City of Cockburn

Irrigation System Specifications

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Revisions

Revision	Revision Date	Nature of Revision.	Revised by
A	30/07/2013	Issued for comment	Andy Jarman
B	26/09/13	Conduits sleeved specified as thicker walle class 12 pipe.	Andy Jarman
C	07/01/2016	Amended Document	Julie Reidy
D	7/10/2016	Standard Irrigation Cabinet and VFD VFD Cabinet Amendments	Mladen Thomas
E	11/10/2017	Inserted poly plow specifications Revised SD specifications	Mladen Thomas Alison Waters
F	11/10/17	Formatting and page numbering. Drawings Appendix replaced	Andy Jarman
G	25/11/2020	Large bore casing diameter change	Julie Reidy

1 CONTENTS

1 GENERAL

1.1 Scope of Document

This City of Cockburn Bore, Cabinet and Irrigation Specifications outline the requirements of any landscape irrigation systems to be designed for, and installed within the City of Cockburn *Public Open Spaces*. The Guidelines consists of three parts

1. Bores,
2. Cabinets, and
3. Reticulation systems,

These specifications shall be referred to in the assessment for approval of development of *Public Open Spaces.*

The specifications provided in this specification document are general in nature. Any specific types and sizes regarding pump, pipes casing etc. are specific to the bore location and requirements and therefore this information will need to be supplied by a drilling and bore installation specialist.

1.2 Water Source

Prior to design and construction of an irrigation system for the City of Cockburn, a suitable water source must be identified. Ground water from either a ground water retention basin or bore shall be the preferred source of water for irrigation, however there may be some extenuating circumstances that this is not possible. Under such circumstances the POS may be watered permanently or temporarily from a potable water source, however this option must be approved by the Manager of Parks prior to the commencement of the design stage.

1.3 Bore Location

Bores shall be located so as to give ample heavy vehicle access to allow for future servicing requirements (without the need for cranes to facilitate pump removal) and be located within the property boundaries.

1.4 Site Protection and Existing Services

The irrigation contractor shall only occupy the necessary portion of the site in which they are to carry out their works. All care must be taken to avoid damage to existing grounds, building, paths, kerbing, mowing strips, roadways, fences or any other property as well existing landscaping trees and vegetation. Any damages caused by the contractor shall be repaired or corrected at the contractor's expense to the City's approval.

It is the contractor's responsibility to contact **Dial before you dig** to ensure there are no utilities in the area which have not been shown on the plan. Repair of any damage done to any utilities is to be the contractors cost and responsibility.

1.5 Hydro zoning

The City of Cockburn is committed to the sustainable use of our water resources. As a result, to maximise efficiency, hydro zoning of the City's Public Open Spaces ensures the application rate of water is in accordance with the differing zones water requirements.

The three separate activity zones are;

- Zone 1; Active turf areas requiring high quality turf including sports activities and public events.
- Zone 2; Passive turf areas include the area surrounding active turf areas or irrigated and unirrigated lawn areas for passive recreation such as picnic and play areas. It is appropriate that seasonal change of lawn quality/colour may be noticed depending on natural rainfall.
- Zone 3; Garden areas with water wise or native plants and trees, including street verges and median strips.

Irrigation plans for the Council should show separate water zones, and if required clarification of appropriate zones can be determined at this time.

Trees and garden beds shall be watered on their own dedicated programme.

Irrigation systems shall be designed such that Hydro zoned areas such as road verges, garden beds, trees may have the irrigation turned off if required without affecting the balance of the system.

1.6 Water Requirements

Unless otherwise specified, watering requirements shall be based on a minimum 38mm per week evenly distributed over all surfaces within 40 hours. (5 days per week) If the available water does not allow this then a system designed with watering time exceeding 40 hours must be approved by the Manager of Parks at design stage.

Bores shall be constructed to yield a minimum 30% greater than the requirements of the irrigation system it will be servicing.

1.7 Water Velocity

The mainline pressure should not exceed 1.5m per second.

1.8 Materials and Workmanship

All materials shall be new, the best of its kind and free from defects. Workmanship must be best industry standard practice.

All materials, equipment and work shall comply with the appropriate Australian standards, specifications or code, and must conform to the City of Cockburn Irrigation System, Bore and Cabinet guidelines, unless written approval for other specifications is given in writing by the Manager of Parks.

1.9 Setting Out Survey

All setting out shall be done by a licensed surveyor and be in accordance with the contract Specifications and Plans.

Verification of setting out correctness shall be obtained from the Manager of Parks prior to any work commencing. Any work carried out prior to verification will be entirely the Contractor's responsibility. Costs of any alterations required to conform this work to the Contract, shall be borne by the Contractor.

1.10 Final Site Clean up

The entire site must be left in a clean and tidy condition with all spoils, equipment, surplus materials and rubbish to be removed at the contractor's expense. An inspection of the site condition will be carried out

prior to practical completion and should the state of the site not to be cleaned to satisfaction, practical completion shall not be approved until the required works are completed and checked.

1.11 Design Drawings and Approval

Certified irrigation design drawings, bore licences and associated details are to be submitted for approval with the Landscape Plan prior to commencement of installation.

Plans for separate hydro zones to be clearly show in the documentation for council approval.

Installation must not commence until the Council provides approval.

It is recommended that the Landscape design concept be submitted for review, such that any alterations to the Landscape design are made prior to engaging an irrigation contractor to design an irrigation system. Passive and active zones are to be determined prior to system design.

1.12 Certified Irrigation drawings (Shop drawings)

Irrigation drawings to be submitted for approval shall provide a legend of symbols and show:

- Circuit diagram of sprinkler sequence
- Irrigation piping and electrical conduit
- Sprinkler hydro zones
- Schedule of valve locations and flow rates
- Irrigation cabinet and pump location
- Supply current watering program if connecting to an existing system
- The distribution uniformity (DU) with a minimum of 75%

Two A1 drawing and one electronic DWG format of the irrigation design should be submitted for review. Any required alterations will be noted and changes should be resubmitted to Council for approval.

1.13 Practical Completion and Commissioning

On completion of works the contractor must contact the City of Cockburn to arrange a date for a practical completion inspection and commissioning. This process must not proceed without a Council representative being present.

Practical completion shall only be deemed complete when the system is proven to be functioning normally and all ‘as constructed’ drawings have been presented to the superintendent.

1.14 As Constructed Drawings

- During or prior to practical completion, the Contractor shall supply As Constructed drawings to the Manager of Parks.
- Each As Constructed drawing shall:
- Be prepared on a thumb drive or disk, containing details of the site and irrigation design plan in AutoCAD 2007 format.
- Supply 2 x A1 hard copy prints
- Include survey information provided by a licensed surveyor using a Global Positioning System pickup.
- Have full survey information recorded on the nominated layers in a light weight pen line or grey.
- As Constructed Drawings shall include the following details;

- Pipe Location – any changes in pipe-work
- Pipe Sizes – any changes in pipe sizes
- Sprinklers – all models and nozzle sizes.
- Valve locations and numbers– measurements from the three (3) sprinklers closest to each valve.
- Valve decoder number (if appropriate)
- Mainline and Lateral Line Location – measurements from the nearest permanent surface structure, such as the corner of a car park kerb or building wall etc.
- Solenoid Cables including:
- Code for each cable
- Direction cables run to pick up valve off the mainline where solenoid cables do not run with the mainline.

1.15 Defect Liability and Maintenance period

After a practical completion is accepted the contractor shall warrant his workmanship for 12months and will be liable for any rectifications that arise from faulty installation of the system and defective manufacturer materials for a 12 month period. The contractor is to arrange for breakdowns arising from defects to be fixed within 24 hours of notification by the City.

The developer will be responsible for maintaining the irrigation system for a period of 2 years after practical completion. During this period, as well as general maintenance of the system, the effectiveness of the irrigation shall be checked and rectified where required and the height of the sprinklers shall be checked to ensure they are at the required height as soil levels may change due to settling and compaction.

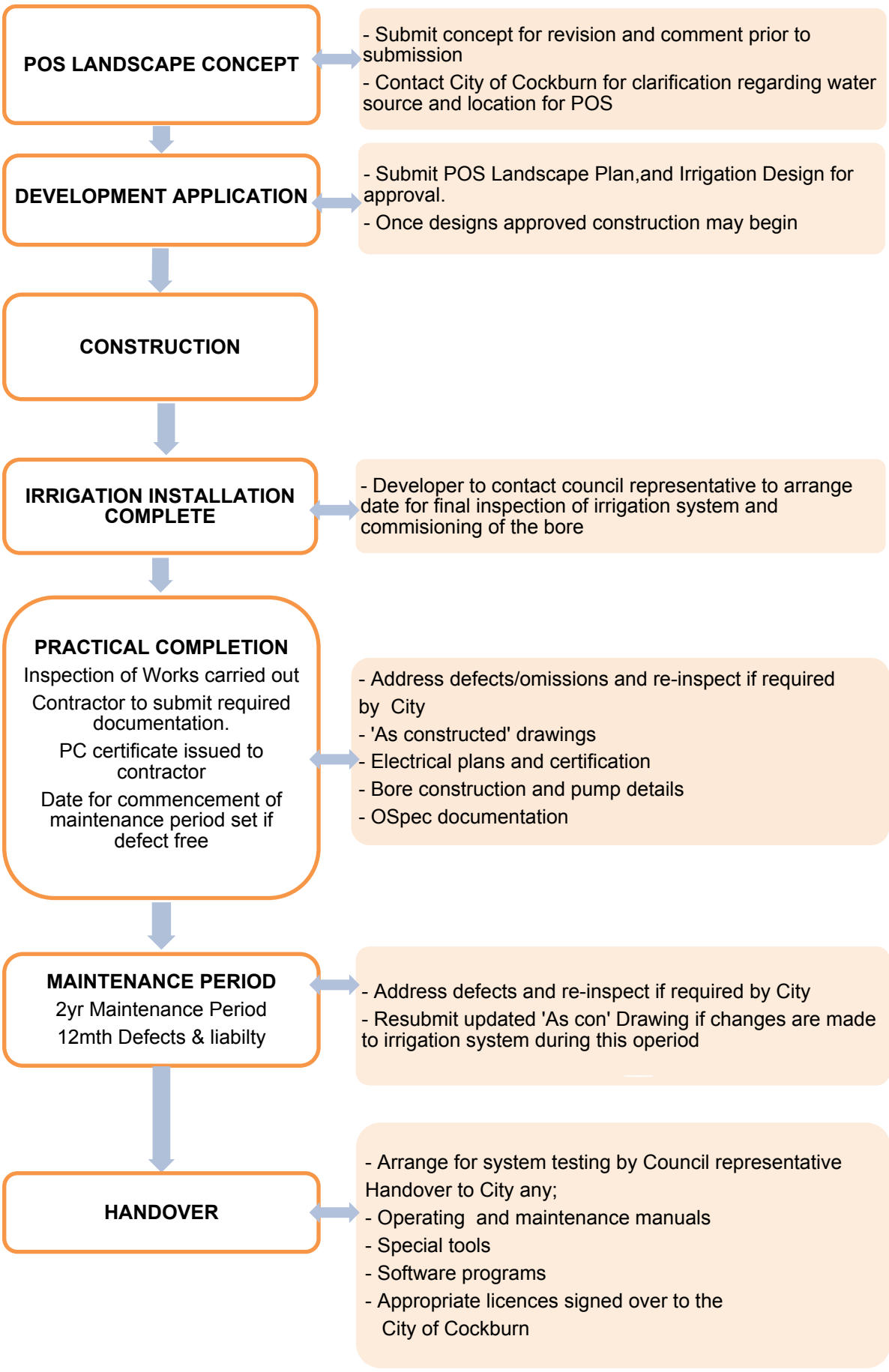
Repairs must not affect any manufacturer's warranty.

1.16 Hand-over

At the end of the 2 year maintenance period, the Manager of Parks will inspect and test the system under normal automatic operation to confirm that the system is fully operational. The City of Cockburn may request that the bore pump be serviced four weeks prior to hand over.

At hand-over the Contractor shall supply all technical information on the reticulation system, two sets of any special tools, and details to enable the Principal to arrange adequate insurance cover.

