with Caprari Pumps Australia Pty Ltd representatives.

2 MANUFACTURER AND DISTRIBUTORS OVERVIEW

2.1 Precast Concrete Manufacturers

Cooke Precast Concrete Pty Ltd (CPC) manufactures the precast concrete products (i.e. pump chambers, valve pits and cover slabs) for the Caprari-CPC range of Precast Concrete Sewage Pumping Stations, using dedicated steel moulds supplied and owned by Caprari.

CPC commenced operations in 1996 and is a manufacturer of a range of precast concrete products serving new infrastructure, defense, commercial and industrial projects throughout Australia. The range of products includes for storm water drainage and sewer access products, trade waste arrestors, septic tanks, electrical pits and covers, water and sewer inspection openings.

CPC has been supplying concrete products to all the major water authorities and councils around Australia since 1996.

Davalan Concrete Pty Ltd (Davalan) supplies batched premixed concrete to CPC for manufacturing the Caprari-CPC range of precast concrete pump stations. The Davalan Concrete Pty Ltd Premix Concrete Batching Plant is located at Elizabeth West, South Australia (SA).

Davalan also supplies pre-mixed concrete to domestic, commercial and industrial markets in SA and has been servicing Adelaide's market with pre-mixed concrete since 1984.

2.2 Supplier

2.2.1 Caprari Pumps S.p.A

Established in 1945, Caprari Pumps S.p.A is a manufacturer and supplier of electric pumps for water purification and treatment, wastewater management, civil, industrial and agricultural water supplies and many other applications. Having its headquarters in Modena (Italy), Caprari have four production plants, eight subsidiaries and presence in five continents with over 700 employees.

Caprari have over 50 years' experience in development and manufacture of pumps, supplying to over 60 countries worldwide. Caprari manufactures a comprehensive range of centrifugal, vortex and electric submersible pumps for potable water, waste water and Irrigation applications. Submersible Wastewater Pumps (K series electric submersible pumps) suitable for pumping sewage and storm water in temporary or permanent installations Caprari also provide expertise in installation, maintenance and refurbishment.

Caprari-CPC Packaged Pumping Stations are supplied with shredder, torque flow or single channel impeller, sewage pumps. Packaged stations are available in a variety of sizes ranging from single pump applications for households to large dual pump stations for sewage and storm water from restaurants, shops, housing estates.

2.2.2 Caprari Pumps Australia Pty Ltd

Caprari Pumps Australia Pty Ltd (Caprari) was established in 2004 as a subsidiary company of Caprari Pumps S.p.A. Caprari has full production and testing facilities in Beverly SA and supports their products with local stock holdings and components. Caprari warehouse and fabrication workshop is a combined 907m². The workshop is equipped with gantry crane, including a dedicated pump test bay complying with AS 2417:2001 *Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1 & 2*.

Caprari have a fully functioning workshop and assembly area at 3 Jeanes Street, Beverley SA enabling them to offer the flexibility of design and assembly of components, sourced from their Italian foundry, submersible motor factory and distribution Centre based in and around Modena, Italy. Most of Caprari pump model are purchased from Italy, in component form, which enables them to build pumps of varying size and configuration, on demand, offering timely solutions for our customers.

Caprari is currently in the process of becoming an accredited Consultant/Contractor of some water agencies such as SA Water, Melbourne Retail Water Agencies (MRWA) etc. to provide design engineering, auditing and construction services to the Land Development industry for Sewage Pumping Stations.

2.3 Distributors

Caprari-CPC brings together a national specialised distribution network of some of the experienced local organizations that are strategically placed to provide supply and support of the Packaged Pump Station with extensive mechanical, electrical, and civil experience. The combined team is represented by close to 400 staff and covers all over Australia.

The pump chamber package is available directly from Caprari distributors. The mechanical and electrical fit out will be quoted to meet water authority specifications and brand preferences.

Australian wide Distributors are:

- a) QLD – Dowdens Pumping & Water Treatment, 9-15 Industrial Street, Mackay QLD 4740
- b) NSW, ACT & WA – Prime Pumps Pty Ltd, 12 Welder Road, Seven Hills, NSW 2147
- c) Victoria – Bell Environmental Pty Ltd, 88-90 Berkshire Road, North Sunshine, VIC 3020
- d) SA, NT & WA – Australian Industrial Pump Systems, 53 Wodonga Street, Beverley SA 5009
- e) Tasmania – Irrigation Tasmania, 5 Reece Court, Somerset TAS 7322

3 THE PRODUCT

Caprari Pumps Australia Pty Ltd markets a range of precast concrete sewage pumping stations. Cooke Precast Concrete Pty Ltd (CPC) manufactures the concrete segments using dedicated steel molds owned and supplied by Caprari.

Davalan Concrete Pty Ltd supplies the premixed concrete to CPC. The concrete segments are jointed with a butyl mastic rubber composite material which is specifically designed for the sealing of segmented concrete pipes and maintenance hole units.

Caprari-CPC Precast Concrete Sewage Pumping Station sizes include 2 m and 3 m diameter pump chambers with separate valve chamber design. Within the 2 m range pump chamber an internal or integral valve chamber design is an available option, if preferred.

Caprari-CPC Precast Concrete Sewage Pumping Station consists of the following precast concrete components:

- Base section (primary chamber);
- Standard increments;
- Valve chamber – Integral / cantilevered or Integrated or Separate; and
- Cover slab.

Each station can be designed to accommodate a multipart cast iron Class B or D solid-top or concrete infill cover or a fabricated aluminium cover. Safety grates and aluminium hand rails are also an option.

The range of Caprari-CPC Precast Concrete Sewage Pumping Stations, listing the model numbers and specifications is shown in the following tables:

- Table 1 – 2 m and 3 m dia wet well with separate valve chamber
- Table 2 – 2 m dia wet well with integral and internal valve chamber
- Table 3 – 2 m and 3 m wet well with integrated (pinned) valve chamber

Table 1: Separate Valve Chamber related to model CapCpc System-2 and CapCpc System-3 (2 m and 3 m dia pump station)

Model	ID (mm)	Primary Chamber depth (mm)	* Separate Valve Chamber (increments 300 or 600mm)	Increments (+ 250 mm)	Max Depth (mm)	Nominal Pit Capacity (Litres)	Extra Capacity per Metre (Litres)	Max Pipe work size (mm)	Cast Iron or Alum Cover	Twin or single Pump
CapCpc System-2	2000	1750	1500 x 1500	Range from 500 – 1500 mm	15,000	5,500	3,142	225 (D1CL) and 280 (PE)	•	•
CapCpc System-3	3000	1750	1500 x 1500	Range from 500 – 1500 mm	15,000	12,370	7,070	300 (D1CL) and 355 (PE)	•	•

* NOTE: Standard dimensions for 'Separate Valve Chamber' is shown above. Customised sizes are available to suit project requirements.

Table 2: Integral and Internal Valve Chambers related to model CapCpc System-2 (2 m dia pump station)

Model	Internal Diameter (mm)	Primary Chamber depth (mm)	Valve Chamber dimensions (increments +250mm)	Nominal Pit Capacity (Litres)	Extra capacity (Litres)	Max pipework size	Cast Iron or Al covers	Twin or single
CapCpc System-2 INTERNAL	2000	1750	1200 x 600 x 1110mm	5,500	3142	225 (D1CL) and 280 (PE)	•	•
CapCpc System-2 INTEGRAL	2000	1750	1700 x 1500 x 1110mm	5,500	3142	225 (D1CL) and 280 (PE)	•	•

Table 3: Integrated (Pinned) Valve Chamber related to model CapCpc System-2 and CapCpc System-3 (2 m and 3 m dia pump station)

Model	ID (mm)	Primary Chamber depth (mm)	Valve Chamber dimensions (increments +250mm)	Nominal Pit Capacity (Litres)	Extra capacity (Litres)	Max pipework size (mm)	Cast Iron or Al covers	Twin or single
CapCpc System-2 INTEGRAL	2000	1750	1700 x 1500 x 1110mm	5,500	3142	225 (D1CL) and 280 (PE)	•	•
CapCpc System-3 INTEGRAL	3000	1750	1700 x 1500 x 1110mm	5,500	7,070	300 (D1CL) and 355 (PE)	•	•

As the Integrated version will have a valve chamber pinned to a squared up section, Caprari have the flexibility to put valve chamber sizing to suit pipework and/or pump sizing.

Both the squared up section of wet well and valve chambers are connected using:

- Concrete interlock; and
- 4 Nos. of M20 x 95 Stainless Steel 316 'Reid' Elephant Foot Ferrules and Stainless Steel 316 bolts in a "T" orientation. Refer to Figure 1.



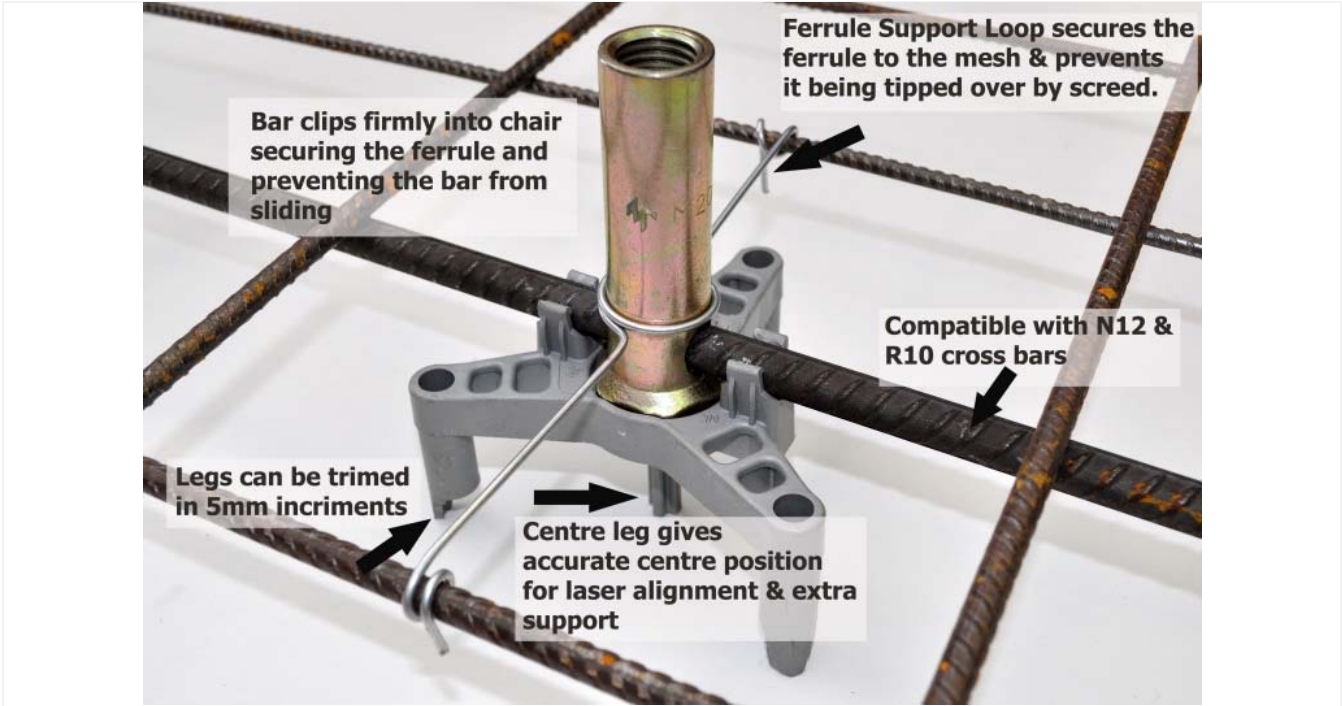


Figure 1: Reid Elephant Foot Ferrule (Premium Grade 316 Stainless Steel)





Provision of holes in pump chamber (integrated range) for 4nos. ferrules (smaller holes) in "T shape" and pipe two pipe outlets (larger holes)



Figure 2: Integrated range – squared up sections of wet well and valve chambers are joined together using 4 Nos. SS316 Reid Elephant Foot Ferrule M20 x 95 and SS316 Bolts

The Integrated version can have 900 x 900 x 1100 mm; or 1200 x 1200 x 1100 mm; or 1500 x 1500 x 1100 mm as standard valve pit sizes (clear opening sizes). In addition, Caprari can manufacture customised larger valve pits as required.

Refer to Appendix E for typical diagram for the following six ranges of Caprari-CPC Pump Stations:

- 2 m model with (a) internal; (b) integral; (c) separate; and (d) integrated valve chamber; and
- 3 m model with (a) separate; and (b) integrated valve chamber

Refer to Appendix F for dimensions and weights of precast base, increments, cover slab and concrete coring.

FYFE Pty Ltd has submitted Engineering Computation (6 pages) for Integrated (Pinned) version of Caprari-CPC Precast Concrete SPS. Page No. 1 of this report is included in Appendix A4 in Addendum No. 1 Issue 2 showing location of 4Nos. REID Elephant Foot Ferrules for Pump Chamber / Valve Chamber.

The full 6-page FYFE Pty Ltd Engineering Computation for Integrated (pinned) version is considered as “Commercial-in-Confidence” document hence included in Addendum No. 2 Issue 2 which is saved in WSAA special folder as reference to the WSAA appraisal team. Supplier’s (Caprari Pumps Australia Pty Ltd) consent is required to access Addendum No. 2 Issue 2.

Caprari-CPC Precast Concrete Sewage Pumping Stations are usually supplied to include fit-out with a range of optional accessories including pumps and valves installed with either polyethylene or ductile iron pipe work, well washers, ladders, platforms and stainless steel adjustable brackets.

Adaptors to suit non-standard pumps can also be provided. Electrical controls including main switchboard and level controls can be supplied by Caprari, to Water Agency specification, if specified.

The following documents are included in Appendix A:

- Appendix A1 - Technical Brochure for Caprari-CPC Pump Station
- Appendix A2 – Design Standards and Specification for Precast Concrete Pump Station prepared by CPC dated 19/03/2013 on FYFE Pty Ltd letterhead
- Appendix A3 – FYFE Pty Ltd Engineering Documentation for Caprari Pump Stations showing design calculations including buoyancy
- Appendix A4 – Page No. 1 of FYFE Pty Ltd Engineering Computation for Integrated (Pinned) version
- Appendix A5 – Sectional Elevation, Plan and Reinforcement Details for a range of Caprari-CPC Precast Concrete Pump Stations
- Appendix A6 – Technical Data Sheet for Bostik 5240 sealing strip
- Appendix A7 - Data Sheet for AGRU Grip® Concrete Protective Liner (mechanically anchored polyethylene protective liners)
- Appendix A8 – Site Pictures of Caprari-CPC Precast Concrete Sewage Pump Station
- Appendix A9 – Caprari-CPC Precast Concrete Sewage Pump Station O&M Manual

The above appendices are included in Addendum No. 1 Issue 2 to the Main WSAA Appraisal Report Issue 2.

4 SCOPE OF THE APPRAISAL

The scope of this appraisal is limited to the range of “Caprari-CPC precast concrete Pump chambers” of the “Caprari-CPC Precast Concrete Sewage Pumping Stations” referenced in Section 3, and the flexible joint sealant supplied.

The range of optional accessories (fit-out) are discussed in Clause 6.2.1.7 and 13 to demonstrate product versatility but not intended to be included in the appraisal as they are usually supplied to individual agency specification.

The appraisal is not limited to any specific pump brands. ‘Caprari pumps’ are currently being used by some Australian Water Authorities and it is the intention of ‘Caprari Pumps Australia Pty Ltd’ to gain approvals for use of their pumps together with ‘Caprari-CPC Precast Sewage Pump Station’ in the majority of Water Authorities over time.

5 APPRAISAL CRITERIA

Appraisal criteria is determined by the WSAA Infrastructure Products and Materials Network and regularly reviewed to ensure that the criteria reflect the requirements of WSAA members.

5.1 Quality Assurance Requirements

The WSAA Infrastructure Product and Materials Network accept precast concrete components manufactured and supplied under cover of a certified ISO 9001 management system. The scope of the certification shall include “Manufacture and supply of premixed concrete to AS 1379” (or similar).

5.2 Performance Requirements

5.2.1 Product Manufacturing Standards

There is no specific Australian or International product standard that provides manufacturers, designers and installers with a document that outlines the specific criteria for the manufacture of precast concrete chambers for sewerage applications, applicable to the scope of products covered by this appraisal.

In Australia and New Zealand Precast Concrete Access Chamber for Sewerage Applications are manufactured in accordance with AS 4198:1994 *Precast concrete access chambers for*

sewerage applications, however this standard is limited to precast concrete access chambers intended for use with buried sewer pipes to a depth of 6 m and for pipes not greater than 300 mm in diameter.

AS/NZS 1546.1 specifies the performance requirements and performance criteria for septic tanks, but is limited to domestic wastewater flows of 14,000 litres per week. This flow limit represents a maximum daily flow of 2000 litres. Applying this standard to a 'small' pumping station (< 90 litres/s) is not recommended by WSAA.

Until such time as an appropriate Industry Standard, Australian or International Standard is developed which specifies the

- (a) requirements of precast concrete access chambers;
- (b) the minimum requirements for the materials to be used in, and the manufacture of; and controlled quality precast concrete access chambers components; and
- (c) includes descriptions of methods of sampling and testing of components.

The performance criteria defined in Section 6.2 shall be applied.

For the purposes of this appraisal the manufacture and supply of premixed concrete used to produce the base casting, standard increments, cantilevered valve chamber, external valve chamber and cover slab has been assessed for compliance against WSA 114:2002 *Concrete Special Class*.

The requirements for special class premixed concrete have been developed for specification in the construction of principally sewerage infrastructure assets where concrete durability is critical to the life expectancy of such assets. Concrete provided shall be the class specified in the purchase order and/or referenced design plans, Specifications or Drawings based upon the individual council or Water Agency standards.

Table 3 in Section 6.2.1.1 provides a comparative assessment with concrete mix design produced by Davalan Concrete Pty Ltd and WSA 114:2002 *Concrete Special Class*.

The concrete structure design has been appraised for compliance with AS 3735 and its Supplement 1- *Concrete structures for retaining liquids for serviceability* and other relevant parts of WSA 04:2005 *Sewage Pumping Code of Australia*.

A geotechnical report, prepared with information determined from soil samples taken at the Sewage Pumping Station site, is requested by Caprari in order to verify the structural integrity of the design of the Precast Concrete Sewage Pumping Stations. As a minimum the geotechnical report shall contain soil classification, information on the water table location, the soil bearing capacity and the lateral earth pressure coefficients.

6 COMPLIANCE WITH APPRAISAL CRITERIA

6.1 Compliance with Quality Assurance Requirements

6.1.1 Premixed concrete plant suppliers

The Industry Standard WSA 114 *Concrete Special Class*, Section 2.1 requires special class concrete to be manufactured by quality endorsed companies to AS/NZS ISO 9001. The scope of ISO 9001 certification should also include reference to "Manufacture and supply of premixed concrete to AS 1379 - *Specification and supply of concrete*" (or similar).

