DESIGN STANDARDS
for
URBAN INFRASTRUCTURE
21 IRRIGATION

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21.1 Introduction

These guidelines form part of any project brief issued by Municipal Services Network, Department of Territory and Municipal Services (TAMS) that contains an irrigation design component or for any irrigation system developed by the private sector for ongoing management by Recreation Services.

Consultants are reminded of the necessity to comply with the requirements for plumbing described in Australian Standard AS 3500, the requirements for irrigation systems in the ACTEW *Water and Sewerage Standards*, to register the plan with the ACT Planning and Land Authority, Customer Services Centre, Mitchell and to comply with the requirements of registration.

It is ActewAGL's legislative right to 'normalise' existing water connections where meters and stop-valves are located more that one metre inside the boundary of open spaces. These are to be progressively 'normalised' to comply with ActewAGL standards and it is optimal that the number of connections to a property be 'normalised' down to a minimum number, preferably one.

Should a basic departure from the guidelines be necessary, approval should be sought through Recreation Services.

Full details of all new products (catalogues, performance charts, technical information, samples, manufacture's brochures etc) and any Water Authority Acceptance Certificates shall be submitted to Recreation Services when requesting approval to incorporate such products into projects that will become assets of Recreation Services. All new or modified sprinklers shall be independently tested, e.g. The Centre for Independent Testing, Adelaide and the test results together with details of the manufacturer's warranty conditions/periods submitted with the request to include new or modified sprinklers.

Systems that incorporate new technologies or recent industry trends, in the broadest context, should be considered but should first be discussed with Recreation Services before commencing design work. All new technologies intended for use on irrigated sports fields must be fully compatible with and capable of being fully operated by the CIMS - Comtrol Controller.

The final arbiter for the approval or rejection of systems that incorporate new technologies or incorporate recent industry trends shall be the Officer for the time being occupying the position of Manager, Sport and Recreation Facilities Section, Recreation Services. A register of approved and non-approved products will be maintained and available to the industry.

21.2 Related codes of practice and guidelines

21.2.1 Industry standards

AS/NZS 1477 PVC Pipes and Fittings for Pressure Applications, Standards Australia.

AS 2698.1 Plastics Pipes and Fittings for Irrigation and Rural Applications – Polyethylene Micro-irrigation Pipe, Standards Australia.

AS 2698.3 Plastics Pipes and Fittings for Irrigation and Rural Applications – Mechanical Joint Fittings for use with Polyethylene Micro-Irrigation Pipes, Standards Australia.

AS/NZS 2845.1 Water Supply - Backflow prevention devices - Materials, design and performance requirements, Standards Australia.

AS.NZS 3500.1.2 National Plumbing and Drainage Code, Standards Australia.

AS/NZS 4130 Polyethylene (PE) Pipes for Pressure Applications, Standards Australia.

21.2.2 Policy and guidelines

Standard Specification for Urban Infrastructure Work, Urban Services, Canberra, 2002.

Overview – Plumbing and Drainage, Planning and Land Management, available online: http://www.palm.act.gov.au/bepcon/ and follow link to plumbing

Water and Sewerage Standards, ACTEW Corporation, Canberra, 2000.

21.3 Types of system

The brief will nominate the types of systems to be designed. If more than one type of system is required within the site, the boundaries of the separate sub-systems will be described or delineated on accompanying drawings.

Low volume systems should generally not be used. Shrub bubblers or high volume systems are preferred. Low volume systems can be used in locked courtyards where the general public do not have access.

Opportunities for reuse of grey (2nd class) water should be considered where they are cost effective. If grey water systems are used, a dual system must be installed to provide an option for using potable water. Provide backflow prevention to the potable water supply.

21.3.1 Potable Water

The majority of irrigation systems are supplied from Canberra's potable water supply. Provide backflow prevention at the connection to the potable water supply main to protect the water supply from contamination.

21.3.2 Second class water

Irrigation of public landscapes is one of the major consumers of Canberra's potable water supply and the ACT Government has a policy of reducing that demand wherever possible by utilising reserves of second class water from lakes around the ACT. A connection to Canberra's potable water supply through a Reduced Pressure Zone back flow prevention device is required for back up.

If not adequately designed, the use of second class water may fail due mainly to algae, debris and cut macrophytes blocking intakes and algal growth within pipes blocking sprinklers.

Some of the problems with second class water can be overcome by better selection of intake sites away from macrophytes, provision of adequate automatic filters and provision of a standby pump in the submersible pump well.

In all cases where the use of second class water is possible, discussions with Recreation Services are to be arranged before starting design work to review the latest developments in the area of second class water.

21.3.3 High volume

The range of irrigation systems which fall within this category include the following:

- automatically controlled pop-up sprinkler systems for which an electricity supply at the time of installation is desirable (the brief will identify whether the installation will be incorporated into a regional computerised irrigation management system (CIMS) or whether stand alone-control is appropriate).
- manually controlled pop-up systems
- quick coupling valve systems

- shrub bubbler and spray systems.

21.3.4 Low volume

The range of irrigation systems that fall within this category include the following:

- automatically controlled drip systems (electricity should be available at time of installation where possible).
- manually controlled drip systems.

Note that low volume irrigation systems generally have a relatively short operational life and should only be used where initial establishment is the major objective. If the brief does not nominate the type of system to be installed, the following guidelines should be applied.

21.4 Guidelines for high volume sprinkler systems

21.4.1 Controllers

Only 6 or 12 station controllers should be installed for stand alone systems. Where more than one controller is installed, all controllers must be able to be operated simultaneously.

21.4.2 Neighbourhood parks

Systems shall be fully automatic pop-up sprinklers for high use turf areas such as barbecue areas and playgrounds, with provision for quick coupling valves at no greater than 50 metre centres for peripheral dry grass areas. Shrub spray sprinklers should be provided for shrubs and trees where significant benefits can be identified. Any grassed car parking areas shall be on separate stations. NOTE: Neighbourhood Parks are not ordinarily irrigated.

21.4.3 District parks

Systems shall be fully automatic pop-up sprinklers for high use turf areas such as playground and barbecue areas. Quick coupling valves should be provided at no greater than 50 metre centres in peripheral dry grass areas for survival watering independent of the automatic system. Any grassed car parking areas shall be on separate stations. Shrub spray sprinklers should be provided for shrubs and trees where significant benefits can be identified. Any low volume systems shall be totally hidden from sight as an added vandalism deterrent. NOTE: Usually only major district parks are irrigated

21.4.4 Other major recreational areas and shrub beds

Systems shall be fully automatic sprinklers for turf areas, shrub sprays or low volume systems for shrub areas or quick coupling valve systems as appropriate. Shrub beds and grassed embankments are to be treated as a separate entity when designing irrigation systems.