2 IRRIGATION DESIGN AND CONSTRUCTION STAGES



3 BORE

3.1 Description of Works

The works shall include all operations, labour, plant, supervision, survey, materials and everything else necessary for the construction and completion of the whole of the works described or implied in this Specification and shown on the Drawings. All works shall generally include:

a) Construction, development and testing of a new groundwater production bore.
b) Testing, commissioning and warranty of the new works.
c) Sampling, labelling and reporting, including submission of copies of “as built” drawings and logs of completed works, and the Department of Water bore completion statement.

The entire works shall be performed in accordance with the following guidelines, the applicable regulations and requirements of the Occupational Health Safety and Welfare Act, the Department of Water, the Minimum Construction Requirements for Water Bores in Australia (3rd edition), and the requirements of any other authority having jurisdiction over the works.

It shall be the appointed contractor’s responsibility to undertake the construction of the bore in a professional and workmanlike manner that will allow for the timely completion of the works without being detrimental to the operation and performance of the bore water supply. It is anticipated that all labour employed on site in construction of the bore shall have a comprehensive understanding of the type of equipment and products being installed.

The Contractor will be provided by the Superintendent with a copy of the Department of Water, Groundwater Well Licence, prior to commencement of bore construction works on site.

3.2 Borehole

Depth

As all bore will require differing depths, the final depth of the bore shall be determined by the Superintendent during drilling operations.

Diameter

Specifications for large and small bores generally are as follows;

	Large Bore	Small Bore
The diameter of the hole to be drilled shall be adequate for the installation of:	200mm PN12 SWJ uPVC production casing	125mmPN12 SWJ uPVC production casing
Including casing of gravel pack material surrounding the bore case:	40mm annulus	30mm annulus
Minimum bore diameter	311mm	216mm

	Large Bore	Small Bore
Minimum diameter, if cable tool drilling,: use suitable steel casing (to be removed after installation of permanent casing and screen)	300mm	-------

Verticality and Alignment

The bore shall be drilled and cased straight and vertical, with a maximum out of vertical tolerance of 80mm per 30 metres of depth. The casing shall be set round, plumb and true to line.

The Contractor shall test the bore for verticality and alignment, supplying all equipment required for testing purposes.

Drilling Method

The Contractor shall construct the bore using either cable tool or mud rotary drilling techniques as he sees fit. The Contractor shall not use any clay, oil, salt or any form of plugging material which could adversely affect the production capacity of the water bearing strata without the prior written approval of the Superintendent.

The Superintendent may, at any time, order the Contractor in writing against the use of materials or techniques which he may deem prejudicial to the satisfactory completion of the borehole.

Use of Explosives

No explosives shall be used during the course of works under this contract.

3.3 Proposed Design

All bores shall have the size, depth, casing type and size, and length and aperture of 'API stainless steel wedge wire bore screen' determined by a bore installation specialist to be in keeping with the requirements dependant on conditions encountered during construction of the borehole.

The annulus surrounding the casing and screen shall be packed with suitably sized washed and graded sand (nominally +1.6mm – 3.2mm) from the static water level to the base of the borehole. The annulus surrounding the casing shall be backfilled with drill cuttings from the surface to the static water level.

Casing centralisers shall be located at no greater than 6 metre intervals along the bore casing and screen.

Sampling:

Representative samples of strata shall be taken by the Contractor every two metres of depth of borehole, or at significant changes of strata, or as otherwise directed by the Superintendent. The Contractor shall take every precaution to guard against contamination from hole erosion or caving. The samples shall be bagged, labelled with the bore name or number, date, and depth of sample, and stored for the duration of the Contract in a location where they will not be destroyed or damaged by drilling operations or site conditions. The Contractor shall supply suitable sample bags and labels as required.

Materials

Production Casing: Shall be PN 12 SWJ uPVC.

Screen Assembly: Shall consist of API stainless steel screen with 0.6mm aperture, with a stainless steel baseplate and a suitable PVC or ABS casing to screen adaptor.

Centralisers: Shall consist of engineered plastic bow centralisers to fit the minimum annulus.

Gravel Pack: Shall consist of washed and graded river sand, graded +1.6mm –3.2mm. (as produced by Cook Minerals or similar)

3.4 Bore Development

Following construction of the borehole and placement of the casing, screen and gravel pack material, the Contractor shall develop the bore to a maximum yield of water, clean and free of suspended materials. Development of the bore shall be carried out using bailing, water jetting, air lifting and surging, chemical treatment or other such methods as may be found necessary by the driller for full and proper completion of development of the bore.

Appropriate piping and fittings shall be provided by the Contractor to direct discharge during development away from the rig and personnel such that the work site remains in a safe condition, and to prevent damage to the area surrounding the work site.

3.5 Test Pumping

On completion of bore development the Contractor shall test pump the bore, including a multi-rate test and a constant rate test. Discharge rates and pump inlet depths to be tested from are to be provided by Superintendent.

The pump used shall be capable of providing sustained discharge at acceptable constant rates and from inlet depths as specified, and shall be capable of achieving various flow rates through discharge head regulation. The Contractor shall provide a means of accurately measuring the flow rate to the approval of the Superintendent.

A staged test of three different rates (provided by superintendent) each of 30 minutes duration will be required, followed by 30 minutes recovery. A constant rate test, nominally of 6 hours duration and at a flow rate provided, will then be required.

To facilitate water level measurements the Contractor shall include with his testing equipment a pipe or tubing clamped to the side of his pump column, through which an electrical water level monitoring device (supplied by the Contractor) can be inserted. The pipe or tubing shall be free of kinks, joints etc which could hinder free movement of the water level measuring device.

Water level measurements shall be made immediately prior to the start of each test, then during the test at the following times:

0 - 15 minutes:	every minute
15 - 60 minutes:	every 5 minutes
60 - 120 minutes:	every 15 minutes
120 - 600 minutes:	every 30 minutes
>600 minutes:	every 60 minutes

Should a pumping test be interrupted for any reason other than at the express direction of the Superintendent, or should the Contractor fail to maintain an acceptably constant yield, the test shall cease and a new test shall be undertaken after completion of an appropriate recovery period nominated by the Superintendent. Payment for the new test shall be at the tendered rates, with the interrupted test being at the Contractor's expense.

3.6 Water Analysis

The Contractor shall be responsible for obtaining an air free water sample just prior to the completion of the constant rate pumping test. The Contractor shall also be responsible for appropriate storage and delivery of the sample to a recognised laboratory within 24 hours of obtaining it, and for analysis of the sample.

In addition to analysis of the water sample, a chemist's report shall be obtained on the suitability of the water for irrigation purposes, addressing particularly salinity, and potential for staining and corrosion.

The Contractor shall be responsible for all costs associated with obtaining the water sample, its storage and delivery to a registered laboratory, and obtaining the water analysis and chemist's report.

3.7 Bore Completion

On completion of bore development and test pumping operations, the Contractor shall cut the bore casing to 100mm above finished ground level and fit a PVC flange (drilled table D) with galvanised backing plate, and a blank galvanised steel top flange with rubber gasket, to prevent unauthorised access into the bore.

3.8 Cleaning Up Site

Upon completion of works the Contractor shall clear up and restore the site as far as possible to a condition unlikely to endanger animals or persons, or to cause a nuisance, to the satisfaction of the Superintendent. Drill cuttings and spoils shall be removed from site and disposed of at an appropriate landfill site. Groundwater Well Licence - Reporting

The Contractor shall complete Department of Water form 2; Particulars of Completed Borehole for construction of the new borehole. The form shall be submitted directly to the Department of Water by the driller, with a copy supplied to the Superintendent for his records.

3.9 Schedule of Rates

See Appendix 7.1 for a schedule of rates template for a bore, to be completed by the relevant drilling contractor.

4 PUMPS

4.1 Description of Works

The works shall include all operations, labour, plant, supervision, survey, materials and everything else necessary for the construction and completion of the whole of the works described or implied in this specification and shown on the Drawings. All works shall generally include:

a) Supply and installation of submersible pumping equipment into an new groundwater production bore,
b) Supply, installation and commissioning of electrical starting, protection and control equipment associated with the new submersible pump unit, and as required for effective and reliable delivery of water into the existing irrigation system. Works to be completed strictly in accordance with the City of Cockburn's 'Specification for Bore, Cabinets and Irrigation'.

The entire works shall be performed in accordance with the this specification, applicable regulations and requirements of the Occupational Health Safety and Welfare Act, the Office of Energy, the Fire and Accident Underwriters Association of WA, the City of Cockburn, and every other authority having jurisdiction over the works.

It shall be the appointed contractor's responsibility to undertake the works in a professional and workmanlike manner that will allow for the timely completion of the works without being detrimental to the operation and performance of the new bore water supply. It is anticipated that all labour employed on site in construction of the bore shall have a comprehensive understanding of the type of equipment and products being installed.

The extent of the works shall comprise:

i) Completion of the bore at the surface with a new concrete plinth and hot dip galvanised headworks assembly and termination ready for connection to a proposed new existing irrigation mainline.
ii) Supply and installation of submersible pump unit, column, cable and low level probe conduit.
iii) Supply and installation of a new City of Cockburn standard electrical cubicle on a concrete plinth to house all equipment required for operation and control of the submersible pump unit and irrigation system.
iv) Testing and commissioning of the new water supply, after connection of power supply by others.

4.2 Borehole Pump

The make, model and motor size of the three phase submersible pump shall be suitable to provide to the duty of a nominated litres per second at a nominated total dynamic head length.

Final pump selection however will not be confirmed until the performance tests on the new bore have been assessed by the Superintendent, and the pump unit shall not be purchased by the Contractor until the required pump duty has been confirmed by the Superintendent.

4.3 Pump Discharge Column

The pump and motor unit shall be installed on pump column as specified. The final length will be determined by the Superintendent after the new bore has been flow and drawdown tested.

A 20mm Class 12 PVC probe conduit shall be installed, terminating 0.5 metres above the top of the pump unit. The top end of the probe conduit shall terminate with a 15mm cat 17 valve socket, screwed

into a 20mm socket provided in the base of the bore head plate. The bottom end of the probe conduit shall be capped, and shall have water entry holes drilled or cut over the lower 200mm of the conduit.

A 25mm Class 12 PVC dosing tube shall be installed terminating 0.5 metres above the top of the pump unit with an open end on the pipe.

The electrical drop cable used in this facility shall be designed by the manufacturer for permanent submergence below water level (eg Hydrofirm, Eucahydro or Aquaflex), and shall be sized in accordance with manufacturer's recommendations for the motor to be installed in the bore. Sufficient excess length of cable shall be left below the bore head, to permit future dis / reconnection of the pump unit without excessive difficulty.

4.4 Discharge Headworks

The bore shall be completed at the surface with a concrete plinth and hot dip galvanised bore head fittings, strictly in accordance with City of Cockburn drawing number 2087896 Rev 1. (See Appendix 7.3)

4.5 Power Supply

Power will be provided to the vicinity of the bore site by Western Power. The Contractor shall be allowed to extend the power supply from the point of attachment pillar to the electrical control cubicle.

4.6 Circuit Breaker

The Contractor shall allow for the supply and fitting of a motor rated circuit breaker in the submersible pump cabinet, as recommended by the motor manufacturer.

4.7 Testing and Commissioning

The Contractor shall allow to return to site upon completion of all works and to carry out running tests in the presence of the Superintendent.

The Contractor shall provide and set up all necessary test apparatus to determine the discharge rate and operating pressure. Water level and current draw readings will also be required. The Contractor shall operate the pump unit from open flow to 1000kPa (or shutoff pressure, whichever is the lower) recording the flow rate, water level, discharge pressure and current draw in 100kPa increments. Results shall be recorded by the Contractor, and supplied to the Superintendent in typewritten tabular format.

The Contractor shall provide any equipment necessary to adequately dispose of water discharged during testing of the facility, without undue disruption to the surrounds of the bore site.

4.8 Schedule of Rates – Pump and Electrical

See Appendix 7.2, schedule of rates template for the pump and electrical requirements of a bore, to be completed by the relevant contractor.

5 CABINETS, CONTROLLERS AND ELECTRICAL

5.1 General

The works associated with this specification shall include the supply and installation of reticulation system pump cubicle control switchboards as detailed in this document.

The works generally, comprises the supply and installation of new Automatic Reticulation System Pump Control Switchboards.