Cooke Precast Concrete Pty Ltd uses premixed concrete supplied by Davalan Concrete Pty Ltd to manufacture Caprari range of precast concrete modular base, standard increments, cantilevered valve pit, external valve pit and cover slabs. Davalan Concrete Pty Ltd is a Quality Endorsed Company and holds ISO 9001 Certificate of Registration No QEC 11136, for the manufacture and supply of premixed concrete. Refer to Appendix B.

6.1.2 Precast concrete manufacturers

Cooke Precast Concrete Pty Ltd (CPC) manufactures the complete range of precast concrete base casting, standard increments, attached cantilevered valve chambers, external valve pit and cover slabs for the Caprari Precast Concrete Sewage Pumping Stations.

Cooke Precast Concrete Pty Ltd is a Quality Endorsed Company and holds AS/NZS ISO 9001:2008 Certificate of Registration No QEC 14467, for the manufacture of precast concrete products in concrete and glass fibre reinforced concrete. Refer to Appendix B.

6.1.3 Supplier

Caprari Pumps Australia Pty Ltd's quality management system has been certified to UNI EN ISO 9001:2008 by DNV in 2004. Caprari has also invested in environmental certification, in accordance with international standard ISO 14001:2004.

The scope of the quality management system covers the design, manufacture, sale and servicing of centrifugal and electric pumps for deep wells, for dry installation, for drainage and sewage, electric pumps for use in potentially explosive atmospheres, and related monitoring and control communication system (Sector EA:18). Refer to Appendix B.

6.1.4 Sub suppliers

6.1.4.1 Flexible Sealant Supplier

Bostik Australia Pty Ltd is a Quality Endorsed Company accredited by SAI Global to ISO 9001:2008, License No. QEC22260. Bostik Australia Pty Ltd states that their quality system has also been formulated around the stringent requirements of the automotive industry. Bostik is a butyl rubber sealant widely used in the sewerage industry in pipe jointing to ensure integrity of joints. Refer to Appendix B.

6.1.4.2 Elephant Foot Ferrule and Bolt (SS316) Supplier for Integrated range

Reid Construction Systems, a division of ITW Australia Pty Ltd, is a Quality Endorsed Company accredited by SAI Global to ISO 9001:2008, License No. QEC23580. Reid Elephant Foot ferrules and associated bolts are manufactured in accordance with Australian Standard AS 3850:2003 with threads conforming to AS 1275.

Reid Australia conducts all testing utilizing Ramset's Product Engineering Laboratory, and external NATA certified laboratories where required. All testing of cast-in-ferrules is done in accordance with ASTM E488-96 (2003). Refer to Appendix B for ISO 9001 certificate and Appendix K for letter issued by Reid along with two pages from 'Anchoring Solutions Design Guide' detailing the ferrules.

6.1.5 Access covers suppliers

Multipart cast iron covers and frames both infill and solid top are supplied by CPC to comply with AS 3996 -2006 *Access covers and grates*.

1 It is recommended that access covers and frames be supplied under cover of an ISO Type 5 Product Certification scheme administered by a JAS-ANZ accredited conformity assessment body.

CPC also supplies grade 5005 aluminium checkered plate covers. The design and fabrication of these covers comply with AS/NZS 1734:1997 *Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate* and welding and inspection comply with AS/NZS 1664:1997 *Aluminium Structures*.

6.2 Compliance with Performance Requirements

6.2.1 Component materials

6.2.1.1 Concrete

The Water Industry Standard WSA 114 *Concrete Special Class*, Section 2.1 requires special class concrete to be manufactured by quality endorsed companies to AS/NZS ISO 9001. The

scope of ISO 9001 certification should also include reference to "Manufacture and supply of premixed concrete to AS 1379 - *Specification and supply of concrete*" (or similar).

Davalan Concrete Pty Ltd supplies pre-mixed concrete to Cooke Precast Concrete Pty Ltd for manufacturing the Caprari range of Precast Concrete Sewage Pumping Stations.

CPC has provided a special concrete mix design for concrete supplied by Davalan Concrete Pty Ltd for the production of the base casting, standard increments, external valve chambers and cover slabs. Davalan Concrete can also vary the concrete mix design details or proportions to achieve specification criteria.

The special concrete mix design details for concrete supplied by Davalan Concrete for the production of the Caprari-CPC Precast Concrete Sewage Pumping Stations complies with Section 4 of WSA 114 *Concrete Special Class*.

Table 4: Concrete Special Class Specification - Comparison of WSA 114 versus Davalan Concrete Pty Ltd

Criteria	WSA 114:2002	Davalan Concrete Pty Ltd
Strength Grade	Minimum 40 MPa	Minimum 50MPa
Compressive Strength at 28 days (MPa) – minimum.	S40 (MPa) (S = Special Concrete)	S50 (MPa) (S = Special Concrete)
Water Cement Ratio	Not to exceed 0.5	Complies
Minimum Cementitious content	350 Kg/m ³	Complies
Maximum Aggregate size	Calcareous aggregate	See Note 1 Complies
Fine Aggregate size	Refer to WSA 114	Trenel washed Concrete sand complies
Admixtures	Refer to WSA 114	Sika Australia Water reducing Admix (See Note 3)
Max Dry Shrinkage	700 x 10 ⁻⁶ . @ 56 days	Complies
Alkali Content (Na ₂ O equivalent)	Maximum 3Kg/m ³	Complies

1 Calcareous aggregate supplied to Davalan Concrete Pty Ltd is sourced from Penrice Quarry, Angaston, SA. The maximum size of aggregate used is 20 mm.

2 The WSAA Water Industry Standard WSA 114 for Concrete Special Class is available on their web site at <https://www.wsaa.asn.au/Publications/NationalCodes/Pages/WaterIndustryStandards.aspx>

3 The Water Reducing Accelerator is a non-chloride accelerator admixture based on modified co-polymer technology.

The following Product Specification is also relevant to this application WSA PS 358 Concrete, Pre-mixed, Special Class.

A copy of the above Specification is attached to Appendix H or can be downloaded from the WSAA website.

6.2.1.2 Angaston Marble Calcareous aggregate

Below is a link to SA Water Specification on Marble Calcareous aggregate from Angaston:

<http://www.sawater.com.au/NR/rdonlyres/47BDA2E1-65A3-4498-AE60-965A0A8AE99B/0/TS3cfinal60613.pdf>

The properties of the calcareous marble enable it to wear at the same rate as the concrete / cement matrix. The wear characteristic ends up an even smooth surface rather than the breakup of the concrete structure resulting in clumps of concrete falling apart which quite often ends up in the bottom of the pump station and into the pumps.

The standard aggregate used in conventional concrete manufacture is dolomite / blue metal which are harder than the cement matrix. Therefore as concrete start to wear, the cement matrix disappears first as it is softer, as a result the exposed dolomite / aggregate falls out of the structure, resulting in the disappearance of concrete.

6.2.1.3 Concrete testing

In accordance with WSA 114:2002 Special class concrete shall be sampled, tested and assessed for compliance in accordance with AS 1379:2007 *Specification and supply of concrete*, Section 5.

The concrete mix supplied by Davalan Concrete Pty Ltd for the manufacture of Caprari-CPC package chambers complies with Section 4 of WSA 114 *Concrete Special Class*.

Davalan Concrete Pty Ltd operates under a Quality Management System which complies with the requirements of ISO9001:2008. The registration covers the quality management system for the manufacture and supply of pre-mixed concrete.

Davalan Concrete Pty Ltd carries out routine quality testing on all grades on concrete produced. All testing is carried out by NATA registered laboratories accredited for compliance with ISO/IEC 17025. Davalan Concrete Pty Ltd use both Hanson Testing and Lab SA Pty Ltd.

6.2.1.4 Reinforcement and Formwork

Reinforcement complies with AS/NZS 4671:2001 *Steel reinforcing materials*. Reinforcing bars and fabric to Grade 500.

Formwork complies with AS 3610:1995 *Formwork for Concrete* (Class 3)

NOTE: AS 3610 deals mainly with the visual quality (appearance) of formed concrete surfaces, whether they are in-situ or precast concrete elements. The surface finish quality is specified as one of five classes.

Classes 1, 2 and 3 are for typical architectural applications where the concrete surface is visible. Classes 4 and 5 are for typical structural applications where the concrete surface is either not visible, or the surface finish quality is not critical (e.g. footings, concrete frames covered by other finishes)

The Caprari-CPC pump station utilises S50 (50 MPa) special mix concrete and in accordance with AS 3735:2001 *Concrete structures retaining liquids* requires a minimum of 65mm (although AS 3735 requirement is minimum 45mm) cover over reinforcing.

A key design feature of Caprari-CPC's precast concrete components is the increased wall thickness to a minimum of 140mm. This increase to wall thickness design eliminates previous restrictions that existed and provide for the first time in a precast pumping chamber a minimum cover to reinforcement to the liquid structure of 65mm of concrete, complying with SA Water's Technical Standard TS 68 - *Reinforced Concrete Construction for Liquid Retaining Structures and/or Aggressive Environments*, reference Clause 7.4.1 and exceeds the minimum cover stipulated in AS 3735.

Click the below link to access the TS 68:

<http://www.sawater.com.au/nr/rdonlyres/c4698204-0cdd-49ef-8188-bbe4f91a028d/0/ts68.pdf>

The above statement is to highlight that the increased concrete cover (65 mm instead of 45 mm) to the steel reinforcement becomes a sacrificial layer which does increase life expectancy of the pump chamber. As described in Clause 6.2.1.2 the nature of the Angaston Marble Calcareous Aggregate promotes an even wear pattern rather than the crumbling of the concrete and falling apart that is typically seen. Therefore having extra material (i.e. as increased concrete layer) becomes sacrificial and prologues the life of the sewage pump station i.e. prologues the time taken to get to the stage where the wear exposes the reinforced steel rods. (Refer to SA Water's TS 68).

As noted by Humes, life span of 'concrete sewer pipes' is increased due to additional material which becomes sacrificial. Refer the below link:

<http://www.humes.com.au/precast-solutions/sewage-transfer/calcareous-aggregate.html>

6.2.1.5 Additional Reinforcement (Four Reinforced Pillars)

The pump chamber has four substantial reinforced columns at 90 degrees, which run right through the main chamber length, and is also designed throughout all the increments, this provides added strength to the pump chamber and houses the unique and patented SwiftLift Rod.

The reinforced pillars greatly increase the stability of the cover slab offering a lot more than a mere circular section for the cover slab to rest on. The reinforced pillar also provides additional strength against ground pressure.

The Pump Chamber is designed to withstand a depth to water table at the surface level.

6.2.1.6 SWIFTLIFT – Unique and Patented Lifting

The SwiftLift rod in the main chamber is one metre in length and the anchor is embedded into the reinforced column and has a lifting rating of 5 tons each.

The key advantage in lifting the primary chamber is that personnel do not have to enter the pit itself to locate and attach to the SwiftLift as is the case in previous designs.

Lifting points are located on top of the products promoting easier craneage. Installation and removal of lifting clutches in the other designs the lifting points are on the outer wall of the increments and what often occurs whilst lifting the segments the chains put pressure on the external wall and the segment upper edges and surrounding area around the lifting point is damaged requiring patching and repair after installation.

6.2.1.7 Jointing material for riser segments and cover slab

Caprari Pumps Australia Pty Ltd has supplied Technical Data Sheet for the Bostik 5240 mastic sealing strip. This product is designed for the sealing of segmented concrete pipes and maintenance hole units.

Caprari recommends the Bostik 5240 product be used as the sealant between the concrete riser segments and the cover slab, particularly in homogenous sandy soils of uniform moisture. The use of mastic sealing strip joints in clay soil, particularly in saturated conditions, should be investigated on a project-by-project basis, in conjunction with the geotechnical report and advice from suitably qualified structural engineer.

The Bostik 5240 sealing strip is a blend of synthetic rubber compounds.

The Network recommended ASTM C990M-09 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric), be used as performance standard for the jointing material.

At the time of preparing this report no comparative performance data for the Bostik 5240 butyl mastic sealing strip was available and this item has been referred to Future Work Items in Section 14 of this appraisal report.

The Bostik 5240 sealing strip has been successfully used in the above applications for over 30 years.

Refer Appendix A6 for the Bostik 5240 Technical Data Sheet.

6.2.1.8 Attachments

Caprari supplies stainless steel (SS) 316 ladders and brackets. Other attachments such as platforms, handrails or fiber reinforced plastic ladders can be fitted to suit Water Agency Specifications.

NOTE: The above items are not included in this appraisal.

6.2.1.9 Concrete specials, special linings and epoxy coating options

Standard components are unlined and uncoated, however a corrosion protection lining and/or coating as specified in the Water Specification can be applied to the interior of the components.

Caprari-CPC Pump chambers can be fitted with mechanically anchored polyethylene protective liners. The AGRU product is preferred.

Click the below links to access the AGRU Grip concrete protective liners:

http://www.theconcretecompany.com/v/07_01.pdf#view=Fit

http://www.agru.at/uploads/tx_bfbrochures/BETONSCHUTZ_EN_NEU_Ansicht.pdf

The poly liner features two offset anchoring studs which integrate into the concrete structure providing high tear resistance and fixation. While acting as a corrosion barrier, the liner also increases the concrete structural strength by 30% and extends the pump station life to 100 plus years.

Epoxy Coating can also be offered as an option when requested.

6.2.1.10 Protective Coatings to Caprari-CPC Pump Chamber

There are three options to upgrade the interior surface of Caprari-CPC pump chamber in terms of coatings:

- Option 1: The standard product is supplied in a concrete finish without any coating. The increased internal concrete cover (65 mm instead of 45 mm) to the steel reinforcement becomes a sacrificial layer acts as additional barrier protection the steel reinforcement which increase the life expectancy of the pump chamber.
- Option 2: To apply a Megapoxy MC 2 part coating. Refer to the below link for details: http://megapoxy.com/wp-content/uploads/2009/10/MC_TB.pdf
- Option 3: To supply the AGRU HDPE concrete protective lining.

6.2.1.11 Wet-well and valve pit access covers

Caprari-CPC packaged pump stations can be supplied to suit project requirements and are available with either a multipart cast iron cover or concrete infill cover or fabricated aluminium cover. Safety grates and aluminium hand rails are also an option.

Caprari-CPC covers can be made project specific and to the Water Authority / Local Council individual requirement.

Cooke Precast Concrete Pty Ltd (CPC) supplies Class B or Class D Cast Iron Covers and Frames complying with AS 3996 which are gas and water tight. In trafficable and non-trafficable areas Class D or Class B covers and frames shall be provided to access points, respectively.

CPC also designs and manufactures aluminium cover, safety grates and aluminium hand rails to suit Water Authority requirements. CPC design and fabricate the aluminium access covers for the wet-well and valve chambers using aluminium of commercial grade 5052 in H32 temper with triple grip finish. The aluminium access covers are not designed for vehicle loads.

Caprari has advised that in line with current trends, pumping stations are rarely located in trafficable areas and ductile iron covers are therefore not normally fitted. Caprari advise that some ductile iron covers exceed OH&S maximum lifting limits and pose other safety risks to service personnel.

Caprari has submitted detailed drawings covering the design and fabrication of the lockage aluminium hinged lids, including the galvanised swing up safety grate. The cover is manufactured from 6 mm aluminium checker plate with recessed hinges and lifting handles. Hinged safety grates are mounted below the cover to prevent operators accidentally falling into the wet-well. The individual covers are opened only during pump removal. The covers are sized to suit the pump and valve access requirements and the hinge assemblies and step down frame is cast into the cover slab.

Caprari advise that their aluminium covers are not water or gas tight. The cover slab is set above ground level if rainwater surface infiltration is likely. The height of the cover slab above ground level is specified on the Project Drawings to conform to the Water Agency requirements.

Alternatively, Caprari-CPC can be offered with aluminium covers and safety grates from suppliers such as McBerns which are gas tight. Refer to the below link for details:

[http://www.odours.com.au/IW/Products/McBerns-Products-\(1\)/Safety-Lids.aspx](http://www.odours.com.au/IW/Products/McBerns-Products-(1)/Safety-Lids.aspx)

Caprari has indicated that aluminium post inserts for corner posts for rail safe telescopic guardrail system can be cast into the cover slab or mounted underneath the cover.

Caprari-CPC aluminium covers, when subjected to centrally placed load of 120 kg, did not exceed the 20 mm deflection of the cover, as specified in Clause 5.8 of the Sewage Pumping Station Code of Australia, WSA-04-2005.

Caprari-CPC safety grates can be made to order with a suitably located lockable access point and cover of minimum size 300 mm x 300 mm to allow easy access for maintenance of all level sensing equipment. Safety grates are provided as standard on all Caprari-CPC pump stations.

The aluminium cover design allows the cover to be opened fully and laid flat.

For valve chamber depths greater than 1.5 m, Caprari recommend safety grates.

6.2.1.12 Mechanical Electrical fit-out and other related accessories

Caprari-CPC partners can offer full scope of options as required for the specific water authority specification including, pipework, valves, lifting chains, guide rails, all associated electrical components including switchboard and remote communications requirements.

6.2.2 General design requirements

Caprari has supplied structural calculations and drawings by a suitably qualified engineer, using appropriate design methodology and relevant standards for the standard precast concrete components, in the size ranges offered by Caprari up to a maximum depth of 15 metres.

The following design loads were considered in the calculations:

- Water density - 10 kN/m³
- Concrete density - 24 kN/m³
- Soil density - 20 kN/m³
- Active earth pressure coefficient (Ka) - 0.4
- Traffic loading - class D
- Surface live load – 3 kPa
- Point loads – 48 kN
- Wheel track – 1800 mm
- Wheel base – 1200 mm

Accompanying the structural calculations and drawings is a design verification statement, signed by a Registered Professional Engineer of Queensland from FYFE Pty Ltd.

The design calculations and associated drawings compiled by FYFE Pty Ltd have incorporated the following requirements:

- An exposure Classification of D (severe/extreme) has been used for all wall surfaces;
- 80 kN vehicle loading has been assumed;
- The capacity of the cantilever covers slab extension;
- Liquid depth 2 m in normal operating range. Calculations for full immersion have been taken into consideration;
- Floatation calculation for an empty chamber with an overall depth of 15m, with ground water level 1.5 m below surface level; and
- A buoyancy re-check with ground water table at the surface level

The requirements of this appraisal have now been met with respect to general design requirements, product type testing, auditing of production quality control systems, review of documentation and guidance for designers, installers and operatives and the products are seen as 'fit for purpose'.

6.2.2.1 Structural integrity

The Caprari pump station utilises a S50 (50 MPa) Special mix concrete. In accordance with AS 3735 the minimum requirement for cover over reinforcement is 45 mm.