21.4.5 Building surrounds

Systems around shopping centres and other publicly accessible areas surrounding buildings shall be automatically controlled pop-up sprinklers for turf areas and shrub sprays for shrub areas. Quick coupling valves should be provided at no greater than 50 metre centres for supplementary watering where appropriate, particularly on peripheral dry grass areas. NOTE: Often these areas may not require irrigation.

21.4.6 Car parks

Quick coupling valves should be provided at no greater than 50 metre spacing to facilitate establishment of plant material. Where there is a risk of damage by cars to quick coupling valves, protection should be provided.

Quick coupling valves should not be installed in car overhang areas and the irrigation system must be capable of being used at all times, even when the car park is full.

21.4.7 Sports Grounds

Systems shall be fully automatic pop-up sprinklers. In sports grounds incorporating turf wickets, include (1) (a) a separate fully automatic pop-up sprinkler system and (b) two quick coupling valves (QCV) with automatic valve under head with a dedicated controller cubicle and controller, and (2) two standard QCVs connected to a continuously 'live' line to be installed around the wicket.

COMTROL – the Computerised Irrigation Management System controller shall be installed at all sports grounds. This is the current system used by Recreation Services for managing irrigation systems. Multi-zone units shall be used when controlling more than one sports ground (Oval). Only 11 stations per zone should be used and all zones are to be operable simultaneously.

21.5 System capacity

Prior to the design of the system the designer should ascertain, through a written request directed to ActewAGL (see *Water and Sewerage Standards*), the maximum and minimum pressure likely to be encountered and maximum permitted draw-off from the city reticulation at the point of off-take from the meter. The design should be based on information obtained. This information shall be stated on the drawings. If insufficient supply is found to exist this should be brought to the attention of Recreation Services before progressing with detailed design.

ActewAGL does not guarantee that the flow, pressure or water quality will remain constant or consistent from day to day or over the lifetime of the network. It is therefore essential that the system be designed with an expectation that pressure and flow will vary.

All feeder mains should be designed so that the maximum head loss does not exceed 5 per cent over the length of the main. All branch mains or laterals to which sprinklers or emitters are to be connected should be designed so that the maximum head loss over the length of the main or lateral does not exceed 5 per cent.

Friction loss shall be no greater than 35kPa through any valve. The maximum velocity in any pipe should never exceed 2.0 metres per sec with 1.5 metres per sec as a desirable maximum.

In high volume systems the operating pressure should be designed to provide pressure to suit the manufacturer's standard nozzle size. In low volume systems at approved spacing, the sprinkler operating pressure for emitters should match the manufacturer's specifications.

21.6 Draw-off rates and operating times

The draw-off rates and operating times are based on ActewAGL requirements (see *Water and Sewerage Standards*).

21.6.1 Automatic systems for irrigation

The design requirements for automatic systems are:

- Systems irrigating more than 2 hectares should have an instantaneous draw off not exceeding 2.68 litres per second per hectare with an allowance for fluctuation of plus/minus 20 per cent for unequal sectorisation.
- Systems irrigating less than 2 hectares should have an instantaneous draw-off not exceeding 3.5 litres per second per hectare.

- In all cases the total volume of water used per hectare of net watered area per night should not exceed 76 kilolitres.
- Use rain sensors or other overriding devices to turn off sprinklers when raining or when the ground is already wet to reduce water wastage.

21.7 Precipitation rates

Precipitation rates should not exceed 20 millimetres an hour for sprinklers (sprays are the only exception). If higher rates are required then approval is required from Recreation Services.

21.8 System layout

21.8.1 Automatic systems

All systems should be controlled electrically. No hydraulic valve under head systems shall be acceptable.

Laterals on sports grounds shall be MDPE pipe PN10 with electrofusion joints. Pipes shall be sized to minimise reductions in diameter of pipes along lateral length, i.e. commence a lateral with 110mm diameter only reducing to 63mm diameter pipe when flow rate and friction losses require it. Continue to use 63mm diameter pipe to the end of the lateral. Sprinkler connections to laterals shall be by means of saddles. Saddles 110mm and greater shall be either electrofusion, stainless steel or gunmetal and equal to Plasson electrofusion saddles, Wang stainless steel take off saddles or Milnes gunmetal saddles. 63mm saddles shall be MDPE in construction with 4 x stainless steel bolts and stainless steel strengthening collar on the branch line.

No sprinklers shall be connected to the mains. Lateral mains to which sprinklers may be connected should, wherever possible, be located along the contour to minimise differences of pressure along the lateral and prevent concentrated drainage from the lowest sprinkler (see also 21.13 Sprinklers/emitters).

Systems should be designed to avoid spraying onto footpaths, roadways or cycleways.

Automatic valves are to be numbered for ready identification on the drawings and located to avoid wetting the operator. A corresponding number should be clearly, permanently engraved or stamped (not painted) on the underside of the lid of the valve box to allow for ease of identification in the field.

Sprinklers shall be spaced to take into account the effect of winds, the shape of the watered area and the precipitation rate of the particular sprinkler.

Sprinkler heads shall be spaced either in an equilateral triangle or square formation. Sprinkler heads shall be spaced at a maximum of 55 per cent of diameter of throw for triangle pattern designs and a maximum of 50 per cent of diameter of throw for square pattern designs. Sprinklers, patterns and spacing used should have a Co-efficient of Uniformity of 85 per cent or more and a Distribution Uniformity of 75 per cent or more. Any proposed departure from the spacing criteria specified above should be discussed fully with Recreation Services who may also discuss the matter with ActewAGL. The agreement of ActewAGL and Recreation Services is required before the designer proceeds outside the set criteria.

The irrigation design should make use of one brand of sprinkler only, and a minimum number of models of other types of equipment. Particular care is required when the design includes a mixture of different models of equipment. Part circle sprinklers shall have matched precipitation rates and preferably be located on separate stations.

The design of systems using low volume emitters shall take particular account of plant types and the size of area to be irrigated.

Designers should take particular care when evaluating tenders to ensure that the proposed sprinkler or low volume emitter brand meets the above criteria. Manufacturers' performance figures shall be used as the established guide. However, where any doubt exists, samples must be submitted to Recreation Services for testing and verification.

21.8.2 Manual systems

These systems are only used in exceptional situations or for temporary works.

QCVs should be set up at up to 50 metre spacing for survival watering independent of the automatic system.

The most desirable sequence of valve operation should be indicated on the drawings to achieve the designed precipitation rates within the limit of flow. Stopcocks are to be numbered for ready identification on the drawings and located to avoid wetting the operator. A corresponding number should be engraved or stamped on the underside of the lid of the valve box to allow for ease of identification in the field.

21.8.3 Provision for modifications

Where extensions such as buildings or other developments are anticipated, the irrigation layout shall provide for that section including the future system to be turned off with minimum interference to the operation of the whole system.

Include in the design to the furthest valves from the controller in all directions a run of 1.5mm 3-core wires of different colours to those in use within the system in a high density polyethylene sheath, laid in trenches with the mainlines and laterals and passing through all valve boxes along the way. At each valve box include a loop of the 3-core wire not less than 1m long. This run of 3-core wire is to be completely separate from all other wiring and shall be used for 'spares' and later modifications.