In particular the work is to include:

- Connection to Western Power underground supply;
- Supply and installation of Consumer Mains, Point of Attachment and Conduit Access to Pump Control Switchboard. Supply and installation of new pump control switchboard within 5 meters of bore location;
- Defects Liability;
- Testing and Commissioning; and
- Maintenance

5.2 Regulations

All workmanship and materials shall be in accordance with S.A.A. Wiring Rules – AS/NZS. 3000:2007 and or subsequently revised editions and the further requirements of this specification.

In addition, the electrical installation shall comply with the State Electricity Act, WA Electrical Requirements and Local Supply Authority requirements.

The above Rules/Act/Regulations shall take precedence if there is any apparent discrepancy or contradiction between them and this specification.

The Contractor shall submit any dispute regarding the interpretation of the Rules/Act Regulations to the appropriate governing body for a ruling.

Licensed electrical tradesmen under the supervision of a licensed Electrical Contractor shall carry out all electrical work.

5.3 “As new” condition on completion date

Proper care shall be taken to protect all apparatus, materials and equipment to be installed. Any item of equipment/wiring that is to form part of the permanent installation shall not be used for construction purposes and shall be energised only for necessary testing of equipment. It will be the Electrical Contractor’s responsibility to ensure that the complete installation is handed over on the Completion Date in an “as new” condition.

Exceptions to the above clause may be allowed / required as directed by the Superintendent for testing of permanently installed equipment.

Ensure care is exercised to prevent the ingress of dirt, moisture and foreign substance into conduits, ducts or other cable enclosure or equipment. Should any ingress occur carefully remove any offending matters and thoroughly cleans enclosures and equipment to approval of the client.

5.4 Samples

The Contractor on request shall supply samples of equipment, fixtures, switches, outlets, materials and/or workmanship, identification labels and the like. Such samples shall be viewed and commented on by the Superintendent in writing, prior to the placement of orders for the appropriate equipment or installation work is carried out.

Such samples are to be retained as criteria as to the standard of equipment, workmanship or material to be supplied. Any item not so complying may forthwith be rejected by the Superintendent and shall be replaced without cost to the client.

5.5 Making Good

When execution of the works causes holes or other damage, then it shall be the Contractors responsibility to repair such holes or damage with materials compatible with the surrounding material and finish off flush with the surface on which they occur to the satisfaction of the client.

Repair in all trades, to approval, damage for which the contractor is responsible to the existing property in or upon which the work under the contract is carried out.

5.6 Manufacturers Details

The Contractor shall at all times refer to Equipment Manufacturers Electrical detailed drawings for relative dimension of equipment.

Consideration shall also be given to segregation of services, ventilation and requirements of other services in positioning equipment within the switchboard.

The Contractor shall be deemed to have viewed all manufacturers' data in order to be completely familiar with all aspects of the project. Claims for additional costs associated with the Contractor not being fully aware of all works necessary will not be considered.

5.7 Power Supply

The power supply to the installation consists of 415/240 volt, three- (3) phase plus neutral, four (4) wires, 50 Hertz. Minimum cable size to be 10mmz.

Equipment supplied under this contract shall be suitable for this supply.

Electrical supply will be derived from the Western Power supply distribution. Allow 10 meters for purpose of tendering.

5.8 Familiarisation

The Contractor shall visit each site and have fully informed himself on the site conditions, facilities and existing electrical installation, construction details and site conditions prior to completing the works.

Claims for additional costs associated with the Contractor not being fully aware of the existing installation or conditions, will not be considered.

5.9 Co-Ordination of Services

The Contractor shall be aware that close liaison between him, the equipment suppliers, and others are required.

The provision of all new services shall be carried out in such a manner to create the least possible disruption to the Proprietor.

Advise the Proprietor 24 hours prior to the disconnection, relocation etc., of any services, to ensure interruption to services are kept to an absolute minimum.

5.10 Drawings

Drawings

The contractor is to provide legible and accurate drawings. Select drawing scales to afford clarity. Typically for switchboards, use scales not less than 1:10 for assemblies and 1:5 for details.

Drawing Number	Drawing Title
nle129350	Typical Electrical Cubicle
nle151694	Typical Electrical Cubicle

As Constructed Drawings

On a set of electrical site and layout prints provided by the City at the commencement of the construction stage, the contractor is to indicate variations to circuits and any other electrical points, underground conduits and cables, draw in pits and the like, measured from two fixed objects.

Keep prints up to date, on site and available for inspection by the City. Add information permanently and legibly using identical symbols to those on the drawings.

Drawing List

In addition to this specification, the following list represents drawings produced for the undertaking of the Electrical Services Installation

5.11 Equipment

Fabricated Equipment

Fabricated equipment is to be of robust, symmetrical and unwarped construction to approval before installation.

Metalwork is to be neatly and accurately cut and free from undulations or any other distortions;

Form bends and folds in sheet metalwork with a suitable bending machine; and,

Neatly execute welding with the finished weld, ground or filed smooth and level with the surrounding surface.

Location and Fixing of Equipment

The contractor is to rigidly fix equipment neatly and symmetrically to rigid supports.

Ensure fixings are in accordance with good engineering practice and meet with approval.

Firmly fasten conduits in place. Ensure that there is no possibility of dislodgment by other trades.

Heights shown on drawings or specified are the heights from finished floor level to the centre of the equipment.

5.12 Wiring

Earthing and Bonding

Earthing in all instances shall comply with the full requirements of AS/NZS 3000:2007, WA Electrical Requirements and local supply authority regulations and contractors guides.

All fittings, G.P.O.'s and equipment shall be directly earthed with an R.C.D.;

All metal conduits shall be electrically and mechanically continuous and be neatly bonded and earthed at switchboards;

Insulated copper earthing conductors shall be integral within the cables of each circuit. Earthing conductors for G.P.O.'s shall be insulated 2.5 sq.mm (7/0.67);

Size of earth conductor installed with pump cables shall be sized in accordance with AS/NZS 3000:2007 and WA Electrical Requirements. Earthing conductors in switchboard, switchgear, terminal boxes, G.P.O. enclosures and anywhere in the vicinity of live metal shall be insulated.

Main Earth

The contractor is to install the main earth electrode, connection and cabling in accordance with AS/NZS 3000:2007and the WA Electrical Requirements. If required minimum resistance to earth is not achieved, provide additional length to earth electrode. The main earth connection shall be made below ground level. Install a pit similar to a FCI Products FC4 earth pit to enclose the main connection and electrodes;

Total number of earth rods shall be installed to achieve minimum allowable resistance to earth;

Provide permanent marking on the pit cover to read "Main Earth";

Make connections with approved copper or brass band type clamps. Ensure that clamping bolts are either of Securely fix a label engraved with 5mm red filled lettering in upper case to read:

MAIN EARTH - DO NOT DISCONNECT; and enclose main earth cable from earth position to main switchboard in H.D. plastic conduit.

Cables

The contractor is to supply, install, connect, and terminate all cabling necessary to complete the installation of works for this project.

All cables shall be new and delivered on site in unbroken reels, and with the "makers" label attached. All cables shall have copper conductors, unless otherwise specified or categorised as "special cable" as determined by the contractor in accordance with the clause "special cable" of this document.

All cable shall be unconditionally guaranteed and such guarantee shall cover replacement of faulty cable and full reimbursement of all costs involved.

Cables shall be PVC insulated with overall PVC sheath V75 grade unless otherwise specified.

The minimum size of cable shall be 2.5 sq. mm (7/0.67) for 240 volt circuits, 0.75 sq. mm (24/0.20) for ELV power circuits and 0.5 sq.mm (7/0.32) for ELV signal circuits. Due consideration shall be given to voltage drop when calculating cable sizes.

Wiring shall be in accordance with circuit diagrams and attached drawings.

Where the system or part of the system to be installed as part of this contract is to be connected to a telecommunication system, all cabling installed as part of the system shall comply with requirements of the relevant Telecommunication codes, regulations and Authority.

All wiring shall comply with the latest issue of the Local Supply Authority where relevant, any additional requirements specified hereunder, and the installation and cable route shall be to the satisfaction of the Proprietor.

During the installation of cable, should any kinks or abrasions to insulation, braiding, sheathing or armouring occur, the affected cable shall be withdrawn and replaced with new cable. In the event of finding evidence for reasonable doubt as to the non-compliance with this clause, the City reserves the right to direct that the suspect cable be withdrawn for inspection. The cost of withdrawing and replacing the cable shall be at the Contractor's expense.

All cables shall be installed under the 'loop into fittings' system. No joints or connections will be permitted. Adequate slackness shall be left in cables behind all switchboards, switches and fittings generally to facilitate their removal for inspection, adjustment or replacement. Any one conductor of a size up to and including 2.5 mm^2 entering a terminal shall have its bared conductor end connection. A number of conductors entering a terminal shall be firmly twisted together and excess length cut off 2mm before the terminal.

In all cases, cabling shall be installed in such a manner that it is replaceable at any time without damage to cubicle, concrete base or reticulation system equipment.

In the event of finding evidence for reasonable doubt as to the non-compliance with this clause, the City reserves the right to direct that the suspect cable be withdrawn for inspection. The cost of withdrawing and replacing the cable shall be at the Contractor's cost.

In Addition to the general requirements, cables shall be installed in conduits in such a way to prevent twisting or kinking of cables or damage to cable sheaths.

Conduits shall be completely assembled prior to the drawing in of cables.

5.13 Wiring Diagrams

Contractors shall provide the following:

Block schematic cable diagrams indicating all system interconnecting cables including cable routes and cable types complete with core make up and numbers;

Detailed plans indicating cable routes and designated circuit identification; and,

Wiring diagram detailing system interconnections and cable/core identification.

5.14 Special Cabling

Where equipment to be supplied and installed under this Specification requires special cabling (i.e. screened cables, unscreened twisted pair, fibre optic cable or other special types of cable), the contractor is to provide these cables as required.

5.15 Cable Identification

All cables shall be labelled by the contractor at both ends designating the panel or device at which the cable originates/terminates. All multi-core control and signalling cable shall have numbered cores or

pairs, and a recognisable colour coding sequence. These shall be detailed on block and wiring diagrams to be supplied.

Where such cables terminate in termination boxes, junction boxes, control panels, switchboards etc., all cables (and individual screens if applicable) including spares, shall terminate in numbered order on a separate row of terminals for each cable. For the purpose of this clause, single core cables that are in one conduit shall be deemed to be a multi-core cable.

Each block of terminals and each terminal therein shall be numbered and identifiable from circuit, wiring and connection diagrams.

Cables shall be labelled using Critchley cable markers or an approved equivalent. The markers shall be:

- Critchley K-type markers for cables or cable cores 7 mm or less in diameter; and,
- Critchley K-type markers on carrier strip of size appropriate to the cable sheath diameter for cables larger than 7 mm in diameter. Carriers to be secured to the cables using Critchley cable strapping which shall be of length 1.5 times cable circumferences.

Cable identification tags shall be orientated uniformly to read left to right from the logical viewing point horizontally and from bottom to top viewed from the right, where installed vertically.

5.16 Cable Numbering

Generally all cables shall be allocated and identified with unique cable number.

Cable identification numbers shall be taken from the block and wiring diagrams for each system.

Each cable shall be fitted with tags at the following points:

- On the cable sheath next to the gland at each end; or
- In cable pits; or
- At any additional point on the cable sheath (or around the core bunch) where requirements in above are not readily traceable from the core terminations.

5.17 Cable Lugs

All cables terminating on a screw, bolt or stud shall be fitted with approved “CRIMP” or “SOLDER” type lugs. Crimped lugs shall be fitted using the correct size and type of crimping tool.

The current rating of lugs shall match as near as is possible to the rating of the cables under the particular circumstances of the cable usage, but in no case shall it be less than the cable current rating.

Flat washers, together with an approved type of securing washer, shall be used when fixing cable lugs to the screw, bolt or stud.

5.18 Taping

Tape and taping used by the Contractor where specified is to be in accordance with the following:

Tapes to be of an approved type to suite the particular conditions and cable application;

Taping shall be such as to achieve at least the equivalent insulation of the cable;

Taping shall be half lapped and securely terminated; and,

Tapes to be coloured to match the colour of the cable being taped.

The following colour codes are to be used throughout all installations:

- Phases Red, white, and blue as applicable.
- Neutral Black.
- Switch wires White.
- For TPS cable Power - Black sheath.
- Light White sheath.
- Main Orange sheath.
- Sub-mains Orange sheath.