FYFE Pty Ltd's Structural Division has prepared computations and construction notes for the 2 m and 3 m diameter concrete components. The design criteria include the following:

For the 2 m and 3 m diameter assembly:

- (a) The overall height of the base section is 2 m. The reinforced wall is tapered and has a minimum thickness of 140mm at the top with a rebate key formed to accept the riser section and sealant.
- (b) Maximum depth – 15 m
- (c) Liquid depth – 2 m in normal operating range Calculations for full immersion have been taken into consideration.
- (d) An exposure classification of D (Severe/extreme)

FYFE Pty Ltd specifications include:

- (a) All concrete elements are to be precast in steel forms using intense vibration.
- (b) The maximum wheel loading on the cover slab is 80 kN (8 Tons). Cover Slabs designed for higher loadings to suit heavy duty covers.
- (c) Floatation calculation for an empty chamber with an overall depth of 15m, with ground water level 1.5 m below surface level; and
- (d) Buoyancy re-checks with ground water table at the surface level.

FYFE Pty Ltd computations have been submitted to verify the design of the concrete components. Using calcareous aggregate, 10 mm loss of material has been allowed for the structural design. The computations include:

- For the 2 m and 3 m diameter wet-well - structural strength to 15 m deep and an exposure classification of D (Severe/extreme).
- The integral valve chamber structural strength computations are based on the protruding structure being cantilevered and not relying on backfill for support.

The Pumping Chambers are available in two systems.

6.2.2.2 *Model CapCpc-System 2 - 2000 mm diameter pump wet-well*

The Base Chamber has an internal diameter of 2000 mm, overall height of 2000mm and internal depth of 1750mm.

The base slab has an overall thickness of 250mm. The overall base diameter is 2570mm, and there are two flat sides giving an overall width of 2280mm and is within the limit for non-over width transport. The inside has a 350mm high non-symmetrical benching or batter to prevent solids builds up in the 'dead area' behind the pump discharge bends.

The mould formed method of manufacture provides a steeper and more efficient sludge batter than is possible with separate pouring and being part of the reinforced base there are no shrinkage cracks that require post-cast sealing. The overall height of the base section is 2000mm. The reinforced wall is tapered and has a minimum thickness of 140mm at the top with a rebate key formed to accept the riser section and sealant.

Increments ranges are available in 500mm, 750mm, 1000mm, 1250mm and 1500mm heights and also have a minimum wall thickness of 140mm.

Overall depth up to 15 m can be achieved.

6.2.2.3 *Model CapCpc-System 3 - 3000 mm diameter pump wet-well*

The Base Chamber has an internal diameter of 3000 mm, overall height of 2000mm and internal depth of 1750mm.

The base slab has an overall thickness of 250mm. The overall base diameter is 3570mm, and there are two flat sides giving an overall width of 3280mm and is within the limit for non-over width transport. The inside has a 475 mm high non-symmetrical benching or batter to prevent solids builds up in the 'dead area' behind the pump discharge bends.

The mould formed method of manufacture provides a steeper and more efficient sludge batter than is possible with separate pouring and being part of the reinforced base there are no shrinkage cracks that require post-cast sealing. The overall height of the base section is 2000mm. The reinforced wall is tapered and has a minimum thickness of 140mm at the top with a rebate key formed to accept the riser section and sealant.

Increments ranges are available in 500mm, 750mm, 1000mm, 1250mm and 1500mm heights and also have a minimum wall thickness of 140mm.

Overall depth up to 15 m can be achieved.

6.2.2.4 *Precast concrete cover slabs*

The cover slab has been designed for a vehicle loading based on W80 wheel load as defined in AS 5100.2:2004 *Bridge Design, Part 2:Design Loads*.

The Precast reinforced concrete cover slab is 250mm thick on both 2 m and 3 m diameter wet-wells, with various sizes clear openings (to suit the required access) for access to the wet-well and to the valve chamber. Width of the cover slab is 2.5 m and 3.5m for the 2 m and 3 m diameter wet-wells, respectively.

The cover slab is 5 m long for the 3 m diameter wet-well and valve chamber. The 2 m diameter standard extended slab will be 4 m long as it generally supports the same control panel with different volume station.

Various sized extended cover slab are be available for both size wet-wells to suit project requirements and where necessary a counter balance will be integrally cast. The extended cover slab will provide adequate sizing for fitment of electrical switchboards. The cover slabs are also available without the valve chamber extension for use when the external valve chamber is adopted.

The underside is flat and does not have the 'locator blocks' which is not necessary as the use of them was stopped approximately 12 years ago by CPC. The 'locator blocks' often became cumbersome and fiddly to work with and most times resulted in being damaged. Some other branded cover slab has 'locator blocks' to key with the riser section and prevents any lateral dislocation or movement.

The Caprari-CPC design top increment that has the cover slab on it will be a full width wall of minimum thickness of 140 mm. The joint between the 'top increment chamber' and 'cover slab' will totally be sealed off using Bostik 5240.

From past experience of the manufacturer there have not been any known reports or complaints regarding root infiltration or problems associated with cover slabs.

6.2.2.5 External Valve Chamber

Caprari-CPC Package Pump Station utilizes a stand-alone external valve chamber to house the non-return valves. The valve chamber dimensions are 1500mm x 1500mm, with an internal dimension of 1200mm x 1200mm, minimum wall thickness of 150mm, overall height of 1400mm and internal depth of 1200mm.

The base slab thickness is 200mm. The cover slab overall top dimension is 1900mm x 1900mm x 150mm thick.

6.2.2.6 Cover to reinforcement for corrosion protection

Based on a minimum concrete strength of 50 MPa and exposure classification 'D' FYFE Pty Ltd directions on cover to reinforcement shall be a minimum of 65 mm to all internal surfaces of the main chamber complying with Clause 7.4.1 of TS 68 and Clause 4.4.3 (Table 4.3) of AS3735 requirements.

6.2.2.7 Precast Concrete Packaged Pump Station – Buoyancy Check

FYFE Pty Ltd has submitted guideline/parameters for ballast calculations to prevent hydrostatic uplift of precast concrete pump station.

All underground structures are potentially subject to hydrostatic loading from ground water should it be present. Where this loading is greater than the self-weight of the structure it is possible the structure could move due to buoyancy forces. There are numerous ways the potential movement due to buoyancy can be eliminated. These include:

- Placement of backfill material either concrete, soil or a combination of both over or around the structure to act as ballast against the uplift forces;
- Anchoring the unit to the underlying soil;
- Increasing the dead weight of the structure; and/or
- Decrease the hydrostatic loading by either removing or lowering the level of ground water around the structure.

FYFE has submitted a buoyancy check for a 3m pump station using the 'backfilled soil' as the ballast, based on the following conditions:

- a) Overall depth is 15m, height of water surrounding the station is 13.5 and the surrounding soil is saturated up to 1.5m below the surface level;
- b) Buoyancy re-check for water table at the surface level
- c) Overall width is 3.57 m (for a 3m station) that would be subjected to uplift force;
- d) In determining the self-weight of the station (base, increments and cover), it is assumed any removable equipment including the pumps are not in place;
- e) The station is completely empty with no water/ sewage present to provide downward loading;

- f) Backfill materials are cohesionless with no soil friction present;
- g) Volume of 'soil core' surrounding the station tapered at 10 degree from base to cover slab; and
- h) Weight of ballast material is adjusted to take into account the hydrostatic loading on it.

The ballast calculations are based on parameters as detailed in Table 5:

Table 5: Parameters for ballast calculations

Parameter	Value
Weight of water	10 kN/m ³
Weight of ballast concrete	24 kN/m ³
Nett ballast loading	14 kN/m ³
Weight of soil backfill	20 kN/m ³
Nett ballast loading	10 kN/m ³
Factor of Safety for	
a) up thrust due to buoyant forces	1.50
b) resisting force due to dead weight of precast components (base + increments + cover) against potential uplift	0.90

Buoyancy check

FYFE concluded the 'resisting forces' due to self-weight of the station (i.e. base + increments + cover) is 3.55 times more than the uplift force.

Refer to Appendix A3 (page 9 of 9 of FYFE computation).

Cover Slab Design

- Type 1 – This is a simple span calculation; 3.2m span, 1.0m width, 250mm thick, with two 48kN loads spaced @ 1.2m centres.
- Type 2 – Very conservative design of 1.8m cantilever from edge of pump station (total slab length = 5.0m)

In reality the cantilevered section will actually bear on the surface surrounding the circular pump station. The live loads considered are also conservative as due to the presence of the control panel and vent stack the two point loads will not occur at the same time.

Refer to Appendix A3 (page 3 of 9 of FYFE computation).

Buoyancy re-check

As a worst scenario case another 'buoyancy check' was done considering the surrounding soil is completely saturated to the surface level resulting in hydrostatic loading of the station for its full depth of 15m.

- Upthrust = 2210 kN (including FOS = 1.5)
- Resisting Forces = 3660 kN (including FOS = 0.9)
- Ratio = 1.65; the resisting force is still 1.65 times more than the uplift force.

Refer to Appendix C.

6.2.3 Product type testing

There is no specific Australian or international standard that provides manufacturers, designers and installers with a document that outlines the specific criteria required to produce modular precast concrete chambers for packaged pump stations for sewerage application.

In Australia and New Zealand Precast Concrete Access Chamber for Sewerage Applications are manufactured in accordance with AS 4198. However AS 4198 is limited to precast concrete access chambers intended for use with buried sewer pipes to a depth of 6 m and for pipes not greater than 300 mm in diameter.

AS/NZS 1546.1 specifies performance requirements and performance criteria for septic tanks, technical means of compliance and provides test specifications that enable septic tanks to be manufactured to comply with the performance requirements and performance criteria. The scope of the standard is limited to domestic wastewater of up to 14,000 litres per week; well below the volume of flows that will be seen in a sewage pump station.

Inspection and testing for serviceability and durability should be carried out on completion of construction. The Constructor is required to undertake acceptance testing of all sewers, pressure mains, wet wells and structures in accordance with the requirements in the Design Specifications.

At an appropriate time after completion the wet-well should be tested for liquid-tightness. The purpose of this test is to verify the leak tightness of the joints and penetrations.

Caprari state that final testing for liquid retention is a responsibility of the Constructor. If units are installed correctly and in accordance with Caprari's installation requirements then Caprari take responsibility.

6.2.4 Review of the documentation and guidance for designers, installers and operatives

Caprari provides customers with documents for submission of their pump station requirements, plus diagrams for customers/designers to nominate pipe positions for factory cored apertures. Also provided to customers is a list of items required to be completed prior to installation and/or commissioning of the pump station.

Refer to Section 8 for further information.

7 WSAA NETWORK REQUESTS

The network raised the following questions:

Question 1: What has driven the need for an increase to cover to reinforcement for the precast pumping chamber?

Answer 1: The pump chambers are subjected to sulphuric acid attack that can exist in sewerage applications. The additional concrete layer available now becomes sacrificial and extends pump station life up to 100 years. Caprari-CPC chambers have a minimum cover to reinforcement to the liquid retaining structure of 65mm, and a minimum to other surface of 50mm.

SA Waters Technical Standard TS 68 (Reinforced Concrete Construction for Liquid Retaining Structures and/or Aggressive Environments) influenced the Caprari-CPC design. The aim is to achieve a 100 year design life as per clause 1.3 of TS 68, and the new pump station conforms to clause 7.4.1 – Cover.

Question 2: Why have the pump chambers been designed to 2 m and 3 m internal diameter when some water authorities have requirements for 2.1 or 2.2 or just over 3 m in diameter?

Answer 2: The 2 m and 3 m internal diameters were chosen as an optimum balance between strengthening the pump station by including additional wall thickness and retaining an overall external dimension which allows for ease of transport, loading and installation.

Question 3: Do we have to purchase the pump chamber from Caprari Pumps Pty Ltd?

Answer 3: The Caprari-CPC pump chamber is available nationwide directly from the distributor in the local area. This ensures that the chambers are provided and fitted out to local water authority requirements in terms of mechanical and electrical specifications. Furthermore there is a local and strong presence to support the product.

Question 4: Are you able to offer electrical design and support, as we want a complete turnkey offer that includes the control panel and associated electrical components?

Answer 4: The Caprari-CPC distribution team has extensive electrical and mechanical design capability and will work with the project requirements. In house capability is available or specific electrical contractors as nominated by the client can be utilized.

Question 5: What options are available with housing the valve pit and or flowmeters.

Answer 5: The new pump station design keeps all required additional structures that house either valves or flowmeters separate to the main chamber. These chambers can be project specific or standard pits in nominal sizes as required by the client. Having separate chambers enables backfilling and compaction to be implemented right around each structure. Furthermore one structure will not bear any load on the other as they are independent therefore ensuring long life expectancy and absolutely no risk of separation or differential movement.

If there is a preference for an internal or integral valve chamber this arrangement is an available option within the CapCpc System -2 (2 m dia range of pump chambers).

Question 6: What further options are available in providing added protection to the pump station chamber?

Answer 6: Poly lining unique Agru HDPE lining can be set into the concrete at time of casting to meet the emerging requirements of Water and Government Authorities in aggressive conditions. The service life of the pump chamber may be increased to 100 plus years. Epoxy Coating is also an option that is offered to further enhance durability.

Question 7: Are aluminium two parts light duty covers and above ground handrails options available for the Caprari-CPC package pump chambers. What other options are available for the chamber covers?

Answer 7: Yes there are full design drawings and options available for the pump chambers which include aluminium safety grates, single or multipart hinged lids and above ground safety and handrails when required.

Cooke Precast are also distributors of various branded cast iron light duty or heavy duty access covers and frames complying with AS 3996.

Question 8: Water Agencies have raised concerns about the concrete chambers floating, lifting out of the ground particularly in high water table areas.

Answer 8: The Caprari-CPC pump chamber has been designed to withstand buoyancy pressures up to its design depth of 15 m and is suitable for areas with the water table 1.5 metres from ground level surface even when the tank is empty. Other products in the market need to be modified or require additional ballast to be added to achieve a similar result.

Question 9: Why have you redesigned the lifting points and anchors on this new range of pump chambers to lift from the top?

Answer 9: Water Agencies and contractors have experienced difficulties in managing and handling the main pump chamber and its increments. In some cases lifting increments from the sidewall embedded anchors has caused pump chamber damage which necessitates patching and repair of products on site.

The new-patented design 'SwiftLift Rod' eliminates the risk of damage and ensures easier handling of the chamber and its increments on site.

Question 10: The Caprari-CPC packaged precast concrete sewage pumping station is a turnkey product which comprised of civil works (i.e. installation of precast segments, provide excavation, trenching and back fill works, water supply and site restoration) and mechanical and electrical fit-out. Which parts of the package does Caprari take responsibility for? Who provides the warranty for the completed packaged pump stations and how many years from the date of installation? Any conditions for such warranty.

Answer 10: Caprari-CPC partners can offer the pumping chamber; package as a supply contract or supply and installation contract as required by the specific project.

Supply and Installation is generally limited to the precast pumping chamber, mechanical and electrical fit out of the pump chamber and valve pit, and in this case all associated works in this scope will be warranted.

It is envisaged in the future that Caprari will supply the pumping chamber only. Installation and mechanical and electrical fit out would be by others. Caprari-CPC can offer supervision of installation of chamber on request. If correct installation is conducted the product is warranted as per manufacturer's criteria.

Excavation, backfilling, supply of potable water, site restoration and power to site is not considered as part of scope of work.

Question 11: How many precast concrete packaged pumping stations have Caprari supplied till now in Australia. Please provide the list of customers?

Answer 11: Cooke Precast Concrete (CPC) who manufacture Caprari-CPC concrete chamber, are Australia's leading supplier of concrete pumping chambers and therefore are considered an authority and one of the most experienced manufacturers of pumping chambers in the market today.

The new design simply has taken on board the market feedback and customer requests over the years to supply a more robust pumping chamber. Therefore based on SA Water TS 68 requirement of minimum cover to reinforcement have ended up with a pumping chamber that has minimum wall thicknesses of 140mm right throughout all sections of wet-well.

The actual raw material being used, method of construction, set up of reinforcement in concrete, vibration techniques, quality assurance, and accumulated experience over many years have not changed from previous pump stations that have been supplied and been in use in the field.

CPC are experts in this field and know how to manufacture, transport, lift, core holes, assemble the pump stations and provide onsite assistance when required. In addition the partnership between Davalan Concrete who supplies the raw material to CPC is also one that has been proven and tested over time which we are proud to continue with, in the new Caprari-CPC pumping chamber range. Caprari-CPC combined with the leading expert mechanical/electrical partners Australia wide will provide a first class product with strong back up and support nationwide.

Question 12: Is it possible for liquid to leak out of the pumping station or for groundwater to ingress?

Answer 12: If the pump chamber is installed correctly there is no possibility of both ingress and egress of water.

Question 13: Is a cored hole in a reinforced component likely to expose any steel? If so what assurance is there that the steel will be adequately covered by epoxy or mortar and prevent corrosion?

Answer 13: Steel is likely to be exposed; however the cover to steel is reinstated when the fitting is epoxied into position.

Question 14: Mastic joints are rated as water resistant but can they withstand differential soil movements or are they only suitable for homogeneous sandy soils of uniform moisture? Does Caprari recommend the use of flexible joint mastic joints in clay soil, particularly in saturated conditions?

Answer 14: Yes, CPC uses and has had a lot of success with a Bostik product (5240 sealing strips). Bostik 5240 is a soft synthetic rubber sealing strip that can withstand extreme heat and cold conditions and still retain its sealing, adhesive properties and resilience. Bostik 5240 will maintain a flexible seal after many years of exposure to the elements.

Question 15: What grade of aluminium checkered plate used to fabricate the covers and do they comply with AS 1734; and whether the design and fabrication in accordance with AS 1664?

Answer 15: The grade of Aluminium used is 5005 primarily this grade of aluminium welds accurately and therefore meets the Australian standards AS1734 and AS1664.

Question 16: Does the welding and inspection of aluminium fabrication (for wet-well and valve covers) comply with the requirements of AS 1664?

Answer 16: The requirements of AS 1664 are met.

Question 17: Does Caprari offer a pump station design and drafting service? Or is it outsourced?

Answer 17: Caprari Pumps can offer drafting service and design service.

Question 18: Can a fibre reinforced plastic ladder system be installed?

Answer 18: This can be offered for specific projects, if required.

Question 19: How does Caprari address vapor attack on the underside of the cover slab?

Answer 19: Vapour attack is prevented via the use of Megapoxy MC when requested.

Question 20: What are the advantages of precast Concrete Sewage Pumping Station?