21.8.4 Provision for extending irrigation systems

Additions to existing irrigation systems should:

- still enable watering within 10 p.m. to 6 a.m. five nights per week
- not increase the velocity of water flow in main pipes beyond prescribed limits
- not affect the operation of the existing system.

21.9 Meter pit equipment

Standard drawings for irrigation meter pits are included in Appendix A. *Water and Sewerage Standards* also have requirements for meter pits (see Standard Drawing WSS 020).

The main between the city reticulation and the meter shall be specified in either copper (up to 80 mm diameter) or ductile iron cement lined (100 mm diameter and above) or MDPE pipe (up to 110mm diameter).

Irrigation systems shall be provided with an approved meter installed in a meter pit. The meter pit shall be located close to and within the boundary of the site and where possible close to the controller.

The pit shall be of reinforced concrete construction as shown on the Standard Drawings and drained into the nearest storm water drain by a 90mm standard storm water pipe. The opening of the pit shall

be fitted with 8mm galvanised chequered plate covers and components, which must be capable of being locked. The locking device shall not protrude above ground level. If a meter pit contains ActewAGL meter, it must only be locked with ActewAGL approval using an ActewAGL master-keyed padlock. ActewAGL must have 24 hour access for maintenance, emergency access and meter reading. The metal lid must also have a peephole flap on the top to permit meter reading without lifting the covers. The meter peephole must be directly above the meter. Each pit lid panel shall not weigh more than 25 kilograms. All lid panels must be hinged.

The meter pit assembly should incorporate stop cocks, a water meter, master valve, a dirt box filter, twice the diameter of the incoming line size with the filter mesh 1.2mm diameter, a double testable check valve (back flow protection), plugged fittings for pressure gauge connection and a pressure reducing valve with twin reflux valves as indicated in Appendix A. Adequate support for these components should be provided as required.

Backflow prevention devices shall comply with Australian Standards AS/NZS 2845 in regard to design, performance, field testing and maintenance.

The valve box for low volume systems should incorporate a stopcock, pressure gauge nipple, solenoid valve, filter, pressure reducing valve and pressure gauge nipple as shown in Appendix B. Pressure gauge connections, a pressure reducing valve, a filter and a dirt box/strainer and serviceable twin reflux valves must be installed on larger systems or where this equipment is not installed in-line in valve boxes. These components must be installed in the order shown in the diagram.

Pressure reducing valves and filters shall be installed on all low volume systems where they are connected to high volume systems in addition to the master pressure reduction valve and strainer.

Master control solenoid valves (metal bodied) shall be fitted into all meter pits of automatic systems.

21.10 Pipes and fittings

21.10.1 Materials

Pipes 80 mm diameter and above will be unplasticised polyvinyl chloride (uPVC) rubber ring jointed, PE 80B Class PN10 medium density polyethylene pipe (MDPE) or ductile iron cement lined (DICL) Class D.

Jointing shall be in accordance with the manufacturer's specification.

MDPE pipe jointing shall be by electrofusion jointing. For uPVC pipes 80mm diameter of larger jointing shall be with rubber ring joints but for pipes less than 80mm solvent weld jointing is preferred.

UPVC pipe and fittings will be in accordance with Australian Standard AS 1477. MDPE will be in accordance with Australian Standard AS/NZS 4130.

All equal tees (unequal-tees), bends and reducers on 100mm or larger uPVC mainlines shall be cast iron rubber ring fittings suitable for use on uPVC pipe. Where available 80mm cast ?(on 100mm pipe) iron fittings are acceptable. All branches 50mm and smaller to valves and take offs shall be stainless steel saddles (Wang saddles) or brass tapping saddles (Milnes saddles). All cast iron fittings shall be supported with concrete thrust blocks.

If effluent water is being used, the pipe used shall be marked with continuous purple coloured stripes to denote effluent use. Rubber ring jointed uPVC fittings, which are manufactured as such, are to be used. Only the rubber rings supplied by the pipe manufacturer shall be used.

The designer shall consider the need for concrete anchor/thrust blocks and these shall be installed as required (see standard drawing WSS 013 in *Water and Sewerage Standards*).

Solvent cement must be of a type suitable for high pressure pipe, for example, Vinidex Type P (green).

The following requirements shall apply to the specification of irrigation hardware.

- BSP threads are required on both the male and female connectors on all threaded connections of 25 mm or greater. This applies to the installation of valves, articulated risers, sprinklers and other components within the pipe system.
- These requirements do not exclude the use of National Pipe Taper (NPT) threaded articulated risers providing they have male British Standard Pipe (BSP) thread adaptors at each end.
- A mix of NPT threads and BSP threads on connections smaller than 25 mm is less of a problem as the chance of thread damage is reduced.
- The manufacturer must offer warranties on sprinklers, valves and other components and service must be provided by the manufacturer's nominated agent.

21.10.2 Location and depth of pipes

Where irrigation is installed in nature strips, pipes shall be laid parallel with or at right angles to the kerb.

All pipes in trenches shall be surrounded by a minimum of 100 mm thickness of coarse sand. Pipes shall be laid with 350 mm minimum final cover and a maximum final cover of 600 mm.

A tracer wire shall be placed at a depth of 200 mm over all uPVC mains. One end of the tracer wire shall terminate in the meter pit. In low volume systems, the end of buried polyethylene pipe should be marked to enable flushing. Polyethylene pipe under mulch should be pegged down with 3 mm wire stakes at least 150 mm long at 1 m intervals.

Changes in direction of any pipes, that is, with T or Elbow joints, shall not be made under paved surfaces unless absolutely necessary.

All systems including low volume systems are to be flushed out once pipe is laid out and before sprinklers or emitters are attached and ends sealed.

Sleeves shall be installed wherever irrigation pipes or control wires are under footpaths, bike paths, roadways, car parks or any other paved area.

Sleeves shall be a minimum of 50 mm for wires and control tubes and be a minimum of 50 mm larger than the outside diameter of the pipe they intend to carry. All sleeves should be heavy duty electrical conduits.

21.11 Valves

21.11.1 Types of valves

All automatic control valves are to be solenoid valves and shall be suitable for operation on 24 VAC 50 HZ with flow adjustment control.

Immediately upstream of every solenoid valve fit an equal size full bore stainless steel ball valve including a stainless steel handle. All valves to be Australian Standards approved or watermarked.

Automatic control valves shall have studs or encapsulated nuts to hold down the bonnet . In high volume systems valves should be limited in size to a maximum of 50 mm diameter. In low volume systems valves no greater than 25 mm diameter may be used.

Only one valve is permitted on each station.

21.11.2 Valves on the main pipe

All stop valves shall be clearly marked to indicate the direction of operation for closure. This may be using an arrow on the hand wheel or a plate attached to the valve body.