5.19 Conduits

Heavy Duty Conduit

Conduits are to be stamped by the manufacturer with conduit class, size and AS approval.

All underground conduits shall be heavy duty rigid PVC (orange).

Heavy-duty conduits are to be sized to accommodate cables specified or nominated by the City.

Make joints between conduits and between conduits and accessories solid and waterproof. Junction boxes and the like in heavy-duty conduit system shall be complete with a neoprene gasket.

Protect conduits exposed to sunlight with an approved painted steel cover.

Install conduits to the manufacturers' preferred recommended practice.

Conduit fittings such as elbows, bends, tees etc. shall not be installed in underground conduit runs.

All changes in direction shall be made using large radius sets in the conduits.

Underground Conduits

The contractor is to install conduits 600mm below finished ground level, except where otherwise shown on drawings.

Install conduits to the manufacturer's preferred recommended practice.

Provide all shoring sheet piling or support necessary to maintain safe excavation of all trenching.

Arrange conduits so that the makers' identification and the conduit category are uppermost in clear view.

Install conduits with a slight fall to the first junction box or cable pit external to the building.

Make joints between conduits and accessories solid and waterproof.

Cover conduits with 150mm depth of rubble free sand and place an identification tape 150mm above the conduit along the entire length of the installation.

Use orange plastic tape, approximately 150mm wide and indelibly marked "DANGER ELECTRIC CABLE BELOW", laid directly over conduits.

Conduits shall be installed in straight lines with pits at each change of direction.

5.20 Fittings and Accessories

All fittings shall be new and of type/make as specified elsewhere. All fittings shall be installed flush unless otherwise specified.

Heights shown on plans and/or schedules shall be the height from finished ground level to the centre of the equipment.

The Contractor shall be responsible for all trimming required for fixing, supporting and securing electrical fittings unless otherwise specified.

5.21 Switchboards

Supply and install switchboards as specified and shown on drawing. Fully equip, without crowding the cabinet, with items specified, including provisions nominated for future additions/development and complete with accessories and components necessary for sound construction and reliable operation.

Ensure wiring fastenings, fittings, sections, screw threads and the like conform to Australian Standard preferred sizes.

Provide conduit, cable, floor duct and ceiling duct entries as required.

Where prospective short circuit current levels are nominated the switchboard design and component selection must be adequate to withstand the prospective mechanical and thermal stresses without damage to the switchboard.

The switchboards shall be fabricated, transported to site, stored, installed, connected and tested as further detailed.

In all cases the method of storage, on site protection and method of installation of all switchboards shall be to the entire satisfaction of the City.

5.22 Compliances with Codes

The design and construction of the specified switchboards shall conform in all respects to the specification, regulations and by-laws of statutory authorities and S.A.A Codes.

5.23 Management of Components

The contractor is to position components neatly and logically so that as far as possible power flow control and operational sequences is obvious. Delineate sections of switchboards containing more than one service by labels and escutcheon panels.

The live connection to fuses and MACBS shall be fully insulated and where these components are mounted vertically, the live connection shall be at the top.

Locate relays and contactors for ease of cabling and maintenance.

Position and ventilate heat-generating equipment to ensure that no component is subjected to excessive temperatures.

All appropriate fuses relays, switches, circuit breakers etc. must be included within the cubicle, however these shall be located so that all 240/415 Voltage equipment is behind hinged panels.

5.24 Construction Details

Switchboard structural frames including brackets and the like shall be manufactured from not less than 2.5mm marine grade aluminium.

Cladding for switchboards, escutcheon panels and the like shall be fabricated from not less than 2.5mm marine grade aluminium, orbital sand finish to all external panels.

Doors shall be fabricated from 2.5mm marine grade aluminium.

The cabinet shall be totally enclosed, weatherproof, lockable via minimum of (2) Lockwood stream bolt deadlock type (not night latches) keyed to suit the City of Cockburn “WAS” key.

Cabinet shall be ventilated top and bottom with all ventilation fitted with brass flywire.

All internal securing and mounting angles and straps shall be welded into the cubicle during manufacture. Screw heads on cubicle exterior will not be accepted.

5.25 Hardware Construction

All metal work by the contractor shall be machine bent, and folded, flat smooth and free from warps, twists and other distortions. The edges of all cut-outs and/or holes shall be free of burrs and shall be ground to a clear face.

Holes provided for cable access shall be suitably grommeted. Panels and/or escutcheons shall be fitted with knurled chrome plated thumbscrews. The screw heads shall be fitted with screwdriver slots. Screws shall be complete with captive fibre washers.

5.26 Fixing Methods

All bolts screws, etc., used by the contractor on switchboards shall be of metric thread and if of ferrous metal, shall be cadmium plated.

Any fixing to the cubicle shall be done by use of “Riv-Nuts”, “Root-Nuts”, or other approved fastening methods. Bolts used throughout the construction are to be cadmium plated unless any other finish is specified elsewhere.

5.27 Shop Drawings

Prior to commencement of construction, the Electrical Contractor shall submit shop drawings of the switchboards to the City for approval.

Cubicle and Western Power metre panel shall be dimensions such that Western Power metre can be installed with applicable fuses.

Western Power approval of main switchboard layouts shall be obtained before submission to the City.

5.28 Dimension All Compartments

Full consideration by the contractor shall be given to:

- the size of the components and accessibility for maintenance and removal, with ample space and fixings.

- the type and quantity of cabling entering the compartment and connections to the components. There shall be ample room to enable disconnection to, or dismantling of any piece of apparatus enclosed within the compartment.

5.29 Cubicle Finish

Cubicle to be orbital sand finished.

5.30 Busbar

Busbars supplied and installed by the contractor are to be high conductivity electrolytic copper of adequate size for the maximum current rating of each and all items of switchboard equipment and be rigidly supported on approved insulating material supports.

All joints and tee-offs on the busbar system shall be accessible for visual inspection and access with a tension wrench for physical checking of tension in the joints.

All joints and tee-offs with rectangular busbars shall be standardised in dimension, arrangement and bolting. Bolts shall be of high tensile steel.

Bolts shall be tightened with a torque wrench to obtain optimum contact pressure between both surfaces and to the value stated by the bolt manufacturer for the particular size and application of the bolt.

NOTE: Single bolted joints are not acceptable.

The manufacturer in the cutting, forming and assembly of the busbar system shall exercise special care.

Each edge shall be smooth and free of any deformation and cutting techniques shall be such that no lip is left on the cut edge.

All burrs shall be removed, and the mating surfaces of all joints shall be true and flat. Matching faces of all joints shall be smoothed by draw-filling or flat belt sanding and lightly smeared with Petroleum Jelly immediately after sanding or cleaning.

Bending and forming of busbars shall be carried out using bending devices and jigs specifically designed for the bending of copper busbar, and all such bends and set shall be free from cracks and with minimal distortion of the busbar cross-section.

At no stage shall the busbar be annealed.

Holes drilled for bolts through the busbar shall be concentric and shall have maximum 1mm clearance on diameter over the bolt size.

Metric bolts to AS1110 - 1980 shall be used throughout the construction of the busbar system.

Busbar shall be colour coded with the appropriate phase colours by painting, PVC coating or taping.

Earth and neutral bars shall have sufficient ways for connection for all conductors at one conductor per terminal.

5.31 Cabling Within Switchboards

All cabling within the switchboards shall be installed in vertically and horizontally installed slotted P.V.C. cable duct. P.V.C. ducting shall be fitted with clip-on lids.

The size of cable duct shall be assessed by taking the full cable capacity of the relative section of cubicle, including future extensions, and ascertaining that these cables shall not occupy more than 40% of space in this duct.

Ducting shall be provided above and below each bank of fuses or A.C.B. chassis, group of relays, etc., jointing to main ducts running vertically, top to bottom, at far ends of cubicle.

Where cables are to be terminated on bolt or studs, they shall be fitted with soldered or compression type cable lugs.

No exposed live metal will be permitted in the cabling zones. Ample space shall be provided in the cabling zones to accommodate incoming and outgoing cables, together with the necessary trays, PVC ducts and supports to carry the cables.

The type area and size of compartment for cable terminations shall be made with cognisance of the size of the conductor connected and its ability to withstand a fault, which could be attained prior to the circuit protection device opening.

5.32 Air Circuit Breakers (A.C.B.)

The contractor is to supply and install the appropriate rated Hienemann or equivalent motor circuit breaker. This circuit breaker is to be installed inside the cubicle behind a hinged panel.

Air circuit breakers Miniature type air circuit breakers shall comply with the relevant codes and regulations.

Air circuit breakers shall be selected to have a fault withstand level equal to or greater than the prospective fault level. The minimum air circuit breaker fault level rating shall be 6ka.

Where A.C.B.'s are indicated as chassis mounted, they shall be mounted on standard pressed steel chassis, complete with three-phase busbar system. Unless otherwise indicated, allow 30% spare space for future A.C.B.s. Provide all busbar connections, fixings etc., to facilitate fitting of future A.C.B.'s.

Unless otherwise indicated, switchboards shall be fitted with removable escutcheon covers of 2.5mm with cut outs for the A.C.B.'s arranged so that only the toggles and rating plates of the A.C.B.'s shall be exposed. Supply suitable blanking covers/plates to escutcheon cut outs for future A.C.B. provision.

5.33 Isolating Switches

The contractor is to ensure isolating switches are fully insulated and rated to meet the required duty. Class 'M' or 'X' as applicable.

5.34 Circuit Schedule and Line Diagram

Each switchboard shall be fitted with a typewritten circuit schedule and line diagram showing the internal connections of the respective board. This shall be mounted in a glazed holder fixed to the inside of the switchboard door.

5.35 Testing

Before delivery of any switchboard to site, carry out operational tests in the presence of, and to the satisfaction of, the City, after giving advance notice to him in writing of the intention to carry out the tests.

5.36 Labelling

All equipment such as switches, ACB's, fuses, contactors, time switches and the like shall be labelled to indicate their function by the contractor.

A label fixed to the door shall identify the switchboard.

All labels shall be machine engraved traffolyte, fixed into position.

5.37 Gland Plates

Gland plates supplied and installed by the contractor shall be manufactured from 2.5mm aluminium plate.

Gland plates shall be bonded to the main earth bar during switchboard manufacture.

5.38 Escutcheon Panels

The contractor is to mount equipment securely on suitable mounting channels behind removable Escutcheon Panels, giving front access to the terminals.

Generally finish equipment flush with the Escutcheon. Ensure that panels expose switch and circuit breaker handles, toggles and fuse carriers. Ensure that there is minimal deflection when equipment is handled or operated as would reasonably be expected during service.

Fabricate Escutcheon from 2.5mm marine grade aluminium and form a return edge all around and reinforce as required. Cut Escutcheons for the full complement of the switchboard and blank off as required to approval. Neatly execute cut outs with edges free from burrs and fit closely to the equipment.

Escutcheons shall have separate cut outs for each individual air and moulded case circuit breaker.

Fix Escutcheon with captive chrome plated brass screws with fibre washers and fit each escutcheon with a minimum 2 chrome plated 'D' type handles.

Provide chrome plated locating pins on the cabinet for each escutcheon, with at least 2 per panel.

5.39 Channel Base

A channel base of at least 75mm shall be fabricated and after manufacture, and be hot dip galvanised.

The base shall be held to the concrete by at least four fixings, two of which shall be within the cubicle. Fixings shall be a minimum of 75mm x 10mm.

The base shall be waterproofed to the concrete with a silicon sealant.

Isolate the channel base by a continuous rubber or fibre strip affixed to the cubicle.

5.40 Concrete Base

The concrete base shall be constructed from a minimum of 20-20-80/20 Mpa concrete and conform to the relevant SAA standards.

The concrete base shall finish a minimum of 100mm above the surrounding finished ground level and a minimum of 300 mm below ground level.

Heavy-duty conduits shall be installed in the concrete base. All conduits shall be category A heavy-duty conduits.

5.41 Door

Provide with

- lift off hinges;
- adequate stiffeners welded to the door, in order to rigidly secure it against unauthorised entry;
- two solid link sliding arm which latches in the open position top and bottom of the door;

The cabinet shall be totally enclosed, weatherproof and lockable via minimum of two Lockwood stream latched deadbolt type locks not night latches, and keyed to the City of Cockburn “WAS” master key.