Answer 20: Advantages are as follows:

- a) The Caprari CPC pump chamber has a minimum wall thickness of 140mm and the cover to reinforcement on the liquid structure is minimum 65mm which provides 100 year life.
- b) The Caprari-CPC chambers are made from Angaston Marble calcareous aggregate, providing the highest possible resistance to sulphate attack.
- c) The primary chamber is cast as one piece therefore no issues with separation or leaks as the case with pipe to base systems. Primary chamber has lifting points / anchors rated at 5 tons each enabling safe and easy lifting transportation and facilitating site installation. There is no need for personnel to climb into the primary chamber to hook up to the lifting points then climbing back in to unhook, and if lifting points are in the base floor they need to be covered as they are, then at risk of corrosion as they are exposed.
- d) Precast chamber designed to 15 metres depth with no floatation possible.
- e) Components are standard manufacture and quality, is consistent every time.
- f) Battering / slopes are cast and therefore aid in optimising hydraulic intake to pump inlet also direct wastewater solids to centre of pump chamber.
- g) Caprari -CPC chambers have four reinforced columns built into the entire length of the primary chamber and all segments and extensions, this provides for a more stable area for the cover slab to sit on.

Question 21: Can block-outs instead of core penetrations be used and is it possible to specify an integrally cast embedded pipe connector into a precast concrete segment.

Answer 21: Mould manufacture and assembly will not allow either of these opportunities as generally no one pump station has the same penetration locations as another.

8 FITTING INSTRUCTIONS, TRAINING AND INSTALLATION

Caprari-CPC provide customers with proforma documents for submission of their pumping station requirements plus diagrams for customers/designers to nominate pipeline positions for location factory cored apertures. There are also documents for the customer to complete advising Caprari of the required delivery dates and programmed commissioning dates. Caprari also provide a checklist of items required to be completed prior to commissioning of the pumping station.

Caprari advise that installation is usually carried out by experienced civil contractors but the modular design provides a simple and trouble free assembly. However, a Caprari representative will be made available to provide specialised assistance or to oversee the installation.

The pumping station is delivered in numbered segments fully pre-cored in accordance with design if requested. The pumping station concrete components are fitted with spherical head lifters 'cast in' for ease and security of slinging, lifting and placement. Location keys moulded in each joint ensure no rotational misalignment can occur.

Caprari provide a general installation guideline to enable agencies to follow the assembly and ensure the installation proceeds in accordance with the manufacturer's expectations. These guidelines are for use with the specific instructions provided with each pumping station. If required, Caprari can also supply on-site supervision and technical assistance through to complete pumping station installation and commissioning contracts in most regional areas via their network of affiliated companies and authorised distributors.

At the completion of commissioning Caprari provide the Asset Owners with Operation and Maintenance Manuals in accordance with the specified requirements. Refer to Appendix A6 for further information.

8.1 Backfill Requirements

Caprari recommends the consulting engineer conducts a site investigation to establish indicative subsurface conditions prior to the commencement of construction.

Caprari has submitted backfill requirements and construction notes for correct installation procedures, as detailed below. The Construction Notes are based on normal site conditions which are free of groundwater and apply to installations in cohesive and non-cohesive soils. Sites which have ground water will need dewatering for construction purposes.

- a) The units shall be installed to the correct line and level, and in a manner that is safe and which will not cause damage to the unit. All installation shall comply with statutory workplace regulations.
- b) All soils under the units shall be compacted to not less than 95% standard compaction.
- c) A 100mm layer of quarry rubble shall be placed under the base of the unit and compacted to not less than 98% standard compaction.
- d) The rubble base shall be true to line and level and finished to provide a firm uniform base on which to place the unit.
- e) Bostik 5240 sealing strip shall be provided between all joints in the walls and cover slab as applicable for individual project. The mortar or strip shall be installed in accordance with manufacturer's specifications.

- f) Backfill around pits shall be natural soils, free from clay lumps, vegetation, or other deleterious materials, or quarry materials. Some Water Authority has special requirements such as City West Water Melbourne would require a granular backfill to ensure adequate compaction for tanks, trucks and crane trucks. Caprari can provide the required backfill material as per Client's request.
- g) All backfill placed around the unit shall be placed in uniform layers around all sides of the units.
- h) The backfill around and over the unit, to within 500mm of finished ground level, shall be compacted to not less than 95% standard compaction.
- i) The backfill within the top 500mm of finished ground level, shall be compacted to not less than: -
 - 98% standard compaction for units installed in roadways, paved areas, areas subject to traffic etc.
 - 95% standard compaction for units in non-trafficable areas.
 - Any greater compaction if specified by others for the overall storm water installation.

9 PRODUCT MARKING

Caprari distributors stencil their name and contact details on the cover slab. Caprari suggest that traceability is not an issue with pumping stations as their manufacture and specification is normally well documented in records held by the water agency.

10 PACKAGING AND TRANSPORTATION

Caprari are responsible for delivery of the precast concrete components to site. The precast components are loaded onto the truck using timber chocks between and beneath each component. Transportation follows an agreed procedure that includes re-tensioning chains after the first 20 km. Cooke Precast Concrete Pty Ltd provides the transport driver with a checklist for each item to be signed off as inspected by the driver, loader and receiver at the construction site. The checklist also carries a diagram of the slinging procedure to ensure no damage occurs at the rebate joint. Refer to Appendix J.

11 PRODUCT WARRANTY

This product is covered by the normal commercial and legal requirements of the Competition and Consumer Act 2010, which covers manufacture to the relevant standard, which in this case for concrete is AS 3972:2010 *General purpose and blended cements*. Additional warranties may be negotiated on a project specific basis.

12 WATER AGENCY EXPERIENCE WITH THE PRODUCT OR FIELD TESTING REPORT

At the time of WSAA submission, Caprari have delivered presentation twice to SA Water who have indicated that they will accept the newly designed pumping station for trial.

The point to be highlighted is that the manufacturer of Caprari-CPC chamber is CPC (Cooke Precast Concrete) who are an approved supplier of products to SA Water and government agencies, and have over the years manufactured precast pumping chambers for distribution by others for decades.

CPC have extensive experience in the manufacture of chambers and are situated in the same premises as Davalan Concrete who are the current supplier of raw material for manufacture of chambers again a relationship and partnership that has been proven over time.

Over the years the number of pumping chambers manufactured by CPC is estimated to be around 1500 pumping chambers.

The pump chamber is available for inspection at Cooke PreCast Concrete Pty Ltd. In addition a cutaway model has also been manufactured with a substantial section of the wall cut out which exposes the position of the reinforcement in relation to the concrete cover. It has been noted that the minimum cover of 65mm to the liquid retaining structure has been achieved right through the product.

The Caprari-CPC product has been strengthened in areas that have been found to previously have limitations, therefore this product exceeds all others precast pumping chambers on the market in terms of strength, robustness, life expectancy, and ease of handling on site.

13 DISCUSSION

Caprari-CPC supplies packaged precast pumping stations in two sizes 2000 mm and 3000 mm diameter with integral or separate valve chambers Caprari design with the integral valve chamber is compact and provides a fully sealed yet drained valve space with no differential settlement or interconnecting pipework and a short one-way drain line.

The mould formed concrete components of the pumping station are intensely vibrated to create an 'off steel' finish to AS 3610 Class 2X without laitance. Caprari guarantee the cover to reinforcement and no separation of concrete and reinforcement. The base is one piece form a single mould, therefore has no shrinkage and provides maximum strength. The single mould base section provides a watertight enclosure to the normal maximum height of sewage during pumping, eliminating the possibility of head pressure leakage through the floor slab.

Cooke Precast has advised that in over 30 years of manufacturing the precast concrete pumping station components.

Whilst computations have been provided for nominated depths for each size of wet-well, Caprari-CPC has advised that site specific calculations can be done if there is a requirement for a deeper chamber or a chamber location in specified severe adverse conditions.

The Caprari-CPC range of Precast Concrete Sewage Pumping Stations incorporates a range of optional items beyond the reasonable scope of this appraisal. The many variations result in an adaptable product designed to satisfying the requirements of water agencies for Sewage Pumping Stations in this size range.

The optional items available but not included in this appraisal are:

- (a) PE and DI pipe work and 'Y' piece variations;
- (b) All valves;
- (c) Pumps, rails, mounting and bracing brackets, baffle plate and lifting chains;
- (d) Level controls;
- (e) Auto well washer;
- (f) Ladders and Platforms;
- (g) Vent piping;
- (h) Odour Filter;
- (i) Control panel and electrical wiring;
- (j) Agru concrete connection socket;
- (k) HDPE concrete protective liners;
- (l) Epoxy Coating;
- (m) SS 316 plates for connecting segments;
- (n) Non-trafficable aluminium covers;
- (o) Aluminium access safety grates;
- (p) Pump Anodic protection;
- (q) Trafficable and non-trafficable ductile iron access covers and frames;

- (r) By Pass Scour to wet well;
- (s) Emergency Bypass complete with isolation valve, check valve and access spigot; and
- (t) Flowmeter (electromagnetic) with isolation valve and dismantling joint

14 LIFE EXPECTANCY

The life expectancy of unprotected concrete sewer structures is impossible to nominate in general terms. Sewer conditions vary widely in Australia and levels of septicity that generate concrete corrosion are many and varied. The factors include sewage type, sewage age, sewage temperature, and ventilated or sealed sewers. In highly corrosive installations it is recommended that additional measures are adopted to protect or reduce the corrosive effect on the exposed concrete surfaces. To assess the life expectancy of the Caprari-CPC precast concrete pumping chambers it is recommended that agencies draw on their local knowledge and look for advice from Caprari. To provide a basis for life expectancy estimation the following is recommended:

"Based on the documented product conformance to the nominated standards and installation in compliance with the manufacturer's instructions in locations subject to 'normal domestic' sewage in a fully ventilated sewer, at temperatures below 20°C, this product range has been rated 'B' - Life expectancy in excess of 50 years before major rehabilitation. This rating is only a general guide to life expectancy and may increase or decrease as a result of the quality of installation, system operating conditions, operating environment and other geographical and site specific factors".

However Caprari-CPC pump station has an extended life expectancy due to the minimum wall thickness of 140 mm, which offers minimum concrete cover to reinforcement to the liquid retaining side of 65 mm. The life expectancy is expected to be 100 years. The Caprari-CPC chamber sets a new standard in the area of cover to reinforcement within the precast pumping chamber category. It is important for the cover to reinforcement to be adequate throughout the whole structure and to extend throughout the pump station chamber design.

The above statement is to highlight that the increased concrete cover (65 mm instead of 45 mm) to the steel reinforcement becomes a sacrificial layer which does increase life expectancy of the pump chamber. Refer to Clause 6.2.1.2 and Clause 6.2.1.4 which describe how the sacrificial layer increases the life expectancy of Precast Concrete Sewage Pump Station.

In the lower section the wall thickness and cover to reinforcement is greatly increased. However the consistency of wall thickness and cover to reinforcement is often lost with traditional designed precast pump chambers particularly as we move to the upper levels of the primary chamber and continues to be lost in all incremental sections that are added to build the pump chamber in total. Caprari-CPC offers peace of mind knowing that the robustness and cover to reinforcement has been designed throughout every section and component, the product is only as good as its weakest link, therefore designing the weakest link out ensures the longest life of pump station in the class of precast pumping chambers currently in the market.

15 FUTURE WORKS

Within 12 months from the date of publication of the report Caprari are required to provide comparative performance data for the Bostik 5240 sealing strip against ASTM C990-09.

16 REPORT RECOMMENDATIONS

It is recommended that WSAA Members and Associates, subject to any specific requirements of the Member or Associate, accept or authorise the Caprari-CPC range of Precast Concrete Sewage Pumping Stations, as detailed in this report for use in sewerage networks provided pipeline design, installation, acceptance testing and commissioning are

in accordance with relevant WSAA Codes, WSAA Member Integrated Codes, and the manufacturer's requirements.

Water Agencies considering installing an Caprari-CPC Precast Concrete Sewage Pumping Stations at depths greater than 10 m are advised to consult with Caprari Pumps Australia Pty Ltd representatives.

17 DISCLAIMER

This Product Appraisal Report (Report) is issued by the Water Services Association of Australia Limited on the understanding that:

This Report applies to the product(s) as submitted. Any changes to the product(s) either minor or major shall void this Report.

To maintain the recommendations of this Report any such changes shall be detailed and notified to the Product Appraisal Manager for consideration and review of the Report and appropriate action. Appraisals and their recommendations will be the subject of continuous review dependent upon the satisfactory performance of products.

WSAA reserves the right to undertake random audits of product manufacture and installation. Where products fail to maintain appraised performance requirements the appraisal and its recommendations may be modified and reissued. Appraisal reports will be reviewed and reissued at regular intervals not exceeding five (5) years.

The following information explains a number of very important limits on your ability to rely on the information in this Report. Please read it carefully and take it into account when considering the contents of this Report.

Any enquiries regarding this report should be directed to the Program Manager, Carl Radford, Phone: 03 8605 7601 email carl.radford@wsaa.asn.au.

17.1 Issue of Report

This Report has been published and/or prepared by the Water Services Association of Australia Limited and nominated Project Manager and peer group of technical specialists (the Publishers).

The Report has been prepared for use within Australia only by technical specialists that have expertise in the function of products such as those appraised in the Report (the Recipients).

By accepting this Report, the Recipient acknowledges and represents to the Publisher(s) and each person involved in the preparation of the Report that the Recipient has understood and accepted the terms of this Disclaimer.

17.2 Limits on Reliance on Information and Recommendations

17.2.1 Disclaimer of liability

Neither the Publisher(s) nor any person involved in the preparation of the Report accept(s) any liability for any loss or damage suffered by any person however caused (including negligence or the omission by any person to do anything) relating in any way to the Report or the product appraisal criteria underlying it. This includes (without limitation) any liability for any recommendation or information in the Report or any errors or omissions.

17.2.2 Need for independent assessment

The information and any recommendation contained (expressly or by implication) in this Report are provided in good faith. However, you should treat the information as indicative only. You should not rely on that information or any such recommendation except to the extent that you reach an agreement to the contrary with the Publisher(s).

This Report does not contain all information that a person might require for the purposes of assessing any product discussed or appraised within it (Product). The product appraisal criteria used in preparing this Report may not address all relevant aspects of the Product.

Recipients should seek independent evidence of any matter which is material to their decisions in connection with an assessment of the Product and consult their own advisers for any technical information required. Any decision to use the Product should take into account the reliability of that independent evidence obtained by the Recipient regarding the Product.

Recipients should also independently verify and assess the appropriateness of any recommendation in the Report, especially given that any recommendation will not take into account a Recipient's particular needs or circumstances.

WSAA has not evaluated the extent of the product liability and professional indemnity insurance that the provider of the product maintains. Recipients should ensure that they evaluate the allocation of liability for product defects and any professional advice obtained in relation to the product or its specification including the requirements for product liability and professional indemnity insurance.

17.3 No Updating

Neither the Publisher(s) nor any person involved in the preparation of this Report [has] [have] any obligation to notify you of any change in the information contained in this Report or of any new information concerning the Publisher(s) or the Product or any other matter.

17.4 No Warranty

The Publisher(s) do[es] not, in any way, warrant that steps have been taken to verify or audit the accuracy or completeness of the information in this Report, or the accuracy, completeness or reasonableness of any recommendation in this Report.

APPENDIX A – TECHNICAL MANUAL AND SPECIFICATION

Refer to Addendum No 1 to this main report to access the below appendices:

Appendix A1	Technical Brochure for Caprari-CPC Pump Station
Appendix A2	Design Standards and Specification for Precast Concrete Pump Station prepared by CPC dated 19/03/2013 on FYFE Pty Ltd letterhead
Appendix A3	FYFE Pty Ltd Engineering Documentation for Cooke Precast Concrete Pump Stations showing design calculations including buoyancy
Appendix A4	Page No. 1 of FYFE Pty Ltd Engineering Computation for Integrated (Pinned) Version
Appendix A5	Sectional Elevation, Plan and Reinforcement Details for a range of Cooke Precast Concrete Precast Pump Stations <ul style="list-style-type: none"> • Cover Slab • Pit Plan, Elevation and Sections • Pit Reinforcement details for pump station depth 15 m or less • Pit Reinforcement details for pump station depth 10 m or less • Pit Reinforcement details for pump station depth 5 m or less • Cover Slab Details and Reinforcement
Appendix A6	Technical Data Sheet for Bostik 5240 sealing strip
Appendix A7	Data Sheet for AGRU Grip® Concrete Protective Liner (mechanically anchored polyethylene protective liners)
Appendix A8	Site Pictures of Caprari-CPC Precast Concrete Sewage Pump Station
Appendix A9	Caprari-CPC Precast Concrete Sewage Pump Station O & M Manual

APPENDIX B - QUALITY CERTIFICATIONS

TABLE B1 CAPRARI PUMPS AUSTRALIA PTY LTD – MANAGEMENT SYSTEMS

Quality Systems Standard	ISO 9001:2008
Certificate No.	CERT0037-94-AQ-IND-SINCERT
Certifying agency	DNV Business Assurance Management System Certificate ¹
First date of certification	29/11/1994
Current date of certification	23/03/2015
Expiry date of certification	17/04/2018

¹ DNV Business Assurance Management System Certificate is not accredited to JAS-ANZ and Stan Nalbandidis, National Product & Customer Support Manager of Caprari Pumps Australia Pty Ltd has stated that Caprari Pumps Australia Pty Ltd is not the manufacturer and operates only as the marketing agency and does not require the higher level of quality certification.

TABLE B2 COOKE PRECAST CONCRETE PTY LTD – MANAGEMENT SYSTEMS

Quality Systems Standard	ISO 9001:2008
Certificate No.	QEC14467
Certifying agency	SAI Global
First date of certification	02/05/2002
Current date of certification	13/03/2014
Expiry date of certification	02/05/2017

TABLE B3 DAVALAN CONCRETE PTY LTD – MANAGEMENT SYSTEMS

Quality Systems Standard	ISO 9001:2008
Certificate No.	QEC 11136
Certifying agency	SAI Global
First date of certification	04/05/1998
Current date of certification	18/02/2013
Expiry date of certification	25/06/2016

TABLE B4 BOSTIK AUSTRALIA PTY LTD – MANAGEMENT SYSTEMS

Quality Systems Standard	ISO 9001:2008
Certificate No.	QEC22260
Certifying agency	SAI Global
First date of certification	16/6/1997
Current date of certification	07/03/2013
Expiry date of certification	06/03/2016

TABLE B5 REID CONSTRUCTION SYSTEMS - MANAGEMENT SYSTEMS

Quality Systems Standard	ISO 9001:2008
Certificate No.	QEC23580
Certifying agency	SAI Global
First date of certification	09/10/2006
Current date of certification	25/07/2012
Expiry date of certification	09/10/2015



DNV BUSINESS ASSURANCE

MANAGEMENT SYSTEM CERTIFICATE

Certificato Figlio No. / Child Certificate No. **CERTCC7-00327-94-AQ-IND-SINCERT**
 Appartenente al Certificato Master No. / belongs to Master Certificate No. **CERT-00327-94-AQ-IND-SINCERT**

Si attesta che / This is to certify that

caprari

CAPRARI PUMPS AUSTRALIA PTY LTD

3, Jeanes Street, Beverley 5009 - Australia
21, Livingston Street, Phillipstown - Christchurch 8011- New Zealand

E' conforme ai requisiti della norma per i sistemi di gestione:
Has been found to conform to the management system standard:

ISO 9001:2008

Questa certificazione è valida per il seguente campo applicativo:
This Certificate is valid for the following product or service ranges:

**Sale and servicing of: centrifugal and electric pumps for deep wells, for dry installations,
 for drainage and sewage, electric pumps for use in potentially explosive atmospheres,
 and related monitoring and control communication systems (Sector EA : 18)**

Data Prima Emissione/Initial Certification Date:

1994-11-29

Il Certificato è valido fino al:

This Certificate is valid until:

2018-04-17

L'audit è stato eseguito sotto la supervisione di/
The audit has been performed under the
supervision of

Gianluigi Borghetti
Lead Auditor



SGQ V003 A P10 8.1003 B
 SGA V003 C SSI V003 C
 SCR V004 F PSN V001 F
 Numero di M.A.T.A. per gli sistemi di controllo remoto SSG,
 SGA, P10, 100, 15 e 150 di M.A.T.A. per gli sistemi di
 controllo remoto SSG, SGA, SSI, PSN e PR2
 e di M.A.T.A. per gli sistemi di controllo remoto L10

Luogo e data / Place and date:

Vimercate, (MB) 2015-03-23

Per l'organismo di Certificazione:

For the Certification Body:

Zeno Beltrami
Management Representative

La validità del presente certificato è subordinata al rispetto delle condizioni contenute nel contratto di Certificazione.
 Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

DNV GL BUSINESS ASSURANCE ITALIA S.R.L. - VIA ENERGY PARK, 14 - 20871 VIMERCATE (MB) - ITALY - TEL. 039.68.99.905 - WWW.DNVGL.COM/IT



CERTIFICATE OF REGISTRATION

This is to certify that:

Cooke Pre-Cast Concrete Pty Ltd

ABN 19 180 139 612

3 Peachey Road Edinburgh North SA 5113 AUSTRALIA

operates a

QUALITY MANAGEMENT SYSTEM

which complies with the requirements of

ISO 9001:2008

for the following scope

The manufacture of precast concrete products in concrete and glass fibre reinforced concrete.