All isolating valves shall be housed in a 100mm minimum internal diameter (or greater) uPVC pipe (sewer pipe) capped with a cast iron path box surrounded by 300 mm x 300 mm x 100 mm thick concrete finished to the level of the final grade.

21.11.3 Other valves and equipment

Variable pressure valves mass be used where sprinklers with marked pressure differences occur in the same system.

On larger low volume systems, particularly with perforated pipe, air break valves should be used according to the manufacturer's specification.

Low volume filters should be of an appropriate capacity with a manual flush valve. Drippers should have 120 mm mesh and perforated pipe should have a 150 mm mesh filter.

The pressure reducing valve used in the meter pit shall consist of a main valve controlled by an externally mounted pilot control system. It shall maintain a constant downstream pressure regardless of fluctuations in demand. It shall be a diaphragm type globe valve hydraulically operated and pilot controlled. No water is to discharge into the atmosphere during normal operation. The valve shall be similar in all respects to the Parkway 90B pressure reducing valve.

21.11.4 Location of valves

All automatic valves shall be located in uPVC, concrete or similar lockable valve boxes. The valve boxes shall be located off playing surfaces where possible and installed 100 mm below the final grade. In shrub beds a covering of mulch will suffice. All buried valve boxes shall be marked by a 150 mm x 150 mm square of 4 mm steel chequered plate bolted to the inside of the lid.

Valve boxes should be supported so that later subsidence will not cause the valve box to rest on any pipes. All other valves are to be inconspicuous to avoid vandal damage. Valves should be located either in the meter pit or in garden beds and covered with mulch. If valves cannot be located in these positions, then they should be located underground with 300 mm to 400 mm cover.

Valve boxes shall have lockable lids. Valve boxes located in pavement shall have 8 mm chequered plate steel lids.

21.12 Automatic controllers

21.12.1 Location of controllers

The location of controllers should be unobtrusive yet easily accessible for maintenance and operation. The operator should be able to see as much of the watered area as possible from the controller. Sprinklers should not spray the operator.

The controller should, wherever possible, be incorporated into the wall of a building. External access is mandatory. In open areas where no buildings exist, the controller should be located off the

irrigated surface but not be installed in a pit below ground level. The controller should be close to the meter pit where possible.

21.12.2 Irrigation Controller Housing

21.12.2.1 Free Standing Housing

The controller housing shall be constructed of brick with colorbond, galvanised steel lockable doors, concrete roof, concrete apron with conduits for various cables etc and the concrete floor graded to drain to the outside (see Appendix C). The lock on the controller housing door should be of a barrel type dead latch that could be easily converted to a master key system. Brickwork shall match that of any adjacent building. The roof shall be internally anchored to the walls with sturdy strapping (metal). The strapping shall be internally mounted. A mains voltage power point and an independently switched internal light shall be provided in all housings.

The controller shall be plugged into a Clipsal 2025SF (or equal) power outlet with a Clipsal 970 (or equal) over-voltage arrester installed. The power and light should be on a dedicated circuit. A 1000 mm wide concrete apron shall be placed at the front of irrigation controller housings.

Refer to Standard Drawing at Appendix C.

21.12.2.2 Wall Mounted Housing

Housings should ideally be recessed into the wall and built in as part of the wall so that it is flush with the face of the wall (with no leverage points for vandalism) or fixed to an external wall with not less than four appropriately sized chemical anchor type fasteners.

Where the controller is mounted on or in a wall, the housing shall be of solid steel construction (not flimsy sheet metal) with the following specifications:

- minimum internal dimensions of 700 mm high, 900 mm wide and 300 mm deep
- powder coated and the colour should be transformer grey unless otherwise specified
- Lockwood type 201 cylinder lock easily convertible to a master key system
- door hinged sideways
- double side and rear walls (20 mm brackets to back and side walls)
- top of the switch box mounted at least 1300mm – 1500mm above the final grade but with the controller at ‘about eye level’.

21.12.3 Stand alone controllers

In high volume systems except for systems designed to have one to six stations (with no future expansion), 6 station controllers may be used. All other controllers shall be of 12 or 24 station capacity. No more than 11 or 22 stations should be used, except under special circumstances. If it is necessary to utilise more than 12 stations in the design, a second 12 station controller or a 24 station controller shall be used. Where more than one group of 11 stations is used on the same supply main, all groups of 11 stations must be capable of being operated independently and simultaneously.

Each controller must be able to establish a seed bed (20 start times per day) and still be able to maintain established turf on another part of the facility e.g. Hunter ICC, Rainbird ESP.

21.12.4 Lightning protection

All valve wires, master valves and controllers shall have lightning protection installed using line surge protector ERICO LSP12-30I or equal. The common wire must be connected to earth. The earth wire from the surge protector must be directly connected to an earth stake using 2.5 mm diameter

wire (7/067) and the correct fittings for connecting onto earth stakes. The earth stake and connections should be in a cast iron path box installed flush with the existing surrounds. The 240V mains power shall have adequate lightning protection (e.g. Clipsal 970).

21.12.5 Junction block

All controllers shall have a junction block mounted inside the controller housing just below the controller. All wires from the controller to the junction block shall be fitted with bayonet type fittings.

21.12.6 Wiring

All wiring shall be in accordance with the relevant Australian Standard for low voltage wire.

Size 7/0.67 high density polyethylene coating, multicore control cable shall be used for runs not exceeding 600m and size 7/0.85 for other situations where wire runs exceed 600m. This information is based on a 2.0 watt solenoid valve 50 HZ (24 volt). It is of particular importance to check each brand of valve for electricity draw off at the solenoid and increase the wire size to match.

All wire shall be run in continuous lengths from controller to valve. All cable jointing shall be contained in waterproof containers and adequately sealed against moisture penetration with commercially available joiners designed for direct burial. All joints shall be in a valve box.

Adequate wire (1000 mm) shall be left at valves during installation to enable future replacement of valves without the need for excessive jointing of wires.

Wires shall be laid below or beside the pipe reticulation system in a common trench with the pipes. Wires not in pipe trenches should be in suitably sized heavy duty electrical conduit.

21.13 Sprinklers/emitters

21.13.1 Type of sprinklers

Sprinklers shall have a stainless steel turret where a stainless steel turret is available. Sprinklers are to be of a type that have been tested and approved by Recreation Services. All rotary sprinklers shall be gear driven and rubber capped with a small surface area to minimise injury.

Sprinklers with a radius of 7 metres or more shall have an approved manufacturer's warranty of at least two years. Sprinklers with a radius of 15 metres or more shall have an approved warranty of five years. Other sprinklers must be of commercial quality with at least 12 month's warranty.

For manually and automatically operated pop-up sprinkler systems the designer should indicate on the drawing, the precipitation rate (mm per hour), the design working pressure and the discharge rate for each type of sprinkler selected. The sprinkler manufacturer and the precipitation rate that has been used in the design should be stated with 'or equivalent' and reference given to the nominated nozzle sizes used. For large turf areas, sprinklers with a radius of 15 metres or more shall be used.