The cabinet shall have a legend holder, protected by a transparent sheet affixed to the inside of the door and shall house a circuit diagram.

5.42 Western Power Meter Position

The Western Power meter position shall be isolated from other sections of the cubicle.

The meter accommodation shall comply with Western Power contractors guide for segregation, and front and rear access and clearance. Accommodation shall be suitable for “TIME OF USE TARIFF METERING”.

5.43 Monitoring Equipment

The Contractor is to install equipment as outlined in this specification. This shall include:

- A Reticulation Controller and power supply; (supplied by others).
- A pressure transducer, output range 4-20mA for VFD use
- A pressure transducer, output range 4-20mA for SDS controller use
- An appropriate Amp meter and current transformer.
- A float less level switch.
- Bore Low Level monitor probe and switch relay for signal to control PLC unit; and,
- Wire and connect flow meter direct to controller within 5 meters from cubicle.
- A Rain Bird WR2 Wireless Rain/Freeze Sensor complete with relay and power supply for correct operation.
- A 50mm width 4 meter height Galvanised Water Pipe Pole (with 50mm cap) to be saddle clamped to the side of irrigation cabinet by contractor for the purpose of rain sensor.

The contractor shall supply, install and connect cabling to the following control equipment which shall be supplied by others:

- Bore low level probe terminal located in the bore head junction box.
- All fuses, relays, switches, control equipment, transducers, interconnecting equipment shall be mounted behind a hinged escutcheon.
- High pressure protection connected to the pressure tapping in the bore head junction box complete with 3 second delay, lock and visual fault display.
- Low pressure protection connected to the pressure tapping in the discharge elbow below ground complete with 6 minute delay, lock and visual fault display.
- Pressure gauge with brass fittings. Pressure tube and installation to comply with current AS/NZS 3000:2007 and WA Electrical Requirements.

- Easy 719-AC-RC PLC controller or equivalent programmed for run and fault conditions with run and fault visual display.
- Manually operated reset push button for all fault conditions.

NOTE: All visual indicators and meters shall be mounted on the hinged escutcheon.

5.44 Fault Indication on PLC controller

The following fault/indication is required:

- Pump Running;
- Bore Low Level;
- Overload; and,
- High pressure fault.
- Low pressure fault.
- No flow fault for VFD use.

5.45 Specific Details

The contractor is to ensure the specific requirements detailed below are provided or allowed for.

- Provision of one single spare 10 amp 240 volt GPO in front of panel and one 10 amp 240 volt GPO at rear of panel for SDS controller power supply connection with R.C.D.
- Cubicle design and layout generally as per front elevation on attached drawing.

The Contractor is to make himself fully conversant with all the ancillary equipment e.g. Independent power supplies, operating procedure, programming functions, etc.

Terminal blocks for low voltage control wiring are to be mounted on the front panel within easy reach of maintenance personnel with segregated solenoid wiring as per current regulations.

Install a Key operated Auto – Off – Manual selector switch with removable key.

All indicator lights, fuses, transducers etc. must be labelled to indicate the function of the apparatus.

The Contractor is to liaise with Western Power to ensure all appropriate tickets are submitted.

The Contractor must give 24 hours' notice to the Contract Supervisor prior to commencement of any work at a job site.

All works are to be commissioned with a representative of the City before completion.

5.46 Switchboard Details

The contractor is to ensure the specific requirements detailed below are provided or allowed for.

The pump control switchboard shall consist of a weatherproof freestanding front access cubicle complete with lockable door.

The switchboard shall be mounted on a concrete block as detailed on attached drawing with conduit access into pump cubicle.

Refer to Power and Control diagrams for equipment to be provided.

The switchboard as a whole and all component parts shall be guaranteed to withstand 12,000 AMPS RMS symmetrical with a multiplying factor of 2.1 for asymmetry, for (1) one second.

Cubic size shall be:

- 1200 mm high x 930 mm wide x 500 mm deep for standard soft starter type.
- 1500 mm high x 1050 wide x 550 mm deep for VFD installations.

Segregation to be Form 1 to AS 1136.

5.47 Inspection

During the course of construction of the switchboards, the City may from time to time inspect the progress of construction of switchboards and every facility shall be made available by the contractor at the switchboard manufacturer's premises to enable the inspections to be carried out.

Notwithstanding the above, the contractor is to give one week's notice the City that the boards will be completed on a due date and that a preliminary inspection can be made.

At any such inspection, remove covers or components to facilitate inspection as required by the City.

The City shall carry out a final inspection after a switchboard has been delivered to site and installed in its permanent position and all electrical connections completed.

5.48 Protection, Cleaning and Pre-Commissioning of Switchboards

The contractor is to make provision for:

Vacuum cleaning of all switchgear and equipment mounted within the switchboards to remove dust.

Wiping of all insulated parts, metal pans, etc., to remove all remaining dust particles, filings or metal shavings;

Switchgear containing lubricants shall be washed with an approved solvent and lubricated with oil or grease recommended by the respective switchgear manufacturer; and,

5.49 Consumer Mains

The contractor is to supply and install Consumer Mains from the Western Power point of attachment to the Western Power KWH meter in the pump cubicle.

All supplies to the City of Cockburn facilities shall be underground, including areas where power is overhead.

Consumer mains cabling shall be rated and sized for adequate current carrying capacity in accordance with AS/NZS 3000:2007, WA Electrical Requirements and AS/NZS 3008.1.1 Consumer mains shall be a minimum of 10-sq mm and upgraded if required to suit loading.

Liaise with Western Power for the Point of Attachment from which the supply shall originate at each site.

For supply originating from a Western Power pillar box, (URD Pillar) supply and install a heavy duty conduit originating from the pump control switchboard and terminating at the pillar box. Conduit shall be suitably sized for Consumer Mains.

5.50 Power Supply Location

The contractor is to ensure the Point Of Attachment (POA):

Conforms to Western Power standards, AS/NZS 3000:2007, WA Electrical Requirements and Contractors Guide;

The proposed location of POA is approved by Western Power and the City.

5.51 Pump Cables

The contractor is to comply with the requirements below for submersible pumps cable from the electrical junction box at the bore head to the pump control switchboard.

Supply and install underground conduit access from the electrical junction box at the bore head to the pump control switchboard.

For above ground pumps supply and install PVC sub-main cables from the pump cubicle to the motor terminals.

Supply and install underground conduit access from the cubicle to the motor terminal box.

Cable shall be rated and sized for adequate current carrying capacity in accordance with AS/NZS 3000:2007 and AS/NZS 3008.1.1.

5.52 Motor Starting

Digital Soft Starter

The contractor is responsible to ensure that motor starting complies with “WESTERN POWER ELECTRICAL REQUIREMENTS SECTION MOTOR STARTING” latest revision.

Digital electronic soft starter (size to suit motor at maximum running current).

Variable Frequency Drive

The Variable Frequency Drive (VFD) shall be sized according to the maximum rated amperage draw of the pump (not the nominal power consumption), as specified by the pump manufacturers.

The VFD drive unit/s shall be supplied and installed with appropriate RFI filters required by the Western Power Corporation. An LC Sine Wave filter is to be supplied and installed as per the motor manufacturer requirements.

The VFD shall be either a Danfoss AQUA frequency converter (variable frequency drive), Vacon Flow or similar. This VFD shall be coupled to a 4-20mA signal pressure transducer.

The pump will attempt to maintain pressure (500KPA) by increasing or decreasing speed as necessary to meet the flow demand of normal irrigation.

The variable frequency drive (VFD) shall operate when a control signal is received from the Irrigation Control system. .

The VFD shall be installed within a separate section of the cabinet and to the left side of reticulation cubicle. This section of the cubicle shall be separated from other electrical equipment and connections, to allow access for programming of the VFD by licensed personnel only. The cubicle shall be complete with a thermostatically controlled cooling fan. A hinged escutcheon panel with remote VFD display to be supplied and fitted to the VFD section.

5.53 Reticulation Controller

Irrigation Controller shall be an SDS-100 2 wire controller (signal data systems). The contractor shall make allowance for the supply of required SD-AN-700 standard external antenna aerial to suit modem, SD-MD Signal 3G Modem, and pressure transducer as required for correct operation. Permission must be given by principal for smaller (SD 50 or 75) controller.

NOTE: Only 2wire systems (not multicore) will be accepted.

5.54 Commissioning

The Contractor is to commission the complete system in accordance with the contract document. In carrying out the commissioning tests, the Contractor shall:

- Check all equipment is fully operational and able to provide uninterrupted service, pending system and device failures.
- Demonstrate to the City the correct operation of system functionality and transfer of information between integrated components; and,
- Provide a final commissioning report outlining all test results relative to system and any other information deemed necessary for future records.

5.55 Disconnection of Supply

The Contractor shall, as requested by the City, disconnect and make safe any equipment or parts of a building on which other trades are working, where a danger exists such, that the work may disturb the electrical services. The contractor shall pay all Western Power fees to disconnect and reconnect power supply as required for works to proceed.

Where switchboards, cables or equipment are normally energised, make allowance for disconnection of supply prior to work on it.

Liaise with the City prior to disconnection of supply so that any power shutdowns will cause the minimum disruption

5.56 Balance of Load

The Contractor shall ensure that load is balanced as evenly as possible. Phase connection shall be made to balance the load as evenly as possible over all phases of supply to the satisfaction of the City and supply authority.

5.57 Electrical Danger Notices

The Contractor is responsible for placing electrical danger notices in all places considered dangerous, or as directed by the City, until completion of the contract or at such other times deemed safe by both parties for their removal.

5.58 Testing

The Contractor shall carry out approved 1000-volt insulation tests of all permanently connected wiring to all services/equipment prior to the connection of such wiring to the Electricity Supply. All testing shall be carried out in accordance with the S.A.A. Wiring Rules “Testing of Installations” prior to installation of controller.

The installation shall be tested to the satisfaction of the City and statutory authorities prior to acceptance of the installation and commencement of defects liability period.

This shall include a thorough inspection of the installation, including all tests required to confirm compliance with the specification.

Any equipment or materials found to be faulty or not complying with the drawings and specification shall be either replaced or repaired free of charge to the City and tested again.

5.59 Materials / Equipment Schedule

The Contractor shall provide a schedule of all materials, equipment and components that form part of the works associated with the project. The list shall include all items of equipment, including their component parts.

5.60 Maintenance Manuals

The Contractor shall produce Operation and Maintenance Manuals on completion of the job.

5.61 Maintenance during Defects Liability Period

Without additional charge to the City, the Contractor shall renew any parts that prove faulty from workmanship or materials and for a period of fifty-two weeks after the date of the Certificate of acceptance.

Call Outs during Defects Liability

In addition to the Maintenance Requirements specified during the Defects Liability Period, the Contractor or his nominated service agency must attend on site within (24) hours of notification of a failure of the equipment and associated systems installation. This call out requirement must apply on a 24 hour, 7-day week basis.

5.62 Equipment Ventilation

The contractor is to ensure that all electrical/electronic equipment mounted within cubicle is to be adequately ventilated by either convection or forced air methods.

All fan forced cooling systems are to include, but are not necessarily limited to:

- Low noise, 120mm A.C. slim line axial fans;
- Removable dust filters; and,
- Thermostat control,
- Mechanical protection in the form of finger guards.

6 MATERIALS

6.1 PVC Pipe

PVC pipe shall:

- Conform to AS/NZS1477-2006
- Be a minimum of Class 9, except where indicated in the Specification or Drawings.
- Sized according to the Specification and/or Drawings.
- Be joined by using rubber ring gaskets, when 80mm or greater in diameter.
- Be laid side by side, where more than one pipe is installed in the same trench. There shall be a minimum of 300mm between each pipe.

Note: No other pipework shall be laid with mainlines.

6.2 PVC Fittings

All PVC fittings shall:

- Conform to AS/NZS 1477-1999.
- Be a minimum of Class 18.
- Be separated by a minimum pipe length of 300mm.
- Joined to pipework by using rubber ring gaskets, when greater than 80mm in diameter.

6.3 Joining of PVC Pipes and Fittings

Unless otherwise specified, pipes and fittings shall be solvent weld-type

All pipe and fittings shall be wiped with priming fluid prior to solvent application.