Certificate No: QEC14467

Issued: 14 March 2014

Expires: 2 May 2017

Originally Certified: 2 May 2002

Current Certification: 13 March 2014

Samer Chaouk
Head of Policy, Risk and Certification

Paul Butcher
Global Head – Assurance Services



Registered by:

SAI Global Certification Services Pty Ltd (ACN 108 716 669) 286 Sussex Street Sydney NSW 2000 Australia with SAI Global Limited 286 Sussex Street Sydney NSW 2000 Australia ("SAI Global") and subject to the SAI Global Terms and Conditions for Certification. While all due care and skill was exercised in carrying out this assessment, SAI Global accepts responsibility only for proven negligence. This certificate remains the property of SAI Global and must be returned to SAI Global upon its request. To verify that this certificate is current please refer to SAI Global On-Line Certification register at <http://www.sai-global.com>





CERTIFICATE OF REGISTRATION

This is to certify that:

Davalan Concrete Pty Ltd

ABN 71 008 018 684

Head Office Cnr Peachey & Bellchambers Roads Elizabeth West SA 5112 Australia

Elizabeth West Batching Cnr Peachey & Bellchambers Roads Elizabeth West SA 5112 Australia

Gillman Batching 18 Wilkins Road Gillman SA 5013 Australia

Lonsdale Batching Waddikee Road Lonsdale SA 5160 Australia

operates a

QUALITY MANAGEMENT SYSTEM

which complies with the requirements of

ISO 9001:2008

for the following scope

The manufacture and supply of premixed concrete.

Certificate No: QEC11136

Issued: 22 February 2013

Expires: 25 June 2016

Originally Certified: 4 May 1998

Current Certification: 18 February 2013

Samer Chaouk
Head of Policy, Risk and Certification

Paul Butcher
Global Head – Assurance Services



ISO 9001



WWW.JAS-ANZ.ORG/REGISTER

Registered by:
SAI Global Certification Services Pty Ltd (ACN 108 716 669) 286 Sussex Street Sydney NSW 2000 Australia with SAI Global Limited
286 Sussex Street Sydney NSW 2000 Australia ("SAI Global") and subject to the SAI Global Terms and Conditions for Certification.
While all due care and skill was exercised in carrying out this assessment, SAI Global accepts responsibility only for proven
negligence. This certificate remains the property of SAI Global and must be returned to SAI Global upon its request. To verify that this
certificate is current please refer to SAI Global On-Line Certification register at <http://www.saiglobal.com>



DAVALAN CONCRETE PTY LTD

ABN 71 008 018 684

P.O. Box 200, Elizabeth SA 5112
Email: concrete@davalan.com.au

Tel: (08) 8209 3000
Fax: (08) 8209 3001
Orders: (08) 8240 0122

6/12/11



Davalan
Industries P/L

Tudor
Pavers P/L

Cooke
Precast P/L

Trenel P/L
Sand Supplies

Cooke Precast Pty Ltd
PO Box 130
ELIZABETH 5112

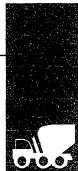
Project: Precast Pump Station 20% Flyash

Strength Grade	S50
Compressive Strength @ 28 days	50 Mpa min
Water Cement Ratio	0.38
Maximum Aggregate Size	10mm
Max Drying Shrinkage	700 microstrain @ 56 days
Slump	80 – 120 mm max
Cement	Adelaide Brighton HE Cement
Flyash	Adelaide Brighton FA
Coarse Aggregates	Penrice Limestone Concrete Agg
Fine Aggregates	Trenel Washed Concrete Sand
Admixtures	Sika Australia Water reducing Admix

Details

ABC	
HE Cement	370kgs
ABC FA	100kgs
PENRICE Angaston	
10mm Agg	1050kgs
Trenel Pty Ltd	
Washed Concrete Sand SSD	630kgs

Water 180 litres
Sika Australia Eco 3w Water reducer – 300mls per 100kgs Cement



Quality
Endorsed
Company

ISO 9001:2008
Standards Australia



CERTIFICATE OF REGISTRATION

This is to certify that:

Bostik Australia Pty Ltd

ABN 79 003 893 838

51-71 High Street, Thomastown, VIC 3074, AUSTRALIA

operates a
QUALITY MANAGEMENT SYSTEM

which complies with the requirements of
ISO 9001:2008

for the following scope

The design, development and manufacture of a range of adhesives, sealants, extruded tapes, rubber and sheet form sound deadeners.
Purchasing activities are carried out at support site: 130 Northcorp Boulevard, Northcorp Business Park, Broadmeadows, VIC 3047, Australia.

Certificate No: QEC22260

Issued: 8 March 2013
Expires: 6 March 2016

Originally Certified: 16 June 1997
Current Certification: 7 March 2013

Samer Chaouk
Head of Policy, Risk and Certification

Paul Butcher
Global Head – Assurance Services



Registered by:
SAI Global Certification Services Pty Ltd (ACN 108 718 889) 288 Sussex Street, Sydney NSW 2000 Australia with SAI Global Limited
288 Sussex Street Sydney NSW 2000 Australia ("SAI Global") and subject to the SAI Global Terms and Conditions for Certification.
While all due care and skill was exercised in carrying out this assessment, SAI Global accepts responsibility only for proven
negligence. This certificate remains the property of SAI Global and must be returned to SAI Global upon its request. To verify that this
certificate is current please refer to SAI Global On-Line Certification register at <http://www.sai-global.com>





CERTIFICATE OF REGISTRATION

This is to certify that:

Reid Construction Systems

A division of

ITW Australia Pty Ltd

ABN 63 004 235 063

1 Ramset Drive CHIRNSIDE PARK VIC 3116 AUSTRALIA

operates a

QUALITY MANAGEMENT SYSTEM

which complies with the requirements of

ISO 9001:2008

for the following scope

The market assessment, design and development as well as the sale, supply and distribution of Concrete Lifting Systems, services and hardware, including anchors and accessories to the pre-cast concrete and reinforcing industries.

Certificate No: QEC23580

Issued: 26 July 2012
Expires: 9 October 2015

Originally Certified: 9 October 2006
Current Certification: 25 July 2012

William Smith
Certification Manager

Duncan Lilley
Global Head – Assurance Services



ISO 9001



WWW.JAS-ANZ.ORG/REGISTER

Registered by:
SAI Global Certification Services Pty Ltd (ACN 108 716 669) 286 Sussex Street Sydney NSW 2000 Australia with SAI Global Limited
286 Sussex Street Sydney NSW 2000 Australia ("SAI Global") and subject to the SAI Global Terms and Conditions for Certification.
While all due care and skill was exercised in carrying out this assessment, SAI Global accepts responsibility only for proven
negligence. This certificate remains the property of SAI Global and must be returned to SAI Global upon its request. To verify that this
certificate is current please refer to SAI Global On-Line Certification register at <http://www.saiglobal.com>

 **SAI GLOBAL**
INFORM INSPIRE IMPROVE

APPENDIX C – FYFE PTY LTD DESIGN VERIFICATION STATEMENT

Our Ref: 50135-2

4 April 2014

Cooke Precast Concrete
3 Peachey Road,
EDINBURGH NORTH SA 5113

Attention: Mr Simon Cooke

PROJECT: PRECAST PUMP STATIONS

RE: 3000mm & 2000mm DIAMETER PUMP STATIONS

We, Fyfe Pty. Ltd., practising structural engineers, confirm that the following designs;

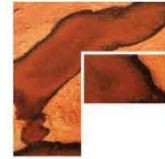
Drawings Reference 50135-2 Sheets S01-S06 (dated 19.03.13)

Specification 50135-2\SP001 (dated 19.03.13)

have been designed to the relevant standards and can be used for a reduced internal diameter of 2000mm. All reinforcement details, thickness dimensions and lifting criteria shall remain unchanged. All dimensions relating to the diameter shall be changed to suit the reduction.



Chris Drew
B.E. (Civil)
FOR FYFE PTY. LTD.



FYFE
Earth Partners
ENVIRONMENT
DEVELOPMENT
RESOURCES

Level 3, 80 Flinders Street
Adelaide SA 5000

GPO Box 2450
Adelaide SA 5001
Telephone 61 8 8201 9600
Facsimile 61 8 8201 9650
www.fyfe.com.au

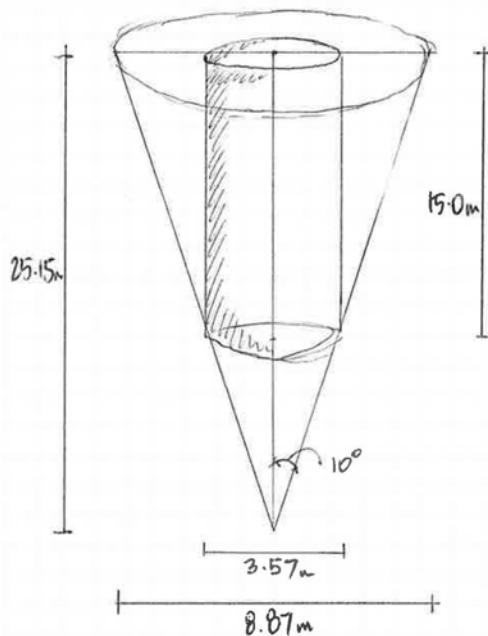
FYFE PTY LTD
ABN 57 008 116 130

DATE 03.04.14 PAGE 9A OF
 REFERENCE SD135-2
 PROJECT NAME CPC PUMP STATIONS
 ACTIVITY DESIGN
 STAFF CODE CRD



BOUANCY CHECK.

Although specifications state that water table level to be a maximum 1.50m below surface level calculations below consider water table at surface.



$$V_{\text{total cone}} = \frac{1}{3} \pi (4.435)^2 (25.15) \\ = 518 \text{ m}^3$$

$$V_{\text{bat cone}} = \frac{1}{3} \pi (3.57/2)^2 (10.15) \\ = 33.9 \text{ m}^3$$

$$V_{\text{cylinder}} = \pi (3.57/2)^2 (15) \\ = 150.2 \text{ m}^3$$

$$V_{\text{soil cone above base}} = V_{\text{total cone}} - V_{\text{bat cone}} - V_{\text{cyl}} \\ = 334 \text{ m}^3$$

Upthrust

$$\text{Pressure @ base} = 15 \text{ m} \times 9.81 = 147.15 \text{ kPa}$$

$$\text{Area} = \pi (3.57/2)^2 = 10 \text{ m}^2$$

$$\text{Force Applied} = 1471.5 \text{ k}$$

$$\times 1.5 \text{ Factor} = 2210 \text{ kN}.$$

DATE	03.04.14	PAGE 10 OF
REFERENCE	50135-2	
PROJECT NAME	CPC PUMP STATIONS	
ACTIVITY	DESIGN	
STAFF CODE	CRD	



Resisting Forces

Drumit :	walls	507 kN
	cover	96.9 kN
	base	<u>60 kN</u>
		663.9 kN.

Soil core: $334 \times (20 \text{ kN/m}^3 - 9.81 \text{ kN/m}^3) = 3403.4 \text{ kN}.$

$\frac{3}{4} = 4067 \text{ kN}.$

$\times 0.9 \text{ Factor} = 3660 \text{ kN}.$

$\frac{3660}{2210} = 1.65 > 1.0 \quad \text{OK}.$

APPENDIX D – FYFE PTY LTD'S RPEQ LETTER

RPEQ – Registered Professional Engineer of Queensland

Our Ref: 50135-2

2 March 2015

Cooke Precast Concrete
3 Peachey Road,
EDINBURGH NORTH SA 5113

Attention: Mr Simon Cooke

PROJECT: PRECAST PUMP STATIONS – RPEQ

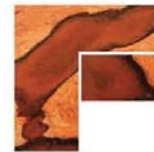
I, Gregory Klopp, RPEQ 6196, confirm that the following designs;

*Drawings Reference 50135-2 Sheets S01-S06 (dated 02.03.2015)**Specification 50135-2\SP001- Updated (dated 02.03.2015)*

Were undertaken under my direct supervision and conform to all relevant codes and standards.



Gregory Klopp
BE (Hons) PhD
RPEQ 6196, MIEAust, CPEng
FOR FYFE PTY. LTD.



FYFE
Earth Partners
ENVIRONMENT
DEVELOPMENT
RESOURCES

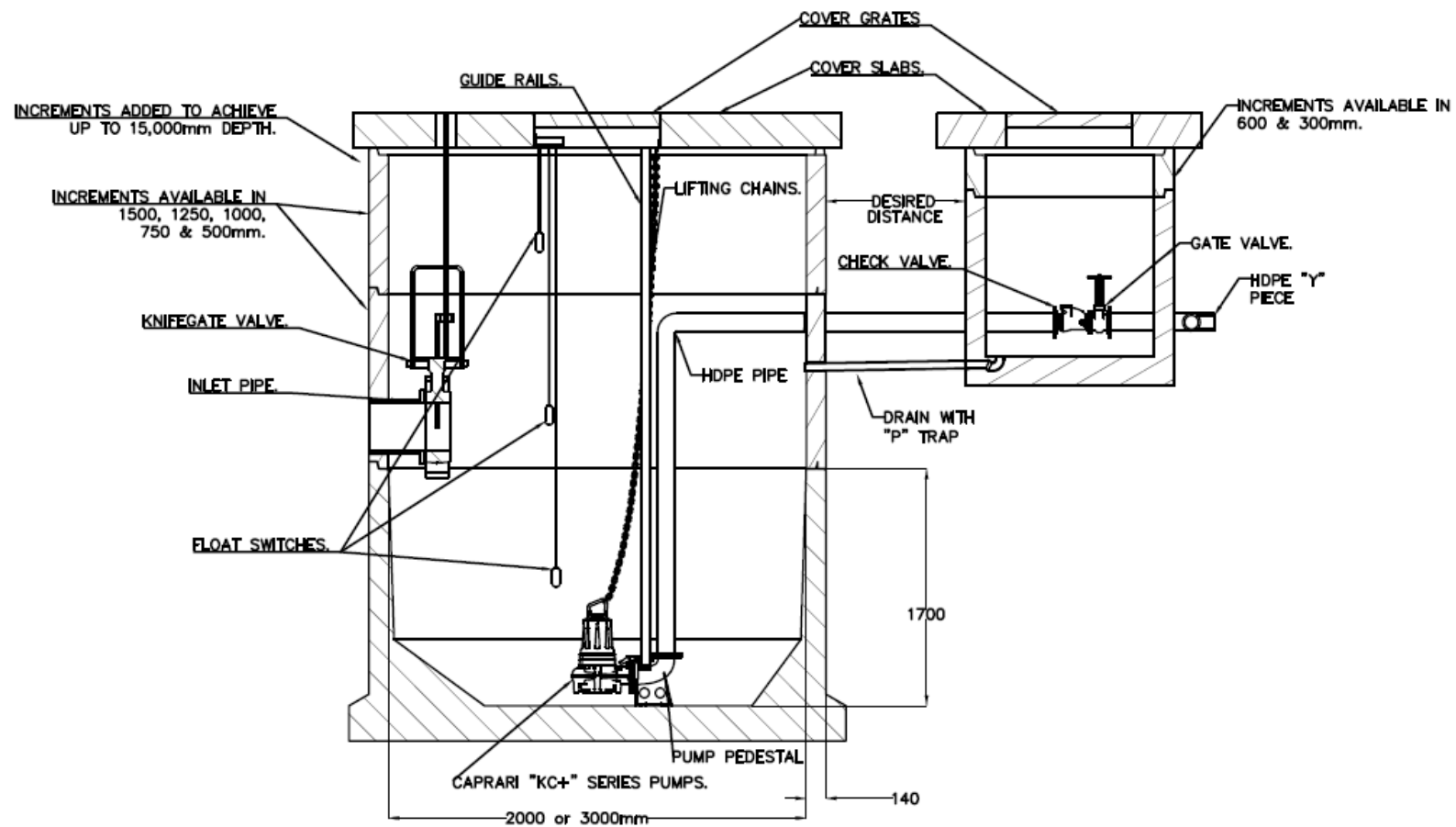
Level 3, 80 Flinders Street
Adelaide SA 5000

GPO Box 2450
Adelaide SA 5001
Telephone 61 8 8201 9600
Facsimile 61 8 8201 9650
www.fyfe.com.au