Risers shall be long enough for the sprinklers or QCVs to be installed temporarily 100 mm above finished ground level. Alternatively, risers may be manufactured to the final length and fitted with suitable temporary extensions. Any uPVC risers shall be no greater than 45 degrees to the horizontal after final adjustments are made.

All sprinkler heads shall have built-in check valves to prevent low point drainage. Check valves with a minimum of 30kPa spring, fitted under sprinkler heads shall be used if sprinkler heads with built-in check valves are not available.

If effluent water is being used, sprinklers with purple coloured caps shall be installed.

In low volume systems, 'turbulent flow' type emitters should be used.

21.13.2 Sprinkler installation

Sprinkler manufacturer's specifications generally require that sprinklers be installed up to 13 mm below grade. This is acceptable on new irrigation installations where grass seeding is proposed. However, where sprinkler replacements are occurring on an existing site, or on new installations where turf is being laid, Recreation Services define grade as that level reached by placing a 25 mm by 25 mm by 900 mm long batten on top of the turf and pressing down on it. Sprinklers should then be installed 10mm below that level. That may mean that the top of the sprinkler is actually in the thatch zone and not in soil.

Sprinklers installed in shrub beds shall be installed in plastic sleeves for greater vandal resistance.

All QCVs shall be connected to their respective feed-lines by copper risers of appropriate dimension, offset from the feed-line by 150mm. Each QCV shall have its own isolating valve housed in a 100mm minimum internal diameter uPVC pipe (sewer pipe) capped with a cast iron path box surrounded by 300mm x 300mm x 100mm thick concrete finished to the level of the final grade.

Disturbed areas around sprinklers shall be covered with a minimum of 300mm x 300mm of turf of the same grass mixture as surrounding turf to prevent soil erosion and to protect the sprinkler from damage by sand grains.

The final adjustment of heights of all sprinklers shall be made when landscaping of the area to be irrigated is complete.

21.13.3 Location of sprinklers and emitters

Sprinklers adjacent to footpaths, kerbs or mowing strips shall be located a minimum 75 mm and maximum 150mm away from the pavement edge to permit the use of mechanised edging equipment.

Sprinklers along the edges of cycle ways, roadways, paved areas and shrub beds shall be part circle sprinklers to prevent over spraying. Special attention should be paid to minimising the risk of hazards such as water spraying onto car windscreens, into open windows or into play areas; or water causing slippery pavements or failure of pavements in roadways or cycle ways. Icing may be a major problem in winter. Hazards may also be caused by water spraying onto pathways, especially where this would cause pedestrians to walk on roadways. Particular attention should be given to sprinkler spacing and layout to avoid over spraying. Square spacing may be the preferable design option to prevent over spraying, particularly on narrow strips of grass.

21.14 Special requirements for second class and grey water systems

A wet well gravity fed pumping system shall be used (see Appendix D). Grey water may also be pumped out of a tank instead of a wet well.

21.14.1 Pumps

At least two similar multi-staged pumps (centrifugal or submersible) should be used with each pump capable of supplying at least 75 per cent of the maximum flow rate.

Pump controls should offer protection against the following:

- dry running
- heat overload
- locked rotor
- broken water seal

- multiple start.

The following devices will be required

- overload current device with automatic and manual reset
- flow switch
- thermal overload device
- multiple start protection
- thermal transformer protection with automatic reset
- pressure sensors for three levels of pressure – high (stops pump), intermediate (sends signal to irrigation controller) and low (sends signal to irrigation controller)
- water level sensor
- lockout circuit with indicator lights and reset
- circuit breakers instead of fuses
- pump confirm running switch to send signal to irrigation controller
- phase failure switch
- pump cycle adjustable from 0 to 15 minutes
- lightning and surge protection for all electrical components.

To achieve even wear on the pumps, on start up the pump to start first should alternate (that is, start 1 pump A, start 2 pump B). In the event of one pump failing the controls should automatically switch to the other pump and send a signal to the irrigation controller.

A manually operated switch is also required so that either pump may be switched on. This switch should override the automatic control. A signal to indicate manual operation should be sent to the irrigation controller.

The pumps should be housed either in a pump house or in the wet well.

Where the pumps and controls are to be housed in a pump house, a brick structured pump house large enough for service personnel to walk into and service all the equipment within it is required. The housing will need to be well lit, vandal proof and have well drained floors. All the pump controls and the irrigation controller should be housed in a weatherproof box in the pump house with easy access for operation and maintenance.

Where the pumps are housed in the well, a separate vandal resistant structure is required for the pump controls and the irrigation controller.

Provision must be made to house the ActewAGL power meter and switchboard. ActewAGL approval is required for all electrical installations and conditions.

Frost protection in the pump house may be required.

21.14.2 Filters

One high quality automatic electric filter (Amiad or equivalent) is required to be installed downstream of the pump in a suitable housing or pit. The automatic filter shall have the following features:

- 140 micron filter

- flushing according to pressure differential and/or time
- flushings counter
- remote controlled flushing operation
- information on filter condition (filtering, flushing, malfunction)
- pumps must shut down immediately if a malfunction occurs and send a signal to the irrigation controller
- suction scanner (driven by an electric motor) to remove any debris from the filter.

A second filter (check filter) should be installed downstream of the automatic filter. It should be of steel construction, with a 140-micron moulded stainless steel strainer and a manual flush valve.

Manual stop valves and the relevant pipe work should be in place to allow the automatic filter to be by passed in emergencies and the remainder of the system to be operational using the check filter. A stop valve is also required on the downstream side of the check filter.

All flushing water is to be returned to the lake (or grey water source). Filters/strainers are also required on the intake and in the wet well. All filters should be sized according to the expected maximum flow rate.

21.14.3 Intake

Second class water systems should be wet well gravity fed. The intake should be at least three metres below the lowest water level and at least 0.5 metres above the bed of the lake. A 'T' piece on the intake is required to double the intake area. The intake area should be covered with a coarse filter (approximately 10mm) to prevent large particles or fish from entering it. The filters should be positioned to require minimum maintenance while still being easy to maintain. The intake should be orientated so that minimum weed and debris will enter the system.

The fittings, filters and pipe used for the intake and suction line must be made of non-corrosive materials such as polyethylene. The suction line should be sized so that the velocity of water does not exceed 1 metre per second while pumping at the maximum flow rate.

21.14.4 Wet well

The wet well in second class water systems shall be constructed of non-corrosive materials such as concrete. All fittings, nuts and bolts should be non-corrosive, preferably high grade stainless steel. Metals should be compatible (that is, not galvanic).

The filter screen should be a slip in type with a maximum orifice size of 2 mm. A spare filter screen should be supplied.

21.14.5 Valves

A pressure reduction valve is required downstream of the filters. It should be an ActewAGL approved valve (including reflux valves) and can be included in the same housing as the filters.