The Contractor shall be liable for any damage that may occur due to excessive application of solvent.

All pipes and fittings shall be wiped clean of excessive solvent.

All mainline fittings and joins shall be rubber ring joined.

Bends shall be fully moulded Class 12 rubber ring joined.

All other fittings shall be cast iron.

Solenoid valve connections to the mainline shall be made with:

- Single branched zinc free bronzed tapping bands for valve sizes 50mm.
- Cast iron and stainless steel tapping saddle or cast iron tee for valve sizes greater than 50mm.

6.4 Valve Boxes – Solenoid, Ball & Gate Valves

Box type valves shall be Carson 1419 or approved equivalent

Valve number shall be inscribed on the lid.

Gate Valves shall be 150mm diameter PVC sleeve installed within and extend to base of the gate valve.

Location

The contractor must confirm the finished ground level prior to installation as changes to the height of the box setting will be at the contractor's expense.

If possible and applicable, valves and valve boxes should be located inside the property boundary line

Valve boxes shall be flush with ground level and not be located within active sports fields or if close to a sports field the opinion of the Manager of Parks should be sought for a preferred location.

The soil level within the valve box should be 100mm below the body of the solenoid valve, with the box siting on bricks to ensure it does not sink over time.

Valve boxes must be suitably large enough to enable servicing of the solenoids. Jumbo valve boxes are required for any solenoid larger than 25mm. All boxes shall have a securable lid, which must be in place prior to practical completion.

All gaps in valve boxes must be sealed up to stop the ingress of sand.

6.5 Flushing Valves

At all mainline ends a tested ball valve of the same size as the mainline shall be installed. This valve shall act as a flushing valve and be contained in 1419 valve boxes

In the case of a ring main, where indicated, two ball valve of the same size as the mainline shall be installed as per design specifications. This valve shall act as a flushing valve and be contained in 1419 valve boxes.

6.6 Solenoid Valves

Solenoid valves shall be Bermad 24v AC 200 series with flow control with Data coil to suit SDS Control system.

Valve sizes shall be indicated in the Specification or Drawings for each job.

All solenoid valves shall have a Philmac or equivalent nylon ball valve installed (in the line) prior to the inlet, to allow easier maintenance.

Where the extent of the Contract is terminated with just the installation of the main and solenoid, then a valve socket shall be installed on the discharge side of the solenoid.

Solenoid valves shall be installed on Milne Code 60A gunmetal tapping saddles with a minimum of 300mm of pipe either side of the valve - except in the case of angle valves where 300mm of pipe is required downstream of the valve only.

Note: The Contractor shall supply measurements for each solenoid valve position. These measurements shall be taken from the three closest sprinklers or fixed objects such as kerbs, light poles and paths, and be clearly shown on the As Constructed drawing/s.

6.7 Isolation Valves

To be installed as per irrigation design specifications in 1419 valve boxes

All under road crossings must have an isolation valve a minimum of 1.5m off the edge of kerb on the supply side of the crossing and be housed in a valve box that enables unrestricted operation and access.

6.8 Valve Wires

The wire type shall be Tyflo multi core cables to suit the reliable operation of the system.

In the event of a 2 wire system being installed, a cable is to be used to suit the reliable operation of the system, or that which is in accordance with the controller manufacturers' recommendation for the application.

All valves wires to be contained within a PVC conduit.

Conduit size to be determined by irrigation design and should be sufficient for addition future applications as direction by the City.

Conduits shall be;

- Continuous between valve and controller, and also valve and valve
- Joined by an approved method and the joins shall be sealed with DBY or equivalent wire connectors.
- An additional one meter of wire shall be allowed at each termination

Cable pits shall be installed at fifty meter intervals or at each change of main line direction.

Three spare 7/.050 cables shall be installed to the end of each mainline run or in the case of a ring main, three spare 7/.050 cables shall be installed around the full length of the mainline.

Note: Solenoid valves shall not be paired in the field. Any pairing of solenoids shall be done at the terminal strip in the pump cubicle. Common wire shall be coded black.

6.9 Irrigation Controller

Irrigation Controller shall be an SDS controller supplied by signal data systems. The contractor shall make allowance for the supply of required antenna, modem, and pressure transducer as required for correct operation. A relay cube with power supply is to be provided for any conventional solenoid irrigation system.

6.10 Sprinklers

Sprinkler shall be selected from the following:

- Hunter S/S I25 (main areas)
- Hunter S/S I40 (main areas)
- Hunter S/S I20 (perimeter)
- Toro 570 Pop up
- Toro Pop Up Bubbler

Sprinklers shall:

- be located offset a minimum of 450mm from the fence where sprinklers are located along fence-lines
- be located offset a minimum of 100-150mm from the back of the kerb or fence-line where sprinklers are located on road verges. (Depending on sprinkler type)
- have a low angle trajectory along road kerbs
- be surrounded by concrete sprinkler surrounds where the sprinkler is located on road verges

be installed in a triangular pattern at spacing's specified according to the individual sprinkler type.

- be fitted with articulated risers.
- Articulated risers shall:
- be set at 45 degrees to the lateral so that future adjustments can be made
- be screwed tight, but only tight enough to prevent leakage
- have a minimum diameter equal to that of the sprinkler base thread.
- Minimum diameters shall apply for the following flow rates:
- Up to 40 litres per minute – 20mm
- 40 to 105 litres per minute – 25mm
- Over 105 litres per minute – 32mm

Note: Details of articulated risers are to be submitted with the Tender. These details shall be approved by the Superintendent prior to installation.

Sprinkler Height and Adjustment

Recommended installation heights for sprinklers:

- Po up sprinkler in new turf; 10mm below finished level
- Pop up sprinkler in garden; 10mm above finished mulch level
- Fixed head sprinkler in garden; 150mm above ground level
- Fixed head bubbler in garden: 75mm above mulch level

The developer shall allow for adjusting sprinkler levels which have moved due to subsidence of soil, regularly during the maintenance period.

Sprinklers to Median Strips

Sprinklers shall be low angled sprinklers, installed to the edges of a median strip throwing inwards.

Tools

For each job, the contractor shall supply two sets of any special tools necessary for sprinkler and valve maintenance i.e. wrenches spanners, screwdrivers and any other tools required for all models of sprinklers and valves used.

7 EARTHWORKS

7.1 Depth of Pipes and Fittings

All pipe work to have a minimum cover of 300mm, with the main line having a minimum cover of 450mm.

All conduits, controls and means of activating valves shall be laid below ground, with a minimum cover of 350mm.

7.2 Pipes under Roads

Pipes that cross under roads shall be:

- Contained within a minimum of Class 12 PVC minimum 100 mm conduit sleeves. This sleeve shall have a diameter twice the diameter of the irrigation pipe. (E.g. 200mm dia. Duct for a 100mm dia. Irrigation pipe) to allow easy removal of the pipe work and/or fittings.
- Buried to a minimum depth of 600mm.
- Installed without cutting, boxing out and reinstating pavements.
- Extend 1.5m past the kerb edge.

7.3 Limestone Sub base

Where applicable the Tenderer should allow for boxing out in limestone, removal and disposal of rubble etc. in the tender price.

7.4 Returfing

The Contractor shall re-turf all trenches/excavations within verges and/or other portions of a reserve as requested by the Principal. Existing cut turf can be reused for returfing **except for returfing the mainline**. A turf cutter shall be used to remove exiting turf and the turf neatly placed to one side. Minimum turf thickness shall be 50mm. All turf shall be kept in a healthy condition until re-laid and shall be re-laid within a twenty-four (24) hour period.

The Contractor shall replace turf extracted for installation for the mainline with new roll on turf. The turf shall be purchased from a turf farm and shall be sting nematode free. The variety of turf shall be confirmed with the principal in writing prior to removal to ensure the same turf species is installed.

The turf shall be minimum length of 2.2 meters x 0.45 meters wide. The minimum turf thickness for new turf shall be 25mm.

The Contractor shall prepare the turf surface prior to installation including the levelling, addition of fertiliser (Dynamic Lifter), top dressing, rolling and watering. The Contractor shall manually water the turf for a minimum of three (3) times per day (early morning, mid morning, afternoon) using a 1,000L water trailer connected to a vehicle. The Contractor shall provide the water for watering as no additional water is on site.

7.5 Trench Construction

Trenches are to be constructed as follows:

- A minimum cover of 300mm and maximum of 450mm over all pipes, fittings and means of activating valve, with the exception being where the mainline exceeds 150mm diameter. In this instance the minimum cover shall be 450mm and maximum 750mm.
- Mainline shall not be installed under any footpaths and play equipment.
- Sufficient width to allow 100mm between pipes laid in the same trench.
- Trenches shall be excavated in straight parallel lines, and when parallel to a road, be no closer than 600mm from the back of kerb.
- The bottom of all trenches shall be smooth and firm such that it will uniformly and continuously support pipework over its entire length.

Backfilling

The Principal shall have sole discretion in determining material unsuitable for backfill. Where unsuitable material for backfill is excavated during trenching, the Contractor shall be responsible for removing it from the site. Clean sand, supplied by the Principal, shall be used as backfill.

- All pipes shall be:
- Level
- Clear of any rock, rubble or rubbish
- Surrounded beneath and to the sides by not less than 150mm of clean sand

Trenches shall be filled to the top with clean sand as supplied by the Principal.

The Contractor shall make good all wheel tracks caused by the Principal's trucks delivering backfilling sand to site.

Excessive subsidence of trenches after completion of the works shall be the responsibility of the contractor.

Note: Backfilling shall not be carried out until works are inspected by the Superintendent.

No claim for extra payment will be allowed, on account of any difficulty that may arise during trench construction, owing to neglect by the Contractor to inspect each site and allow for necessary precautions and contingencies prior to submitting the Tender.

7.6 POLY PLOW

Poly plow method shall be used for Sporting Field installations. Poly plow method shall be used when indicated on the irrigation plan by the Principal.

The plough machine is to be a four wheeled tractor type machine, with a vibratory plough attachment and cutting tynes of various lengths and bullet widths depending on the lateral pipe size, to be able to install HD poly pipe with minimal disturbance to all turfed areas.

All mainline 90mm in diameter shall be HD poly ploughed any mainline over this size shall be RRJ CLASS 9 PVC or HD poly PN 10 and installed via Ditch witch. All wiring laid with the mainline shall be fed into the plough tyne and shall not dragged in with the pipe. If the contractors installation machine is to use an excavator, the Contractor shall request in writing to use an excavator instead of a Ditch Witch and obain written approval prior from the principal prior to commencement of works.

All lateral piping shall be HD poly PN 10 and installed via the plough method with a minimum depth of 400mm.

Installation of sprinklers on the poly lateral lines shall be connected via Philmac, Plasson or equivalent metric tapping bands, the installation of these shall be by a neat square cut from the turf measuring no more than 300mm x 300mm which after the tapping band and sprinkler has been installed, the removed dirt is replaced, compacted and the sod of turf reinstalled around the sprinkler. Special care shall be taken to make sure the replacement section of turf is level with the existing turf.

The end of the station poly lateral line shall be capped with a metric poly plug to match the width of the pipe. The Contractor shall use the same method for install as indicated for the sprinklers.

After the completion of the poly lateral lines is complete, a ride on roller shall be used to roll over the small cut line and rise caused by the plough. This action will push the turf back into place leaving no trench marks.

9 INSTALLATION

9.1 Cross Stacking of Fittings

Cross stacking of fittings will not be accepted.

9.2 Pipe between Fittings

A minimum length of 300mm of pipe shall be installed between fittings.

9.3 Bending of Pipes

Bending of pipes will not be accepted, unless authorised by the Principal.

Where bending of pipes has been authorised, the maximum radius of the bend shall be in accordance with the pipe manufacturer's specification.

9.4 Changes in Direction of Mainlines

Unless otherwise stated, changes in the direction of mainlines shall be by long radius rubber ring joined bends.

9.5 Thrust Blocks

If specified by the design plan or Specification, thrust blocks shall be installed where indicated, in accordance with the pipe manufacturer’s specification; and at all changes of direction, branches and end caps, where rubber ring pipe is used.

9.6 Mainline Connection to the Pump Discharge Assembly

The Contractor shall connect the mainline to the pump discharge assembly by a cast iron flange fitted with a galvanised backing ring.