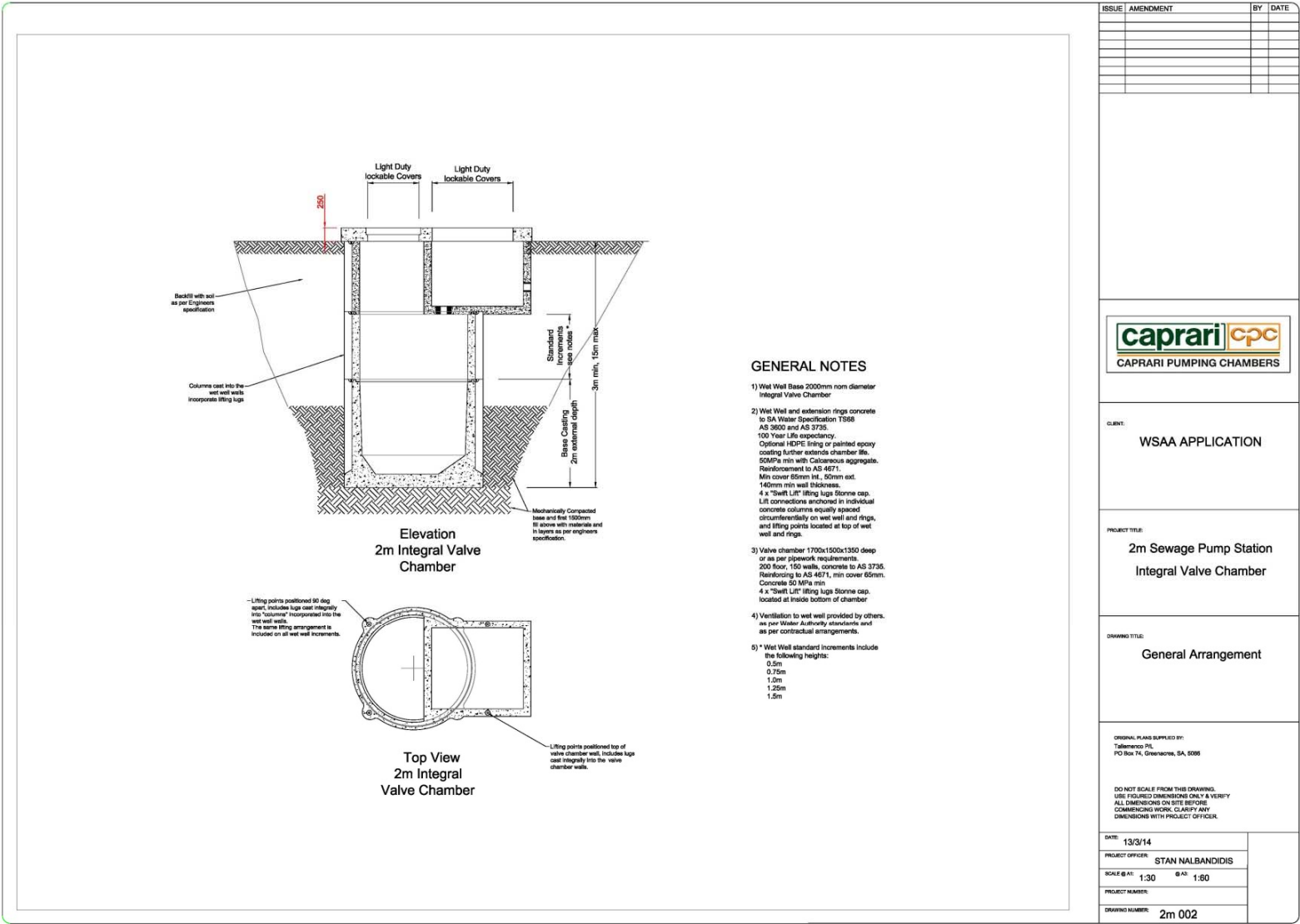
FYFE PTY LTD
ABN 57 008 116 130

50135-2 2015.03.02 RPEQ LETTER.DOCX

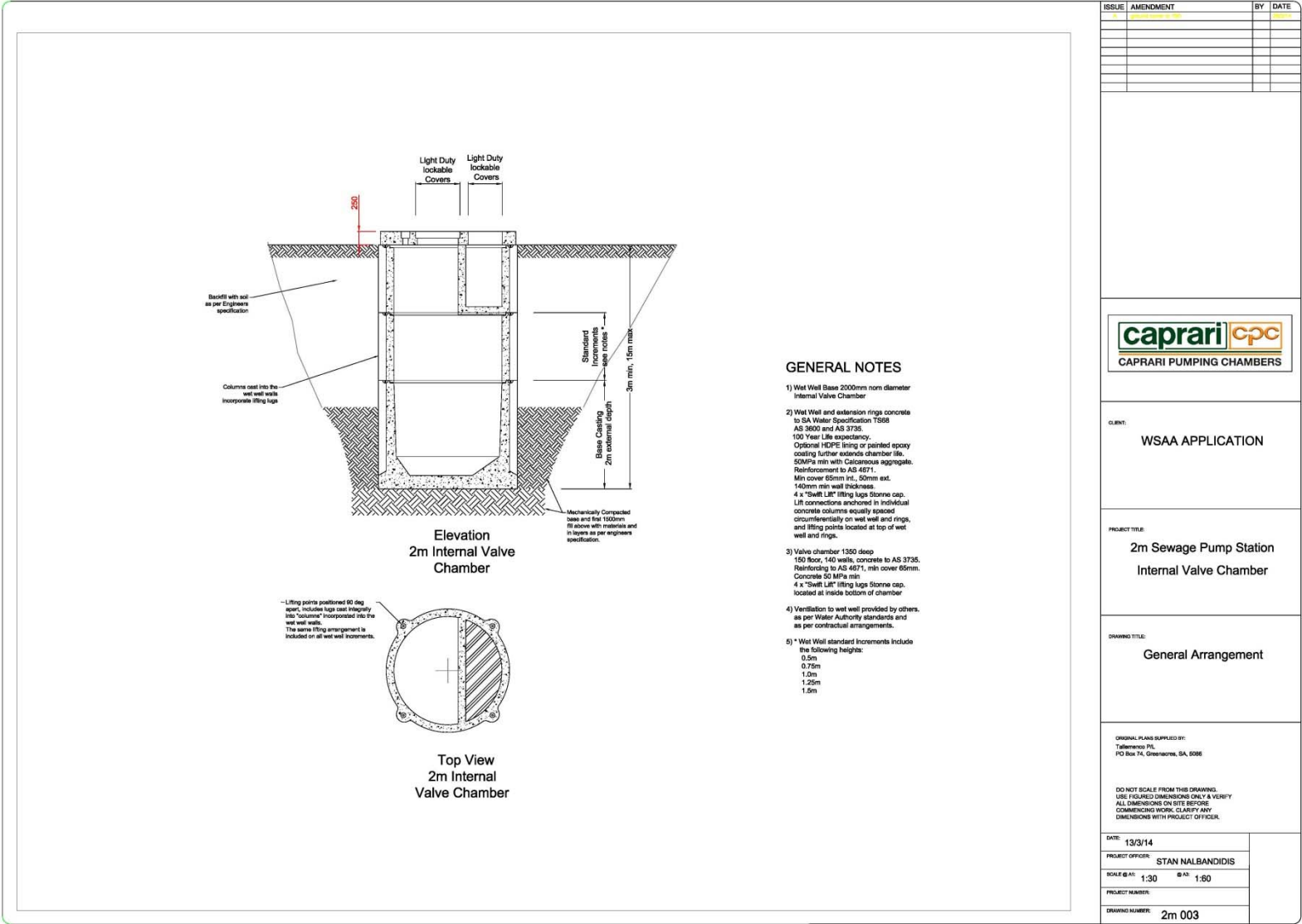


APPENDIX E – TYPICAL DIAGRAMS FOR A RANGE OF CAPRARI-CPC PRECAST PUMP STATIONS

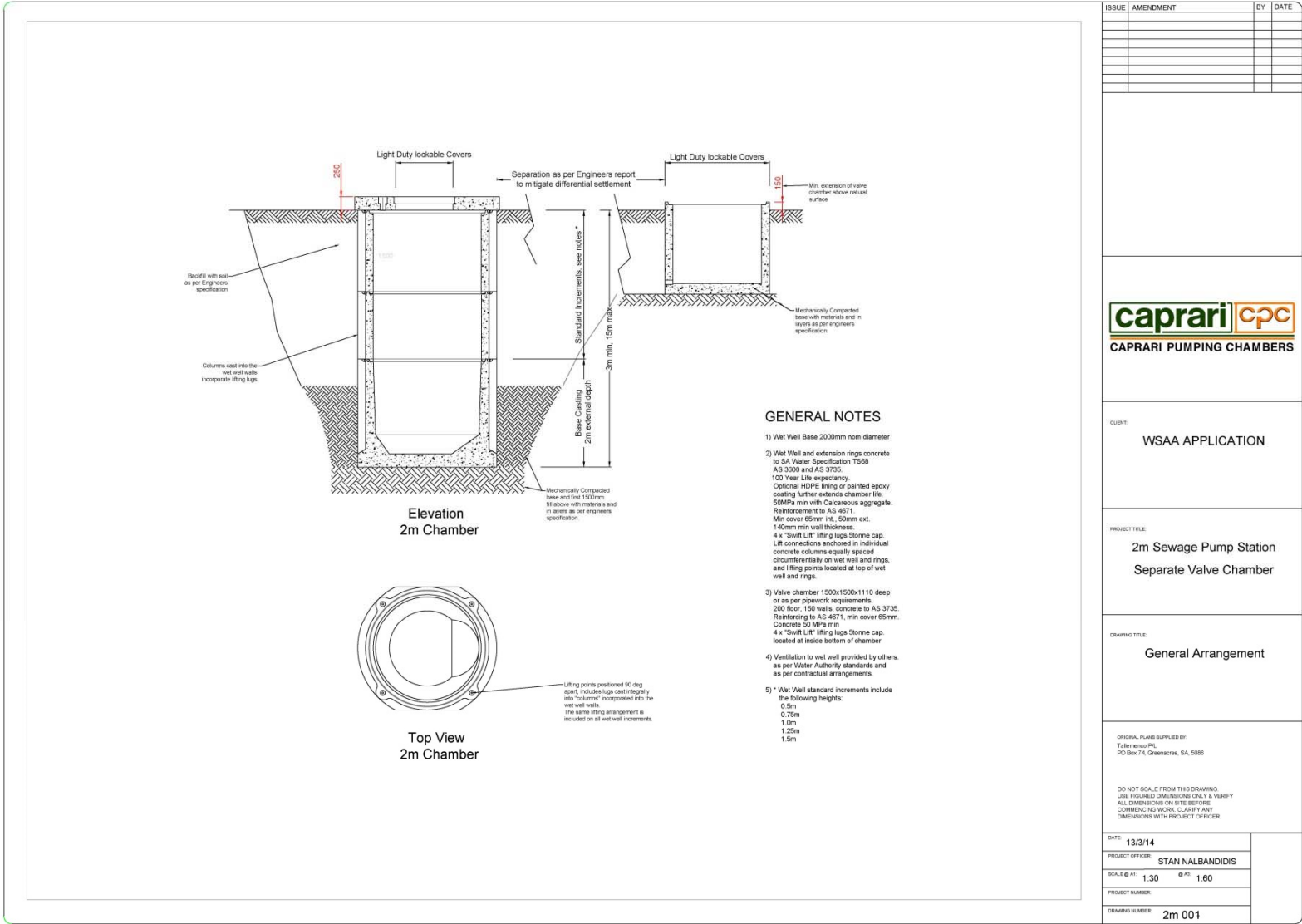
Typical diagram for a 2 m or 3 m dia pump station with external valve chamber



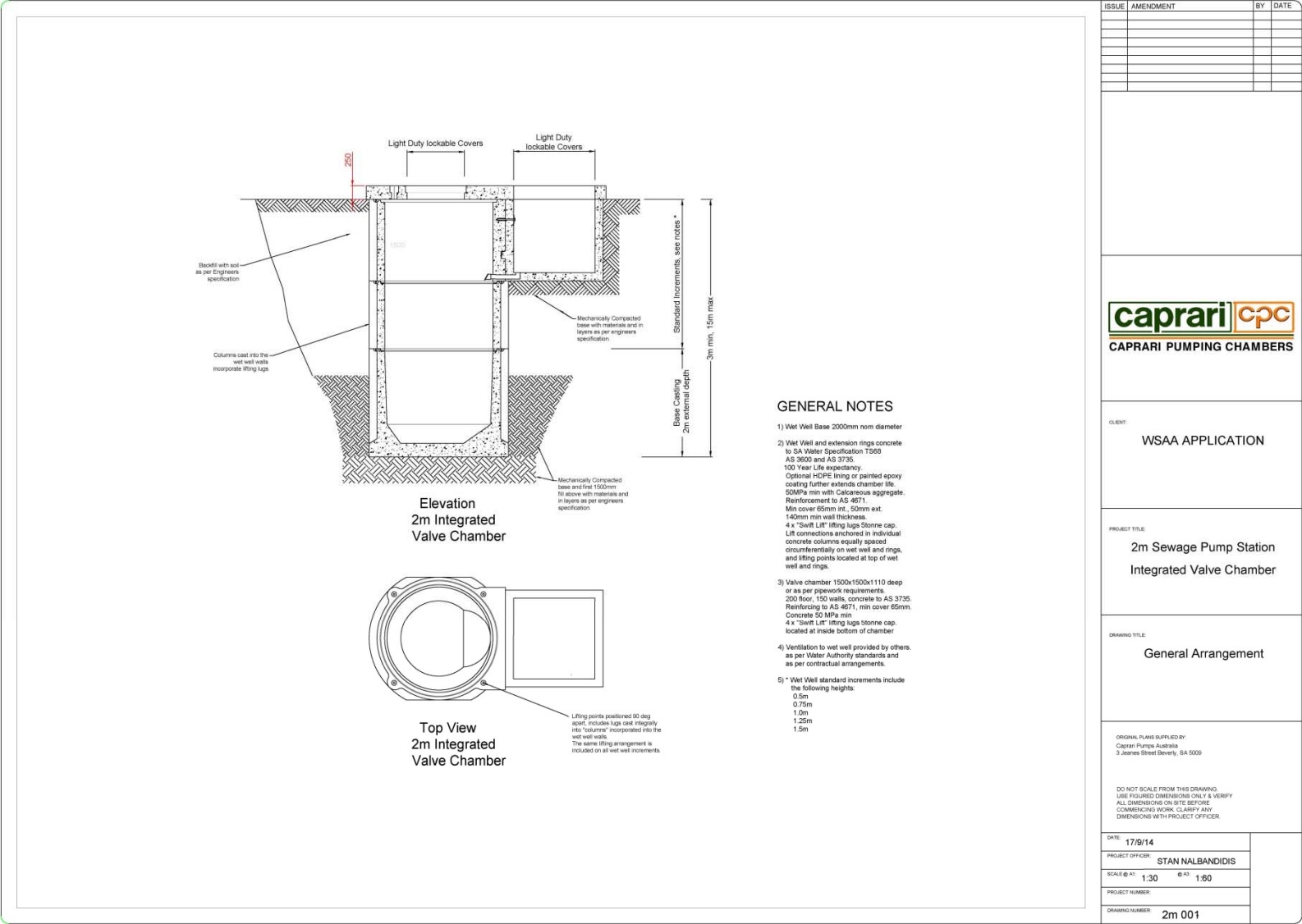
Integral Valve Chamber for a 2 m dia pump station



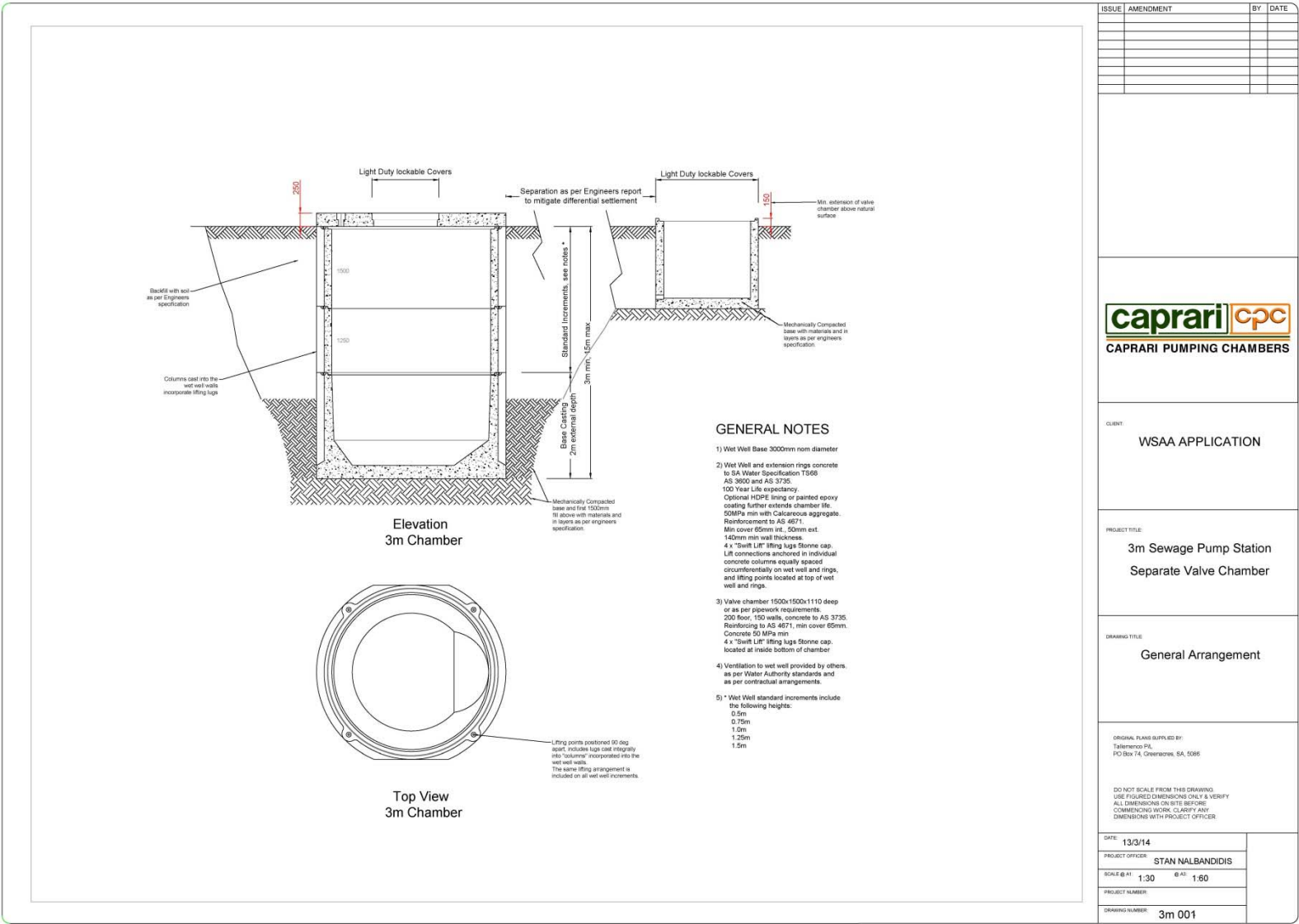
Internal Valve Chamber for a 2 m dia pump station