Automatic valves should be of a type specifically designed for dirty water and still meet the requirements for valves described in 21.11.

21.14.6 Water meter

A water meter must be installed with easy access, on the outlet side of the pump. These requirements include:

- certification from the manufacturer or their agent that the meter is within +/- 5 per cent accuracy
- installation according to manufacturer's instructions
- in addition, installation to include a length of straight, unobstructed (no valves or filters) pipe on the inlet side of the meter which is at least 10 times the pipe diameter and a length of straight unobstructed pipe on the outlet side of the meter which is at least five times the pipe diameter.
- meter able to record to a level that far exceeds expected use in any one year with no reset facility for the total
- meter's unit of measurement sensitive enough to identify 2 per cent of the expected annual water use
- for electronic meters, only the Environment Management Authority holds the PIN for the accumulated total and the back up PIN can only be released with the agreement of the Environment Management Authority
- meter cannot be made to record in reverse.

21.14.7 Potable water connection to second class water system

A standby potable water connection should be included to allow normal irrigation in the event that the 2nd class water supply is not available. Provide backflow prevention.

21.14.8 Service and maintenance

The pumping system should be designed so that servicing and maintenance requirements are kept to a minimum. All components installed must be easy to service and have sufficient space to allow for servicing and adjustment.

21.15 Documentation

21.15.1 Working drawings

The working drawings should include a full description of the work to allow realistic pricing of the project and accurate construction.

All drawings shall be on a series of A1 or A3 sized pages.

The design plan for high volume irrigation systems should show the following:

- system layout at an appropriate scale to fill a single sheet
- meter pit fittings and meter pit drainage
- sprinklers used in design, nozzle size and spacing
- controller type and number of stations
- size, type and location of valves
- operating pressure, discharge rates of sprinklers and maximum draw-off allowable

- number of hours of watering per week needed to apply the required precipitation (no programming schedule is required)
- location of conduits.
- The design plan for low volume irrigation should show the following:
- location of any in ground boxes
- location and type of controller
- filter type and mesh size
- type of pressure regulator and pressure used
- number, type and rate (litres per hour) of emitters
- dripper location (for example, north of tree)
- location of all polythene pipe ends and how they are marked
- emitter spacing
- location of conduits.

Documentation for second class water systems needs to include pump details including type, manufacturer, warranty, dimensions and output. Drawings should include pumps, controls, filters and valves. A list of spare parts and special tools required for regular service and maintenance of the pumping system is also required. A waterproof set (for example, aluminium etched) of the following information is to be located in the pump house or control box

- make and size of pumps
- suggested service schedule
- suggested maintenance schedule
- make and size of filters
- make, type and other relevant information on controls
- diagrams of electrical circuits
- diagram of pumps, filters and pipe layout including valves
- instruction on how to switch from 2nd class to potable water.

Drawings should comply with standard design symbols and notations (see standard drawing WSS 01 in *Water and Sewerage Standards*).

21.15.2 Works as Executed documents

The Consultant will ensure Works as Executed documents are available at handover as per Municipal Services Reference Document Ref-08 Works as Executed Quality Records. Works as Executed drawings will include brand names, type, model and performance specifications for the equipment installed on the project to assist in maintenance according to the schedule of required information in the 'Tender Documents'. All valves shall be triangulated to fixed reference points to enable easy location and the triangulated dimensions shall match the scale of the drawing. Drawings shall show the eastings and northings of all valves, meter pit, controller, mains etc.

21.16 Further reading

Belconnen's Urban Parks, Sportsgrounds and Lake Ginninderra Plan of Management, Canberra Urban Parks and Places, Canberra, 1990.

Inner Canberra's Urban Parks and Sportsgrounds Plan of Management, Canberra Urban Parks and Places, Canberra, 2000.

Irrigation Policy, Canberra Urban Parks and Places, available online: http://www.parksandplaces.act.gov.au/about/ then follow link to management policies then irrigation

Tuggeranong's Urban Parks and Sportsgrounds Plan of Management, Canberra Urban Parks and Places, Canberra, 2000.

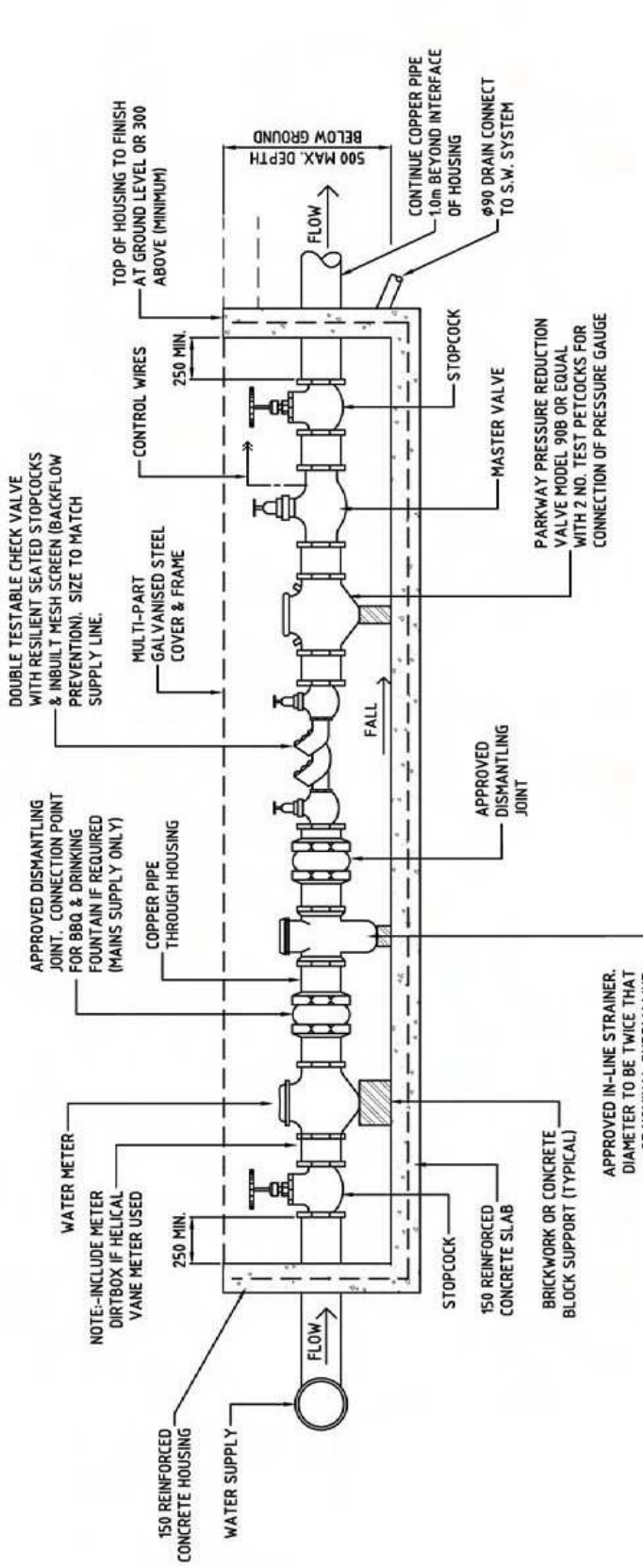
Woden and Weston Creek's Urban Parks and Sportsgrounds Plan of Management, Canberra Urban Parks and Places, Canberra, 1998.