9.7 Inspection of Pipework

Pipework shall not be backfilled until inspected by the Principals Representative.

After backfilling, the trench shall be lightly compacted with a mechanical compactor and the turf re-laid to leave a neat, flush finish.

The Contractor is advised to liaise with the Principal in relation to turf cutting and reinstatement procedures.

9.8 Flushing and Testing

The pipelines shall be flushed and cleared by the contractor until they run clean. The contractor, at his own expense, shall rectify valve or sprinkler malfunction which occurs due to inadequate flushing.

9.9 Pressure Loss

The pressure loss through any automatic valve is not to exceed 10 percent of the systems operating pressure.

10 WATERING HOURS

No routine watering will be scheduled for daytime hours (9.00am to 6.00pm).

- Maximum watering hours will include:
- For routine irrigation purposes, from 1st September to 31st May, between the hours of 6:00pm and 9:00am (35 to 50 millimetres per week, to be applied over five days)
- For irrigation inspection and testing purposes, from 1st September to 31st May, between the hours of 6:00am and 4:00pm
- For establishment of turf grass, from 1st September to 31st May between the hours of 9:00am and 6:00pm and between the hours of 6:00pm and 9:00am (for a maximum of four weeks for any single location within the site).
- For watering-in of particulate fertiliser and pesticides immediately after application, from 1st September to 1st September the following year, between the hours of 9:00am and 6:00pm.
- For irrigation system syringe (routine maintenance) cycles, from 31st May to 1st September between the hours of 6:00pm and 9:00am (3 minutes maximum per valve once per month)

Winter Sprinkler Ban:

- Between 1st June and 31st August each year, irrigation systems will not be operated other than for provision of essential support to:
- Installation, repairing, maintenance or testing of irrigation systems
- Routine maintenance (syringe) cycles for irrigation systems (3 minutes per valve
- per month)
- Turf maintenance activities such as fertilising, weed or pest control, verti-mowing etc.

Activities which necessitate operation of the irrigation system during the period from 9:00am to 6:00pm at any time of the year shall incorporate placement of signs clearly identifying the fact that authorised system maintenance is in progress at that time.

11 APPENDICES

7.1 Bill of Quantities &Schedule of Rates – Bore

7.2 Bill of Quantities & Schedule of Rates – Pump installation

7.3 Bore Headworks Detail

7.4 Concrete base to electrical cabinet

7.5 Typical cabinet electrical layout

7.6 Typical cabinet fabrication drawing

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11.1 Bill of Quantities &Schedule of Rates – Bore

Notes:

1. Rates submitted shall be inclusive of all costs associated with each activity, including supply of all equipment, labour and materials required for completion of each activity.
2. Quantities listed are estimated only, and are not guaranteed quantities.

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT ($)
1	**Mobilisation and demobilisation**				
1.1	For production bore, including site clean up	L/S			
2	**Drilling**				
2.1	Drilling 311mm production borehole	Metre			
3	**Materials (Supply and delivery to site)**				
3.1	PN12 uPVC casing (plain)	Metre			
3.2	casing to screen adaptor	Each			
3.3	API stainless steel screen	Metre			
3.4	Stainless steel base plate to screen	Each			
3.5	PVC flange unit with blank flange	Each			
3.6	Gravel pack material	m^3			
3.7	Casing centraliser	Each			
4	**Running Casing and Screens**				
4.1	Run production casing and screen	Metre			
4.2	Withdraw temporary steel casing	L/S			
4.3	Place gravel pack material	L/S			
5	**Work time charges**				
5.1	Standby (only as directed)	Hour			
5.2	Worktime (only as directed)	Hour			
5.3	Developing bore	Hour			
6	**Test Pumping**				
6.1	Install and remove test pump	L/S			
6.2	Test pumping	Hour			
6.3	Recovery	Hour			
6.4	Disposal of water	L/S			
	Total Cost Estimate				

Contractor: _____ Signed: _____ Date: _____

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11.2 Bill of Quantities & Schedule of Rates – Pump installation

Notes:

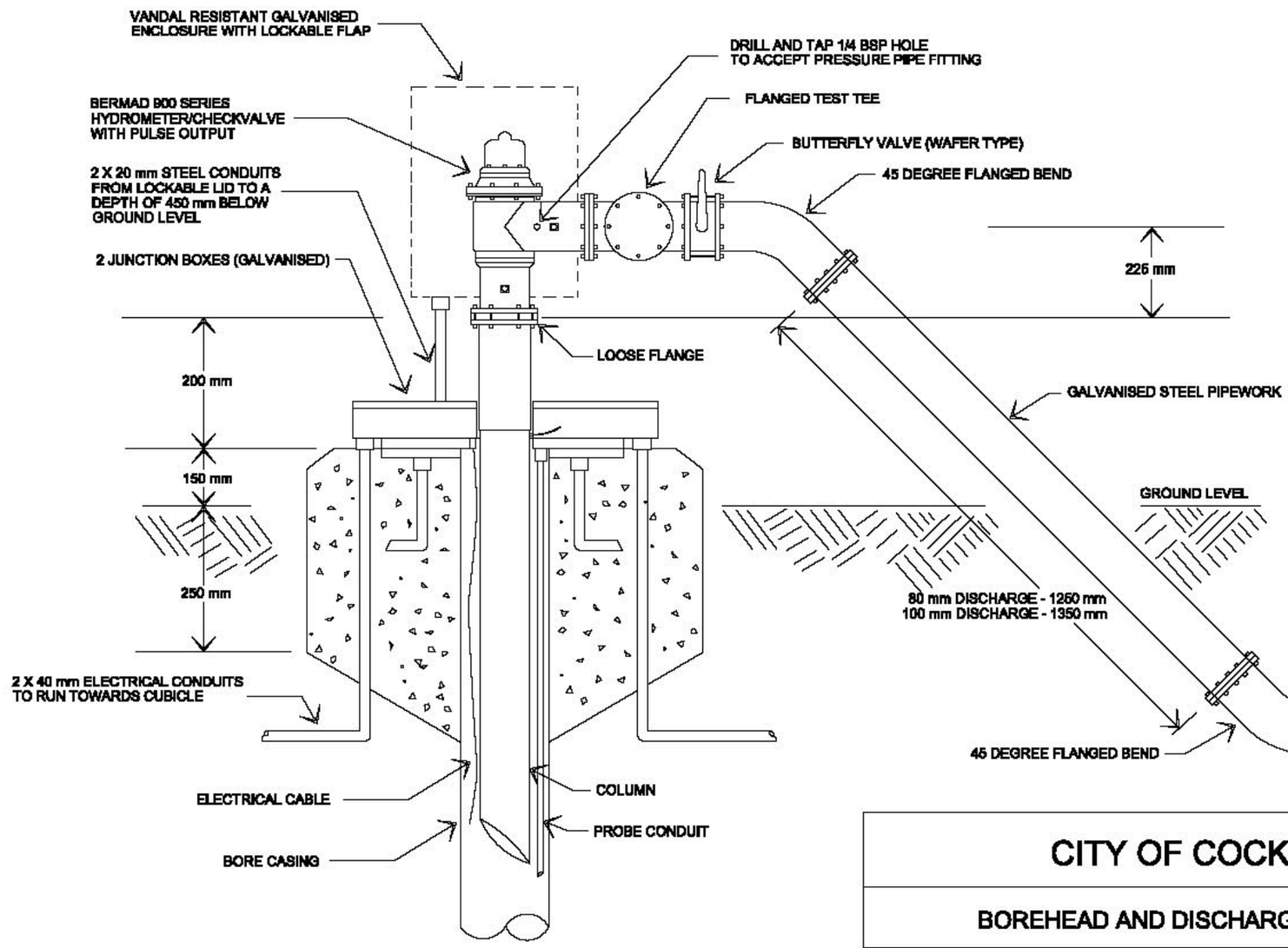
1. Rates submitted shall be inclusive of all costs associated with each activity, including supply of all equipment, labour and materials required for completion of each activity.
2. Quantities listed are estimated only, and are not guaranteed quantities .

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT ($)
1	**Pump Unit**				
1.1	Supply and install submersible pump and motor unit	L/S			
2	**Discharge Column**				
2.1	Supply and install pump column, and PVC probe conduit & dosing tube.	Metre			
2.2	Supply and install submersible electrical drop cable	Metre			
3	**Headworks**				
3.1	Supply and install bore headworks discharge assembly	L/S			
4	**Electrical**				
4.1	Supply and install electrical control cabinet as per specification	L/S			
4.2	Wire to bore within 2 metres of cabinet	L/S			
5	**Mobilisation**				
5.1	Mobilisation and demobilisation	L/S			
6	**Testing**				
6.1	Final testing and commissioning of new water supply	L/S			
7	**SDS Irrigation Controller**				
7.1	SDS-100 2 wire Controller to suit site (package)				
7.2	SD-DR-1 Relay Cube 1-24 stations				
7.3	SD-PS-24VAC Transformer to suit Relay Cube 24VAC or equivalent				
7.4	SD-MD Signal 3G modem (data sim not included)				
7.5	SD-AN-700 Standard external antenna to suit modem				
7.6	SD-PR-A Pressure transducer to suit SDS series controller or equivalent				
7.7	Rain Bird WR2 Wireless Rain/Freeze Sensor c/w 50mm width 4 meter height Galvanised Water Pipe Pole (with 50mm cap)				

	Total Cost Estimate				

Contractor: _____ Signed: _____ Date: _____

11.3 Bore Headworks Detail



CITY OF COCKBURN		
BOREHEAD AND DISCHARGE FLANGE DETAIL		
BORE HEADWORKS DETAILS 1 - ELEVATION		
DESIGNED: NOT TO SCALE		JOB No.
DESIGNED: L.V.	CHECKED	SHEET: 1 OF 1
DRAWN: W.I.	PASSED	DRAWING No.: 2087896 - REV 1

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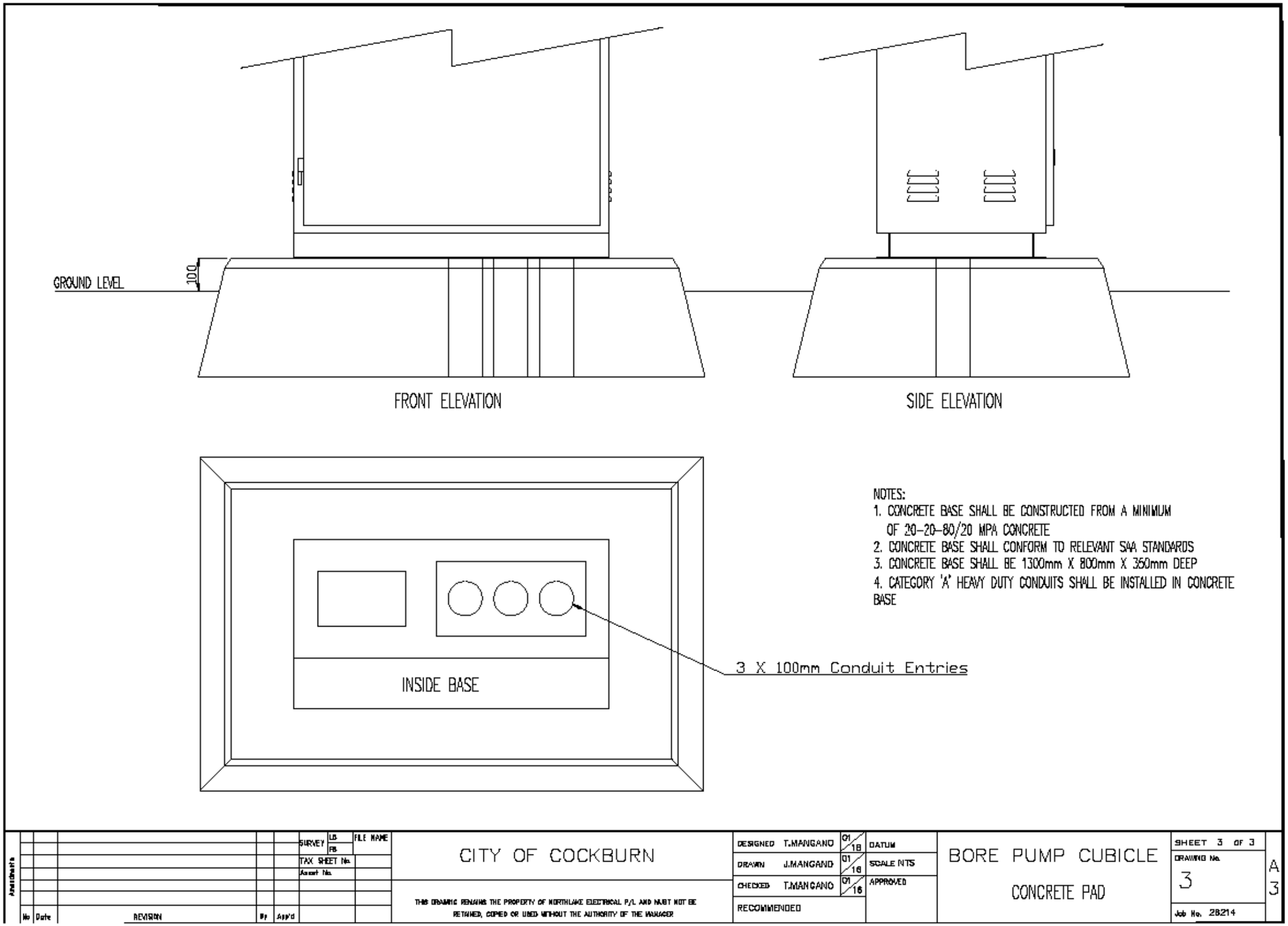
11.4 Concrete base to electrical cabinet