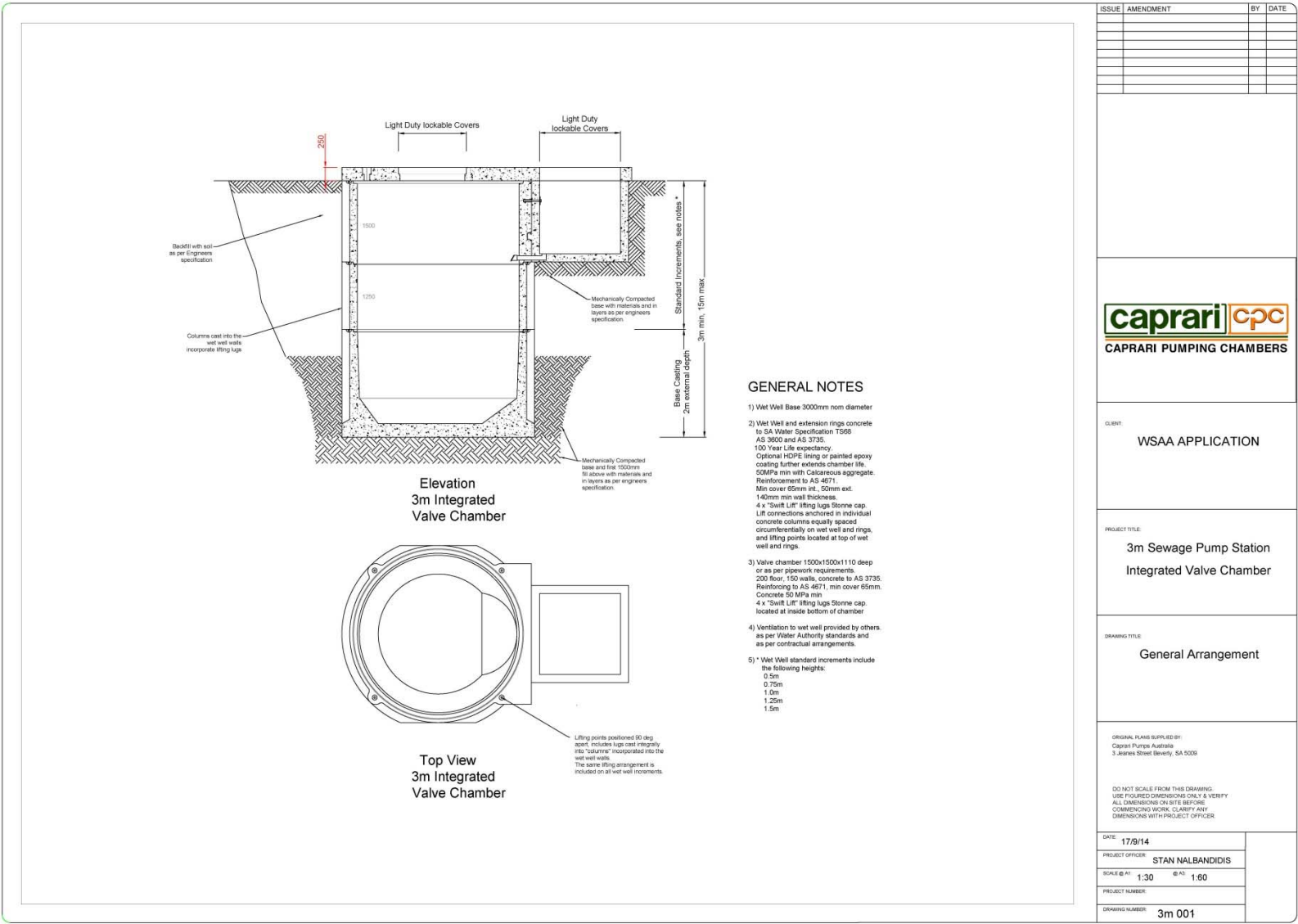
Separate Valve Chamber for a 2 m dia pump station



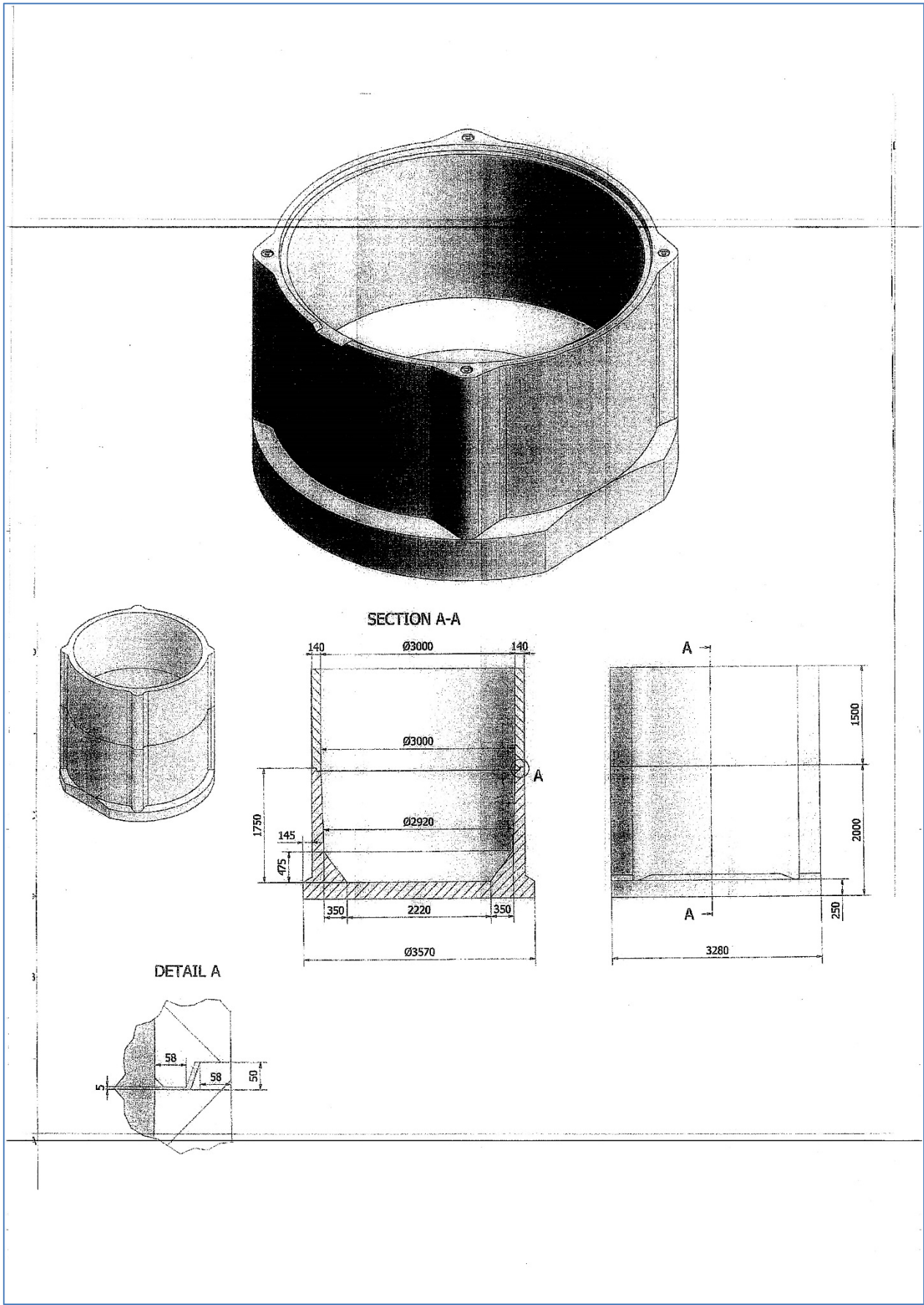
Integrated (pinned) Valve Chamber for a 2 m dia pump station



Separate Valve Chamber for a 3 m dia pump station



Integrated (pinned) Valve Chamber for a 3 m dia pump station



Caprari Pumps Precast Concrete Pump Station – Primary Chamber

APPENDIX F – DIMENSIONS AND WEIGHTS OF PRECAST BASE, INCREMENTS, COVER SLAB AND CONCRETE CORING

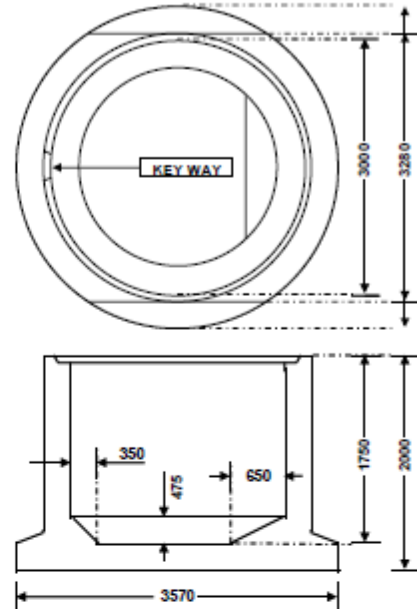
3000 diameter PUMP STATIONS

BASE SECTION - 3000

Concrete	Mass
Calcareous concrete	50Mpa 14,600 kg.

Specifications

Overall Height :-	2000mm.
Effective Height :-	1750mm.
Base Diameter :-	3570mm. (max.)
Internal Diameter (top) :-	3000mm.
Wall Thickness (top) :-	140mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



INCREMENTS - 3000

Increment Effective Height	Mass	50Mpa calc.
500mm.	1,810 kg.	

750mm. 2,715 kg.

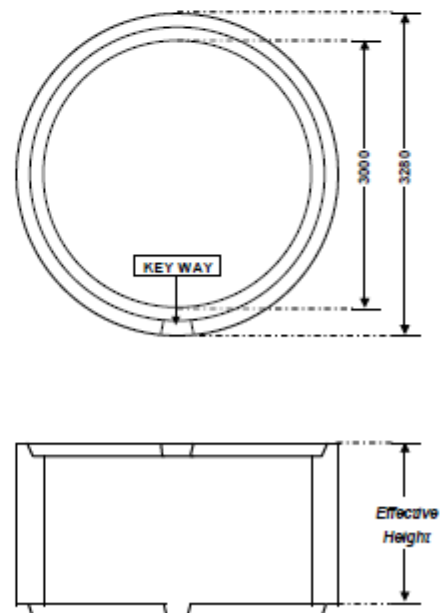
1000mm. 3,615 kg.

1250mm. 4,525 kg.

1500mm. 5,425 kg.

Specifications

Wall Thickness :-	140mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



3000 diameter PUMP STATIONS

STANDARD COVERSLAB - 3000

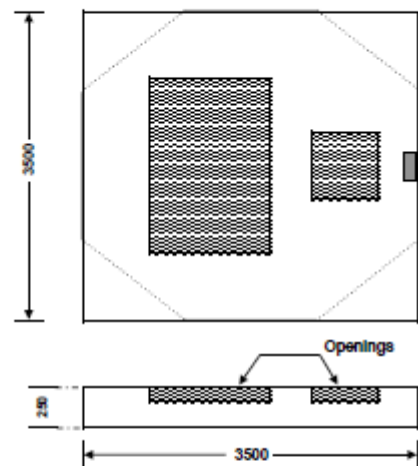
Note :- Placed directly on base or increment

Concrete	Mass
Calcareous concrete	50Mpa 7,150 kg.



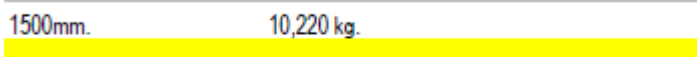
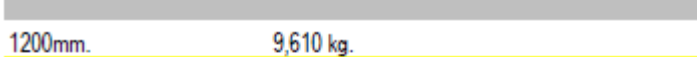
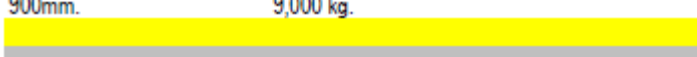
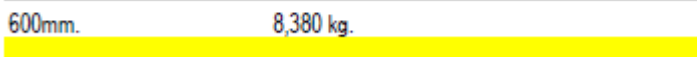
Specifications

Effective Height :-	250mm.
Openings :-	as requested
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



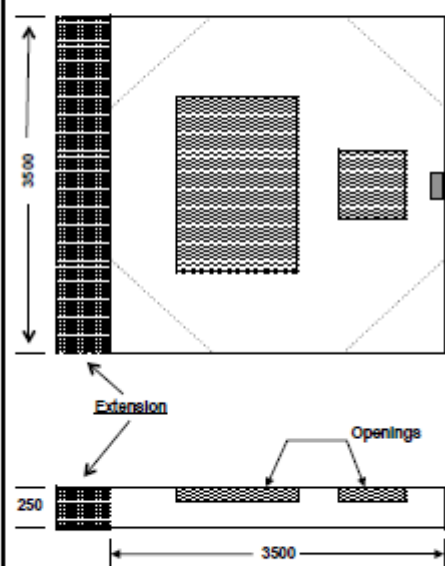
EXTENDED C/SLAB (for switchboard / vent mounting etc)

Extension	Mass	50Mpa calc.
300mm.	7,770 kg.	



Specifications

Effective Height :-	250mm.
Openings :-	as requested
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



EXTERNAL VALVE CHAMBERS

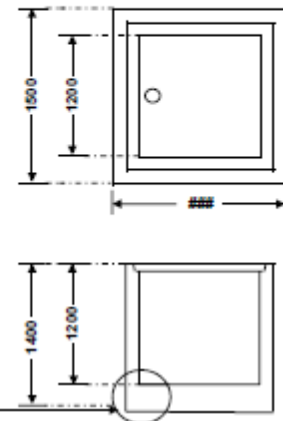
VALVE CHAMBER BASE SECTION - 1200 x 1200

Concrete	Mass
Calcareous concrete	50Mpa 3340 kg.

Specifications

Overall Height :-	1400mm.
Effective Height :-	1200mm.
Base Dimension :-	1500 x 1500
Internal Dimensions (top) :-	1200 x 1200
Wall Thickness (top) :-	150mm.
Lifting (Swift Lifts) :-	(4) 5.0 tonne anchors

P - TRAP OPTION



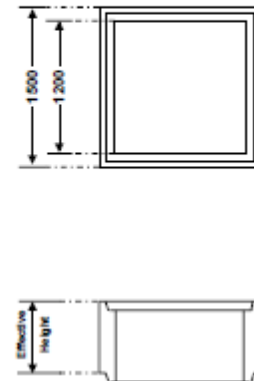
VALVE CHAMBER INCREMENTS - 1200 x 1200

Effective Height	Mass	50Mpa calc.
300mm.	570 kg.	

600mm.	1,140 kg.
--------	-----------

Specifications

Internal Dimensions (top) :-	1200 x 1200
Wall Thickness (top) :-	150mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors

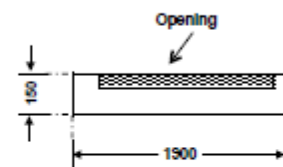


VALVE CHAMBER COVERSLAB - 1200 x 1200 INTERNAL

Concrete	Mass
Calcareous concrete	50Mpa 1260 kg.

Specifications

Overall Dimensions (top) :-	1900 x 1900
Wall Thickness (top) :-	150mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



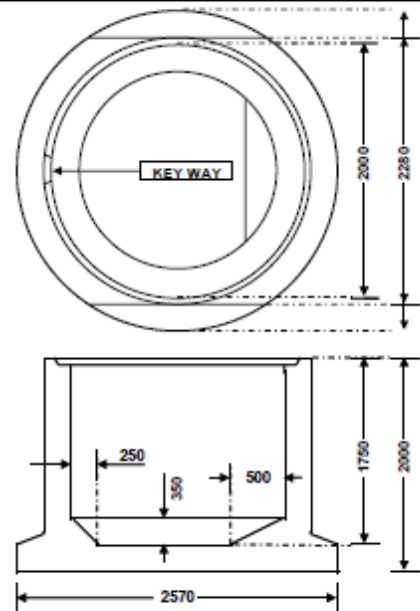
2000 diameter PUMP STATIONS

BASE SECTION - 2000

Concrete		Mass
Calcareous concrete	50Mpa	7,490

Specifications

Overall Height :-	2000mm.
Effective Height :-	1750mm.
Base Diameter :-	2570mm. (max.)
Internal Diameter (top) :-	2000mm.
Wall Thickness (top) :-	140mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors

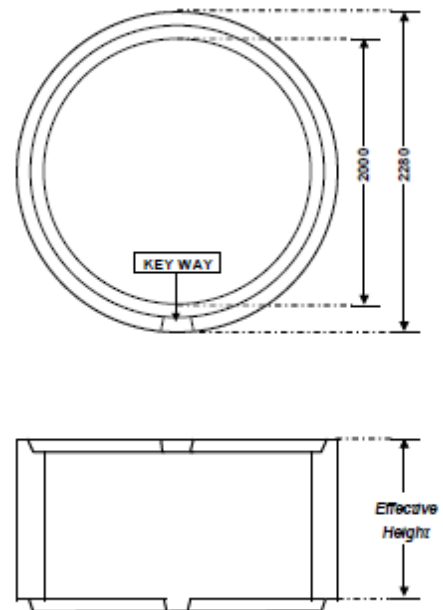


INCREMENTS - 2000

Increment Effective Height	Mass	50Mpa calc.
500mm.	1,060	
750mm.	1,590	
1000mm.	2,120	
1250mm.	2,650	
1500mm.	3,180	

Specifications

Wall Thickness :-	140mm.
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



2000 diameter PUMP STATIONS

STANDARD COVERSLAB - 2000

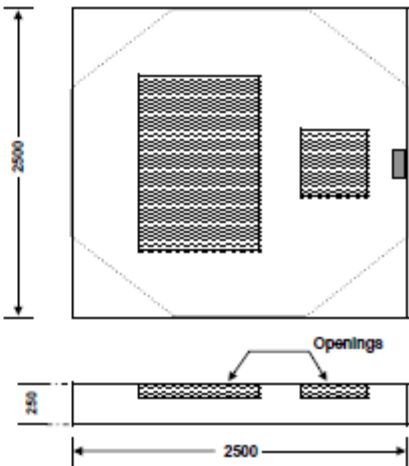
Note :- Placed directly on base or increment

Concrete	Mass
Calcareous concrete	50Mpa 2700



Specifications

Effective Height :-	250mm.
Openings :-	as requested
Lifting (Swift Lifts) :-	(4) 5 tonne anchors

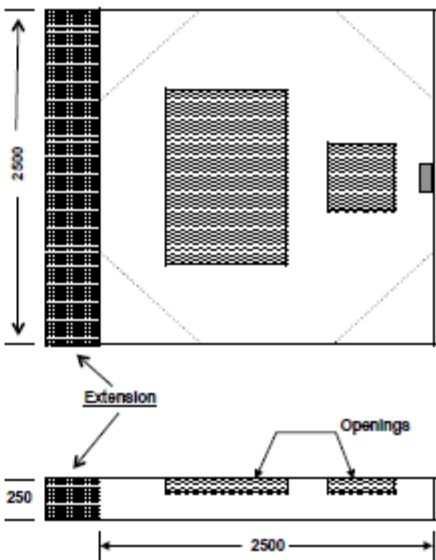


EXTENDED C/SLAB (for switchboard / vent mounting etc)

Extension	Mass	50Mpa calc.
300mm.	3,240 kg.	
600mm.	3,640 kg.	
900mm.	3,960 kg.	
1200mm.	4,380 kg.	
1500mm.	4,820 kg.	