Draft Plan of Management for Urban Open Space and Public Access Sportsgrounds in the Gungahlin Region, Parks and Places Sept. 2005.

21.17 Standard drawings

Appendix A

A1 Irrigation Meter Pit

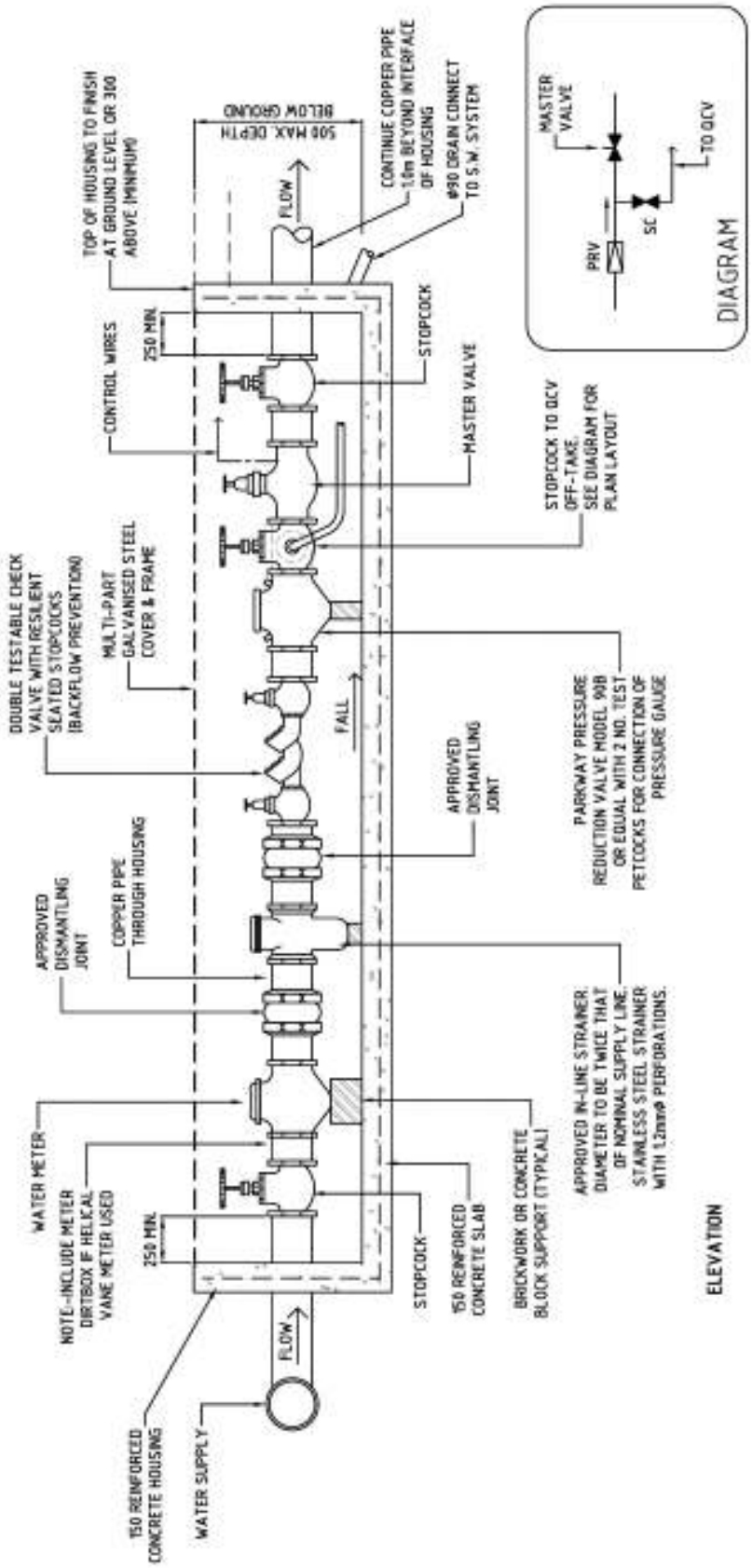


METER PIT DIMENSIONS (mm)			
COMPONENT SIZE	INSIDE DEPTH	INSIDE WIDTH	INSIDE LENGTH
50 to 80	800	600	LENGTHS TO SUIT COMPONENTS - MULTIPLES OF 600 LESS 40
100	980	850	
150	1660	950	
225	1660	1050	

NOTE:
PRESSURE REDUCING VALVE TO BE HYDRAULICALLY OPERATED. PILOT CONTROLLED DIAPHRAM TYPE, CAPABLE OF PREVENTING RETURN FLOW.

IRRIGATION METER PIT & ARRANGEMENT OF EQUIPMENT
(WITHOUT QCV TAKE-OFF)
NOT TO SCALE

A2 Irrigation Meter Pit (with QCV take-off)