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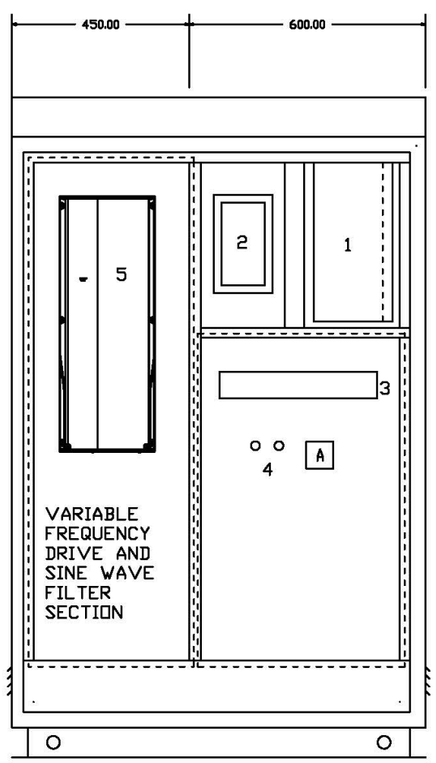
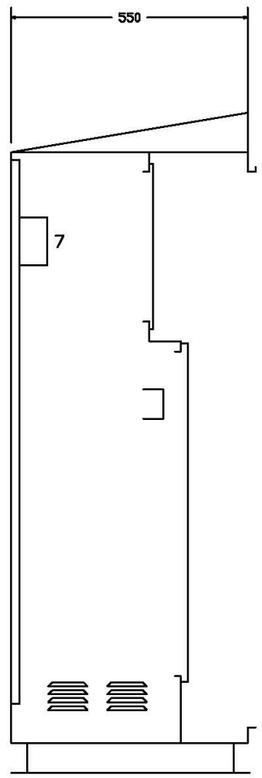
11.5 Typical cabinet electrical layout

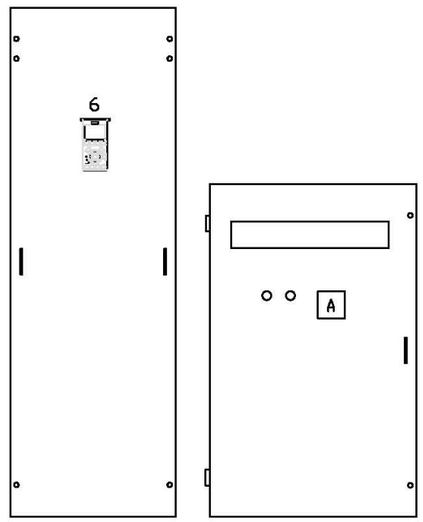
11	0	=	22			COMPONENT	MATERIAL	COMPONENT	MATERIAL
10	0	-	21					ESCUTCHEONS	
9	0	-	20			CUBICLE	2.5mm Aluminium	- SECURED BY	CHROME PLATED KNURLED HEAD SCREWS
8	0	-	19					- LOCATED BY	CHROME PLATED LOCATING PINS
7	1	IRRIGATION CONTROLLER TOP HAT	18			EQUIPMENT PANELS	2.5mm Aluminium	- LOCKS	201 CYLINDER WAS BARRELS
6	1	VFD REMOTE SCREEN	17			DOORS	2.5mm aluminium		
5	1	VFD COMPARTMENT	16	0	-	DOOR STIFFENERS	2.5mm aluminium	FINISH TYPE	ORBITAL SANDED
4	1	22MM PUSH BUTTON	15	0	-			- EXTERNAL COLOUR	NATURAL
3	1	ACB's	14	0	-	DOOR SEAL TYPE	25 x 6mm NEOPRENE RUBBER	- INTERNAL COLOUR	NATURAL
2	1	CONTROLLER	13	0	-	LOCKS		- ESCUTCHEON & MOUNTING PANELS	NATURAL
1	1	WESTERN POWER METER	12	0	-	HINGES	LIFT OFF PINTLE TYPE		
ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION	CONSTRUCTION	DUSTPROF IP56 FORM 1	COMMENTS	
EQUIMENT SCHEDULE						CONSTRUCTION SCHEDULE			



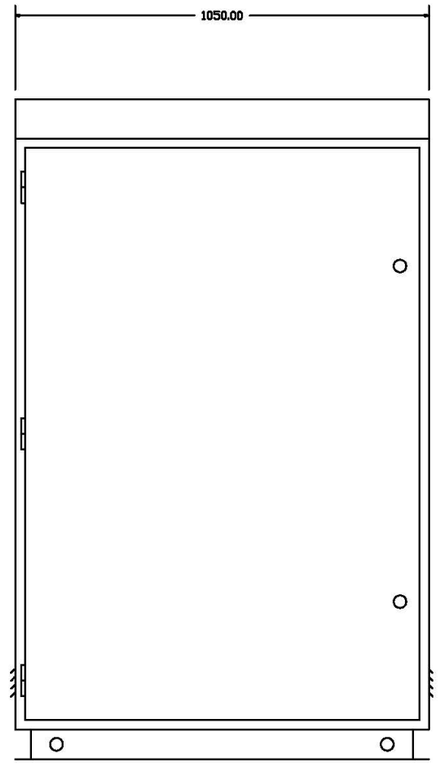
FRONT ELEVATION



SECTION 'A'



Escutcheon layout



FRONT ELEVATION

A	FOR APPROVAL		rh	
Rev.	DESCRIPTION	DATE	Ref.	

Northlake Electrical P/L
Switchboard Manufacturers
U1/33 Cutler Road Jandakot
W.A. 6164.
Ph-9417 7077 Fax 9417 7295
Email:tony@northlakeelectrical.com.au

PROJECT	City Of Cockburn				
CLIENT	NLE Standard 1500 High VFD				
TITLE	Pump cubicle - GENERAL ARRANGEMENT				
DATE	DRAWN	JOB No.	SET OF	DRAWING No.	REV
19-09-2016	JM	N/A	1	nle151694	A

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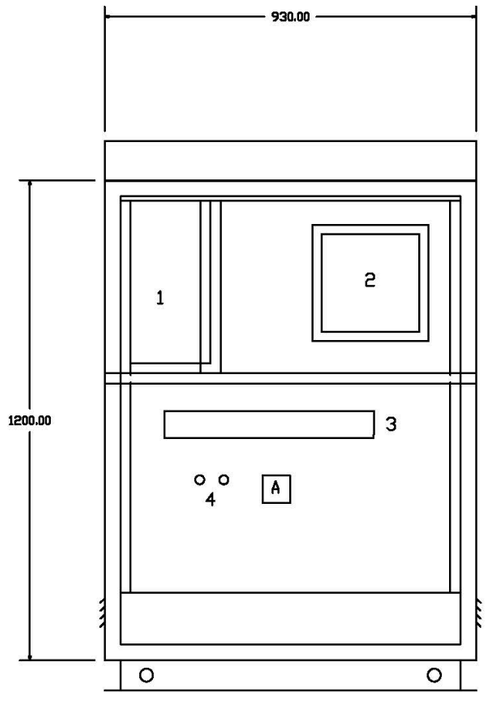
11.6 Typical cabinet fabrication drawing

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
11	0	=	22		
10	0	-	21		
9	0	-	20		
8	0	-	19		
7	0		18		
6	0		17		
5	1	IRRIGATION CONTROLLER TOP HAT	16	0	-
4	1	22MM PUSH BUTTON	15	0	-
3	1	ACB's	14	0	-
2	1	CONTROLLER	13	0	-
1	1	WESTERN POWER METER	12	0	-

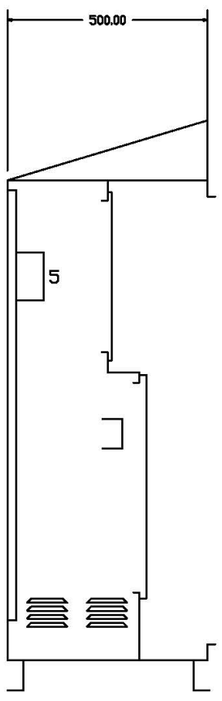
EQUIMENT SCHEDULE

COMPONENT	MATERIAL	COMPONENT	MATERIAL
CUBICLE	2.5mm Aluminium	ESCUTCHEONS	
		- SECURED BY	CHROME PLATED KNURLED HEAD SCREWS
EQUIPMENT PANELS	2.5mm Aluminium	- LOCATED BY	CHROME PLATED LOCATING PINS
DOORS	2.5mm aluminium	- LOCKS	201 CYLINDER WAS BARRELS
DOOR STIFFENERS	2.5mm aluminium		
		FINISH TYPE	ORBITAL SANDED
DOOR SEAL TYPE	25 x 6mm NEOPRENE RUBBER	- EXTERNAL COLOUR	NATURAL
LOCKS		- INTERNAL COLOUR	NATURAL
HINGES	LIFT OFF PINTLE TYPE	- ESCUTCHEON & MOUNTING PANELS	NATURAL
CONSTRUCTION	DUSTPROF IP56 FORM 1	COMMENTS	

CONSTRUCTION SCHEDULE



FRONT ELEVATION
DOOR & ESCUTCHEON REMOVED



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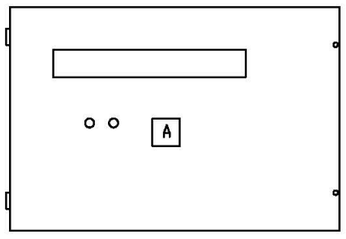
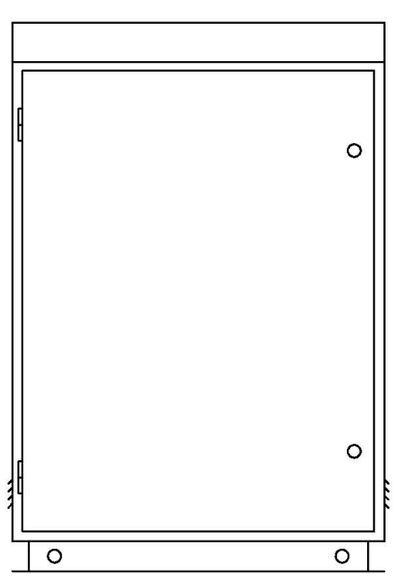


Escutcheon layout



FRONT ELEVATION

Rev.	DESCRIPTION	DATE	Ref.
A	FOR APPROVAL		rh

Northlake Electrical P/L
Switchboard Manufacturers
U1/33 Cutler Road Jandakot
W.A. 6164.
Ph-9417 7077 Fax 9417 7295
Email:tony@northlakeelectrical.com.au

PROJECT	City Of Cockburn				
CLIENT	NLE Standard 1200 High				
TITLE	Pump cubicle - GENERAL ARRANGEMENT				
DATE	DRAWN	JOB No.	SET OF	DRAWING No.	REV
19-09-2016	JM	N/A	1	nle129350	A