Specifications

Effective Height :-	250mm.
Openings :-	as requested
Lifting (Swift Lifts) :-	(4) 5 tonne anchors



HINGED ALLOY COVER & GALV. FRMS

<u>SINGLE PART (CLEAR OPENING SIZE)</u>	
600 X 450 600 X 450 with Safety Gate	
600 X 600 600 X 600 with Safety Gate	
900 X 600 900 X 600 with Safety Gate	
900 X 900 900 X 900 with Safety Gate	
760 X 1140 760 X 1140 with Safety Gate	
<u>TWO PART (CLEAR OPENING SIZE)</u>	
1000 X 1000 1000 X 1000 with Safety Gate	
860 X 1140 860 X 1140 with Safety Gate	
900 X 1200 900 X 1200 with Safety Gate	
1060 X 1140 1060 X 1140 with Safety Gate	
SA WATER with Safety Grates and Fall Protection Guard 1620 X 1060	

GALV. VENT PIPE STACKS

<u>ALL HOT DIP GALV. AFTER FABRICATION</u>	
200 N.B. x 12.000 high LGA Type, 550 x 550 Base Plate With Slotted Extractor	

CAST-IRON COVERS & FRAMES

CLASS "B" LIGHT DUTY (CLEAR OPENING SIZE)

600 dia. ...solid top
300 X 300
450 X 450
600 X 450
600 X 600
750 X 450
750 X 600
750 X 750
900 X 450
900 X 600
900 X 750
900 X 900 TWO PART
1245 X 900 TWO PART
1890 X 900 THREE PART
1460 X 1245 FOUR PART

CLASS "D" HEAVY DUTY (CLEAR OPENING SIZE)

600 dia. ...solid top
450 X 450
600 X 450
600 X 600
750 X 450
750 X 600
750 X 750
900 X 450
900 X 600
900 X 900 TWO PART
1270 X 900 TWO PART

CONCRETE CORING

140mm Walls ie. 2000 & 3000 Dia. Pump Stations

(coring sizes available includes establishment, marking out & set up .)

65 mm Dia.
75 mm Dia.
82 mm Dia.
100 mm Dia.
125 mm Dia.
150 mm Dia.
175 mm Dia.
200 mm Dia.
250 mm Dia.
300 mm Dia.
400 mm Dia.
450 mm Dia.

MISC. PRODUCTS / SERVICES

FITTING OF DICL PIPE INLET STUBS

UP TO 250mm Dia.
UP TO 350mm Dia.
UP TO 500mm Dia.

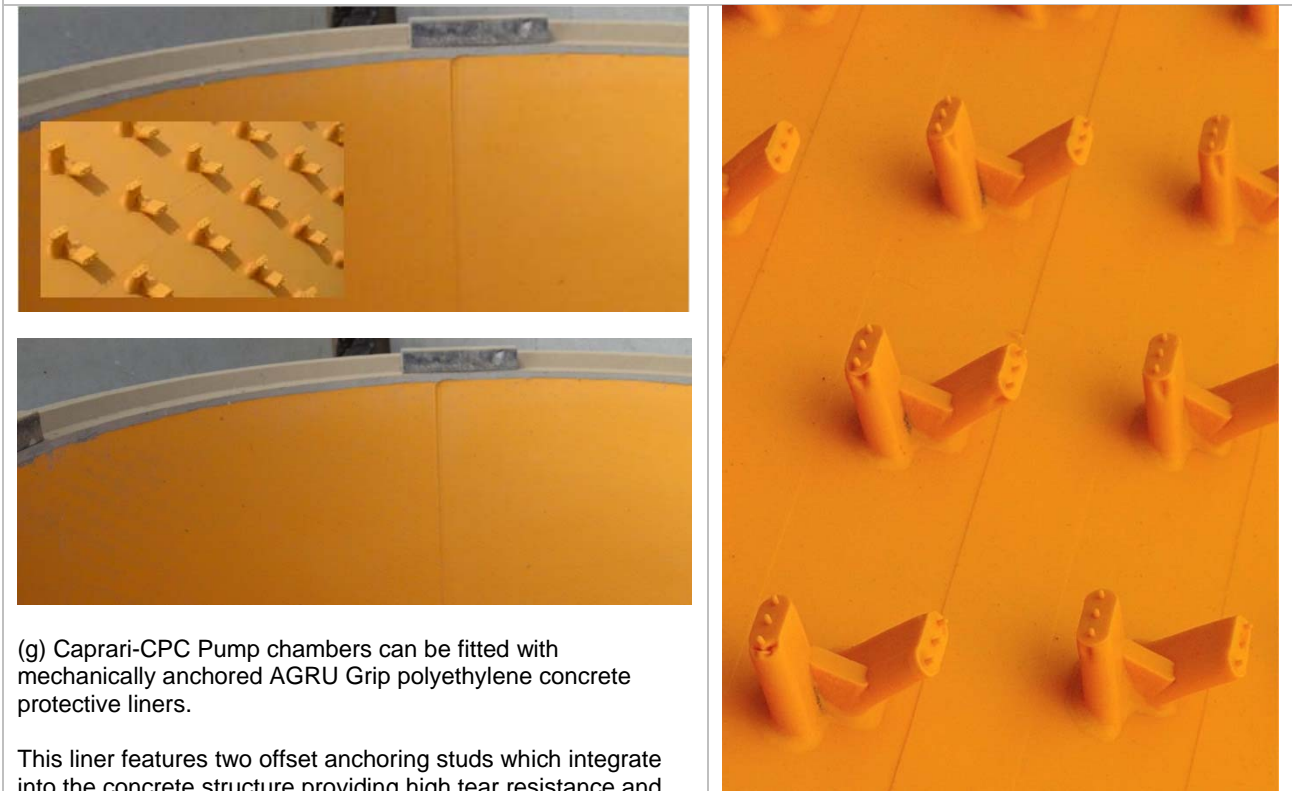
Pipe Sealant / Carton 5 x 4.000mtr. Rolls
Educt / Ashdown Vents
Hair Pin Tie Down Anchors
Fitting of " Y " Piece
100 Dia. I.O. Cover & Frame ...cast-iron
150 Dia. I.O. Cover & Frame ...cast-iron

APPENDIX G – FEATURES OF CAPRARI-CPC PRECAST PUMPING STATION

 <p>(a) Caprari Pumps Precast Concrete Pump Station model</p>	 <p>(b) SWIFTLIFT – Unique and Patented Lifting, unique lifting system with pick up points on top of chamber</p>	 <p>(c) Picture showing the SWIFT LIFT anchor rod which is approximately 1 metre in length and is cast into the reinforced column of which there are four off, rated to lift 5 tons.</p>
 <p>(d) Pump Chamber - featuring four reinforced columns in each segments of chamber with 140mm thick walls</p>	 <p>(e) Wide range of pump control options – purpose built for water authority requirements</p>	



(f) Wide range of cover slabs with access covers and frames meeting customer’s project requirements



(g) Caprari-CPC Pump chambers can be fitted with mechanically anchored AGRU Grip polyethylene concrete protective liners.

This liner features two offset anchoring studs which integrate into the concrete structure providing high tear resistance and fixation. While acting as a corrosion barrier, the liner also increased the concrete structural strength by 30% and extends the pump station life to 100 plus years.

(h) The above picture shows the underside of the Agru Grip Poly liner, highlighting the offset teeth which embed into the concrete ensuring there is absolutely no way that the line can simply fall off or detach once the concrete has set.

APPENDIX H - WSAA PRODUCT SPECIFICATION

WATER SERVICES ASSOCIATION of Australia

PRODUCT SPECIFICATION

WSA PS - 358 CONCRETE, PRE-MIXED, SPECIAL CLASS

358.1 SCOPE

This specification covers Special Class pre-mixed concrete for use in such applications as cast in-situ (sewerage) maintenance holes and for concrete placed in an aggressive environment. This class of concrete may not be appropriate for water retaining structures. Seek Water Agency advice for such structures. It may be used for purchase of products, referencing in a project specification, inclusion on design drawings and for appraisal of products.

358.2 REQUIREMENTS

(a) Special Class concrete shall conform to WSA 114.

358.3 OPTIONS TO BE SPECIFIED

Strength Class ¹	
Slump ²	
Calcareous aggregates ^{3, 4}	

358.4 AGENCY APPROVED VARIATIONS TO BE SPECIFIED

Not used.

358.5 QUALITY ASSURANCE

Concrete shall be manufactured and supplied under cover of a certified ISO 9001 management system. The scope of the ISO 9001 certification shall include "Manufacture and supply of pre-mixed concrete to AS 1379" (or similar).

NOTES:

- 1 The Strength Class of concrete ordered shall be as specified in the Project Specification or on the Design Drawings.
- 2 Slump shall be as specified in the Project Specification or on the Design Drawings. Slump shall be appropriate to the project and method of concrete placement. If slump is not nominated in the project specification, the supplier's and/or other specialist advice shall be obtained.
- 3 Calcareous aggregate is defined as having an acid solubility greater than 98% when tested in accordance with AWWA B 100.
- 4 Calcareous aggregates are not available in all locations.

UNCONTROLLED IF PRINTED

File Name: WSA_PS_358_01

Copyright

Issue: 01

February 2008

Doc Name: Product Specifications for Products & Materials

Page 1 of 1

APPENDIX I - SUPPLIER CONTACTS

<p>Caprari Pumps Australia Pty Ltd 3 Jeanes Street Beverley SA 5009 Contact Person: Stan Nalbandidis Phone: 08 8244 4442 Fax: 08 8244 4462 Email: stan@caprari.com.au</p>	<p>Cooke Pre-cast Concrete Pty Ltd 3 Peachey Road Edinburgh North SA 5111 Contact: Person Harley Cooke Phone: 08 8209 3093 Fax: 08 8209 3094 Email: Harley@cookeprecast.com.au</p>
Distributors for Caprari Precast Concrete Pump Station	
<p>VIC and Southern NSW Bell Environmental Pty Ltd 88-90 Berkshire Road North Sunshine, VIC 3020 Phone: 03 9311 8460 Contact: Damien Sullivan Fax: 03 9311 5238 Email: damien@bellenvironmental.com.au</p>	<p>WA Western Irrigation 211 Barrington St Bibra Lake, WA 6163 Mobile: 0411 750 770 Phone: 08 9434 5678 Contact: Andrew Ogden Fax: 08 9434 5777 Mobile: 0411 750 770 Email: andrew@westernirrigation.net.au</p>
<p>SA and NT Australian Industrial Pump Systems, 53 Wodonga Street Beverley SA 5009 Phone: 08 8244 2100 Contact: Graham Dunn Fax: 08 8244 2111 Email: gdunn@aipumps.com.au</p>	<p>Malcolm Thompson Pumps Perth Branch 1st Floor, Unit 1/33 Colquhoun Road, Perth Airport WA 6105 Tel. 08 6462 7755 Contact: Andrew Gibson Fax: 08 6462 7799 Email: agibson@mtp.com.au Kalgoorlie Branch 34 Hopkins Street Boulder WA 6432 Tel. 08 9093 0297 Contact: Andrew Gibson Fax: 08 9093 0271 Email: agibson@mtp.com.au</p>

<p>QLD and Northern NSW</p> <p>Dowdens Pumping & Water Treatment, 9-15 Industrial Street, Mackay QLD 4740</p> <p>Phone: (07) 4969 4949</p> <p>Contact: Steven Dowden or David Dowden</p> <p>Fax: (07) 4969 4900</p> <p>Email: steve.dowden@dowdens.com.au or david.dowden@dowdens.com.au</p>	<p>TAS</p> <p>Irrigation Tasmania</p> <p>5 Reece Court</p> <p>Somerset TAS 7322</p> <p>Phone: 03 6435 1073</p> <p>Contact: Michael Phillips</p> <p>Fax: 0364 350417</p> <p>Email: michael@irrigationtas.com.au</p>
--	--

APPENDIX J – PACKAGING AND TRANSPORTATION



Figure J-1: Loading pump chamber base, standard increment and cover slab



Figure J-2: Transporting Caprari-CPC Precast Components



Figure J-3: Transportation

**APPENDIX K – LETTER SUBMITTED BY REID CONSTRUCTION SYSTEMS
ABOUT THEIR ELEPHANT FOOT AND ROUND BAR FERRULES USED IN THE INTEGRATED VERSION**

ITW Construction Products Australia Pty Ltd
ABN 48 004 297 009
Trading as Reid Construction Systems

296-298 Maroondah Highway
Mooroolbark Vic 3138
PO Box 192, Croydon Vic 3136
Tel: 1300 780 250
Fax: 1300 780 122
Email: info@reids.com.au
Web: www.reids.com.au

20th January 2015

Reid Elephant Foot™ and Round Bar Ferrules

Bob Court
3 Peachey Road
Elizabeth West SA 5113

Dear Bob,

Please be advised that all Reid Elephant Foot and Round Bar ferrules are manufactured in accordance with Australian standard AS3850-2003 with threads conforming to AS1275.

Reid Australia conducts all testing utilising Ramsets' Product Engineering Laboratory, and external NATA certified laboratories where required.

All testing of cast-in ferrules is done in accordance with ASTM E488 – 96 (2003).

Reid Ferrule technical information has been developed over 15 years with over 1000 individual tests between Reid and Ramset (both Australia and New Zealand), with published capacity data derived from Characteristic Ultimate Capacities. Please ensure you have the latest copy of the Anchoring Solutions Design Guide.

Reid also holds certification to ISO9001:2008 for manufacturing.

Should you have any question regarding the above, please do not hesitate to contact me at any time.

Kind Regards,

Mark Agars

Sales Manager – South Australia

Mobile: 0428 029 239
Email: magars@reid.com.au

REINFORCING • PRECAST • TILT-UP

5 Elephant Foot Ferrules

GENERAL INFORMATION

Product

The Elephant Foot Ferrule is a premium grade, medium to heavy duty, cast-in ferrule.

Benefits, Advantages and Features

Improved Security:

- No cross bar required to develop rated capacity.

High Quality Material Options:

- 5.8 grade.
- 42 micron hot dip galvanised.
- Premium 316 SS.

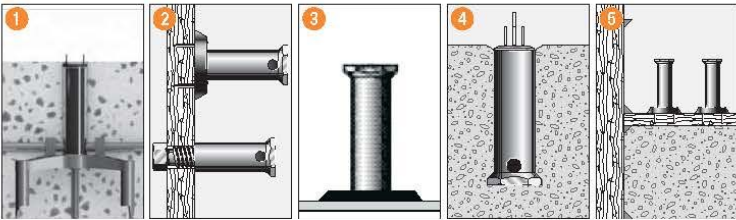
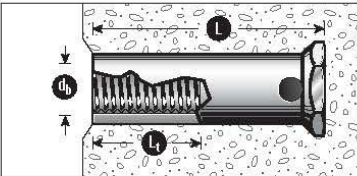
Versatile:

- Use in near or far face applications with our range of accessories.
- May be used with small rebar for fixing to mesh.

Performance Related				
Material				
Installation Related				

Principal Applications

- Small and lightweight precast fixing point.
- Structural connections.
- Curtain wall and panel facade fixings.
- Temporary precast panel bracing points.



1. Chair for tilt-cast.
2. Nailing plate or bolted to formwork.
3. Fixing to steel casting bed with magnetic or glue on nailing plate.
4. "Puddled" into wet concrete.
5. Templated onto face of panel.

Elephant Foot Ferrules

Installation and Working Load Limit Performance Details

Ferrule size, $d_o \times L$ (mm)	Installation details		Minimum dimensions*			Working Load Limit (kN)					
	Cross hole to suit	Tightening Torque, T_t (Nm)**	Edge distance, e_c (mm)	Anchor spacing, a_c (mm)	Substrate thickness, b_n (mm)	Shear, V_s			Tension, N_s		
						Concrete Strength, f_c			Concrete Strength, f_c		
						20 MPa	32 MPa	40 MPa	20 MPa	32 MPa	40 MPa
M10 x 45	R8	17	60	120	50	6.7	7.9	8.5	4.5	5.7	6.4
M12 x 55	R8	30	75	150	65	9.6	11.2	12.1	7.7	9.7	10.8
M12 x 95	R10		135	270	115	15.9	18.6	20.0	16.3	20.1	20.1
M16 x 70	R10	75	100	200	85	14.9	17.4	18.8	11.6	14.7	16.5
M16 x 95			135	270	115	20.6	24.0	25.9	18.8	23.8	26.6
M20 x 70	R10	144	100	200	85	17.6	20.6	22.2	13.0	16.5	18.4
M20 x 95			135	270	115	24.3	28.4	30.6	21.1	26.6	29.8
M24 x 95	N12	250	135	270	115	29.9	35.0	37.7	23.1	29.2	32.6

* For shear loads acting towards an edge or where these minimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity.

** Recommended tightening torques are based on the use of grade 4.6 bolts.

Note: Confirm bolt capacity independently of tabulated information.

DESCRIPTION AND PART NUMBERS

Ferrule size, d_o	Ferrule OD (mm)	Ferrule length, L (mm)	Effective depth, h (mm)	Thread length, L_t (mm)	Cross hole to suit	Part No.		
						Zn	Gal	316SS
M10	16	45	41	20	R8	FE10045		FE10045SS
M12	17	55	51	25	R8	FE12055	FE12055GH	FE12055SS
		95	91		R10	FF12095	FF12095GH	
M16	22	70	66	32	R10	FE16070	FE16070GH	FE16070SS
		95	91			FE16095	FE16095GH	
M20	26	70	66	35	R10	FE20070	FE20070GH	
		95	91	38		FE20095	FE20095GH	FE20095SS
M24	32	95	91	50	N12	FE24095	FE24095GH	

Effective depth, h (mm). Read value from "Description and Part Numbers" table.

ENGINEERING PROPERTIES

Ferrule size, d_o	Stress area threaded section, A_s (mm ²)	Carbon Steel		Stainless Steel		Section modulus, Z (mm ³)
		Yield strength, f_y (MPa)	UTS, f_u (MPa)	Yield strength, f_y (MPa)	UTS, f_u (MPa)	
M10	71.2	400	500	450	700	190.0
M12	88.3	400	500	450	700	334.5
M16	158.0	400	500	450	600	692.8
M20	242.0	400	500	450	600	1034.0
M24	365.0	400	500	n/a	n/a	2066.0

Melbourne Office

Suite 8.02 Level 8,
401 Docklands Drive
Docklands VIC 3008
Phone: (03) 8605 7601
Fax: (03) 8605 7612

Sydney Office

Suite 1, Level 30, 9 Castlereagh Street
Sydney NSW 2000
GPO Box 915
Sydney NSW 2001
Phone: (02) 9221 5966
Fax: (02) 9221 5977

www.wsaa.asn.au



WATER SERVICES
ASSOCIATION OF AUSTRALIA