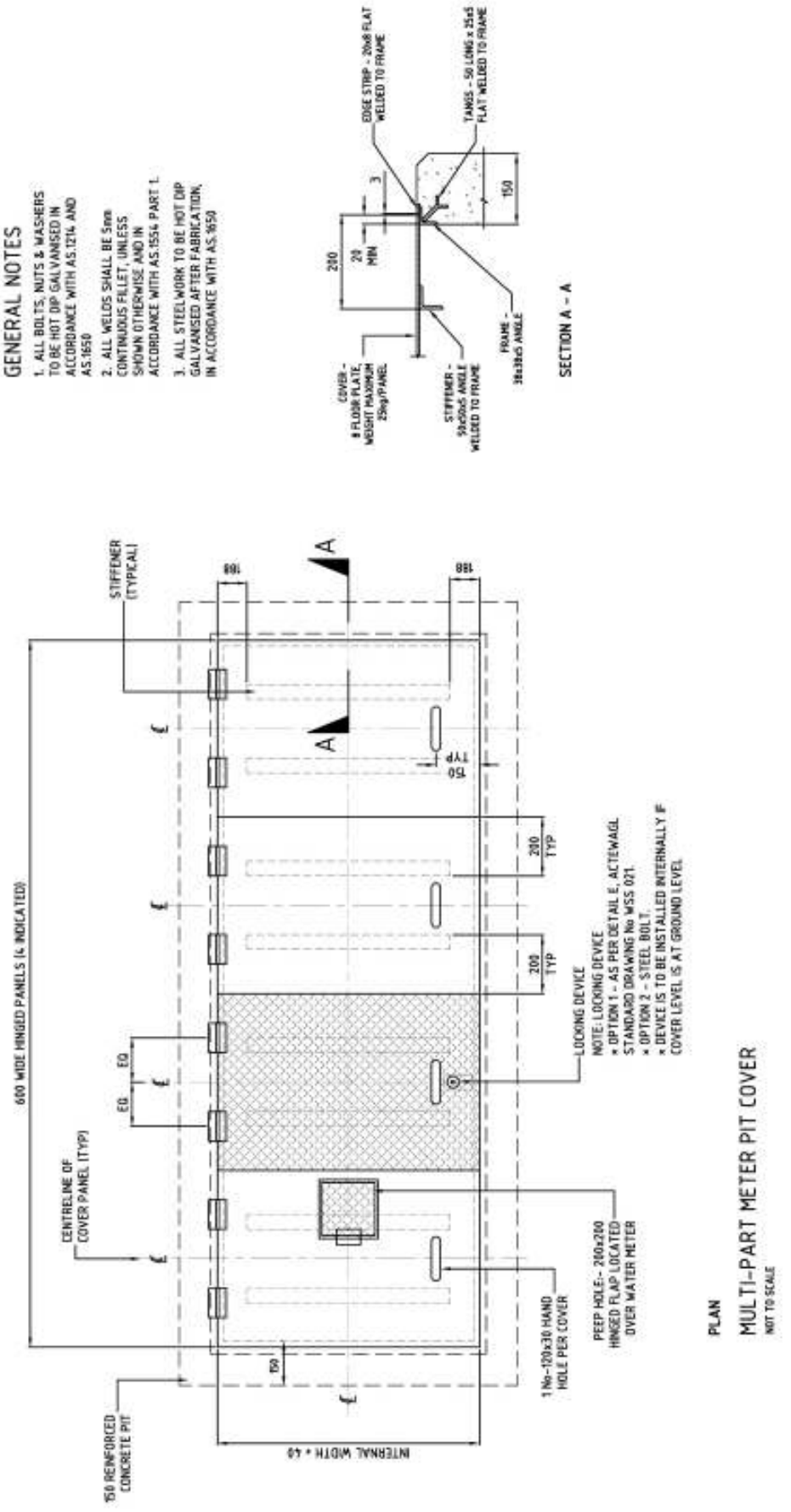
METER PIT DIMENSIONS (mm)			
COMPONENT SIZE	INSIDE DEPTH	INSIDE WIDTH	INSIDE LENGTH
50 to 80	860	600	LENGTHS TO SUIT COMPONENTS - MULTIPLES OF 660 LESS 40
100	980	850	
150	1660	950	
225	1660	1050	

NOTE:
PRESSURE REDUCING VALVE TO BE HYDRAULICALLY OPERATED, PILOT CONTROLLED DIAPHRAM TYPE, CAPABLE OF PREVENTING RETURN FLOW.

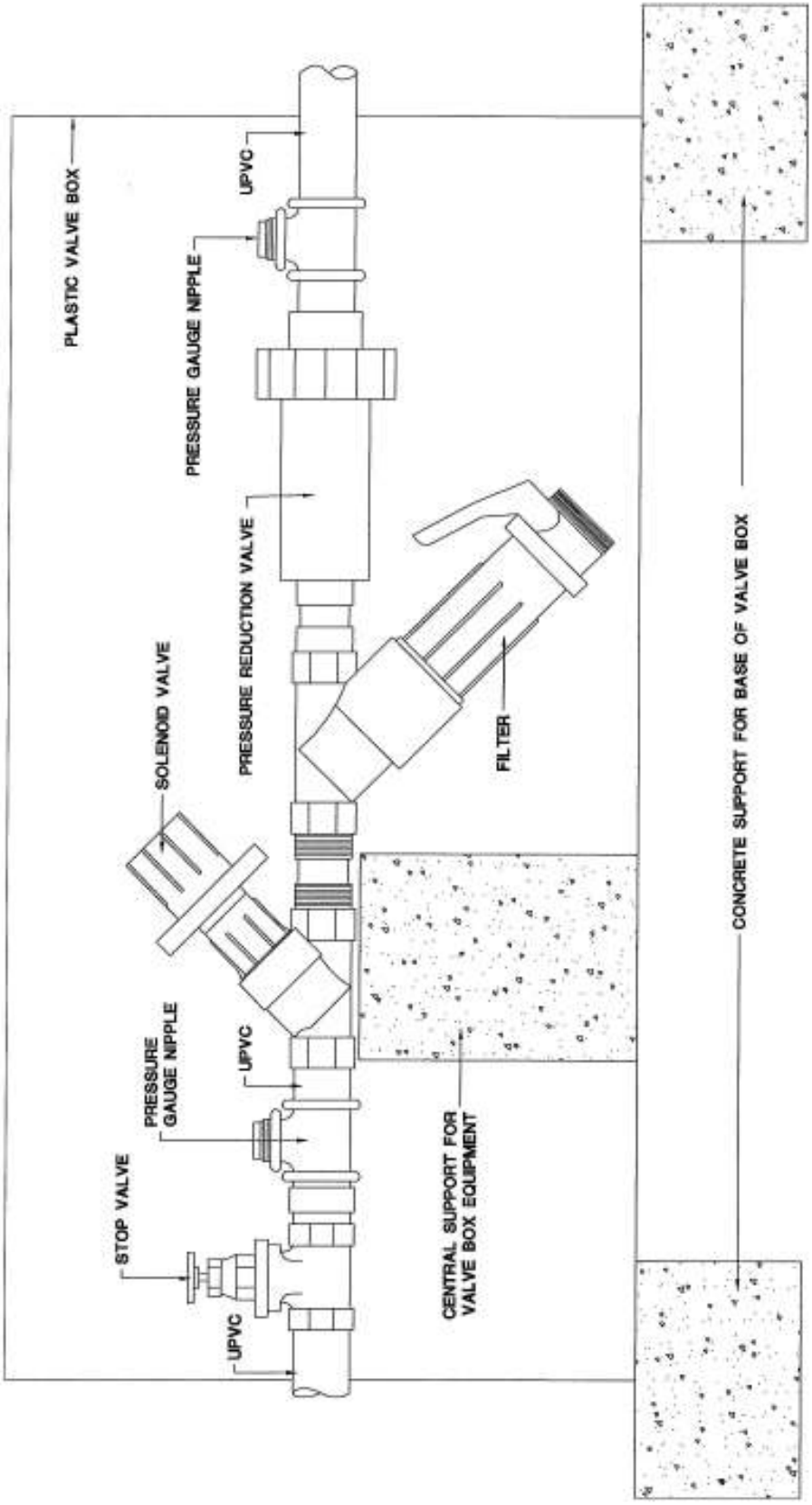
IRRIGATION METER PIT & ARRANGEMENT OF EQUIPMENT (WITH QCV TAKE-OFF)

NOT TO SCALE

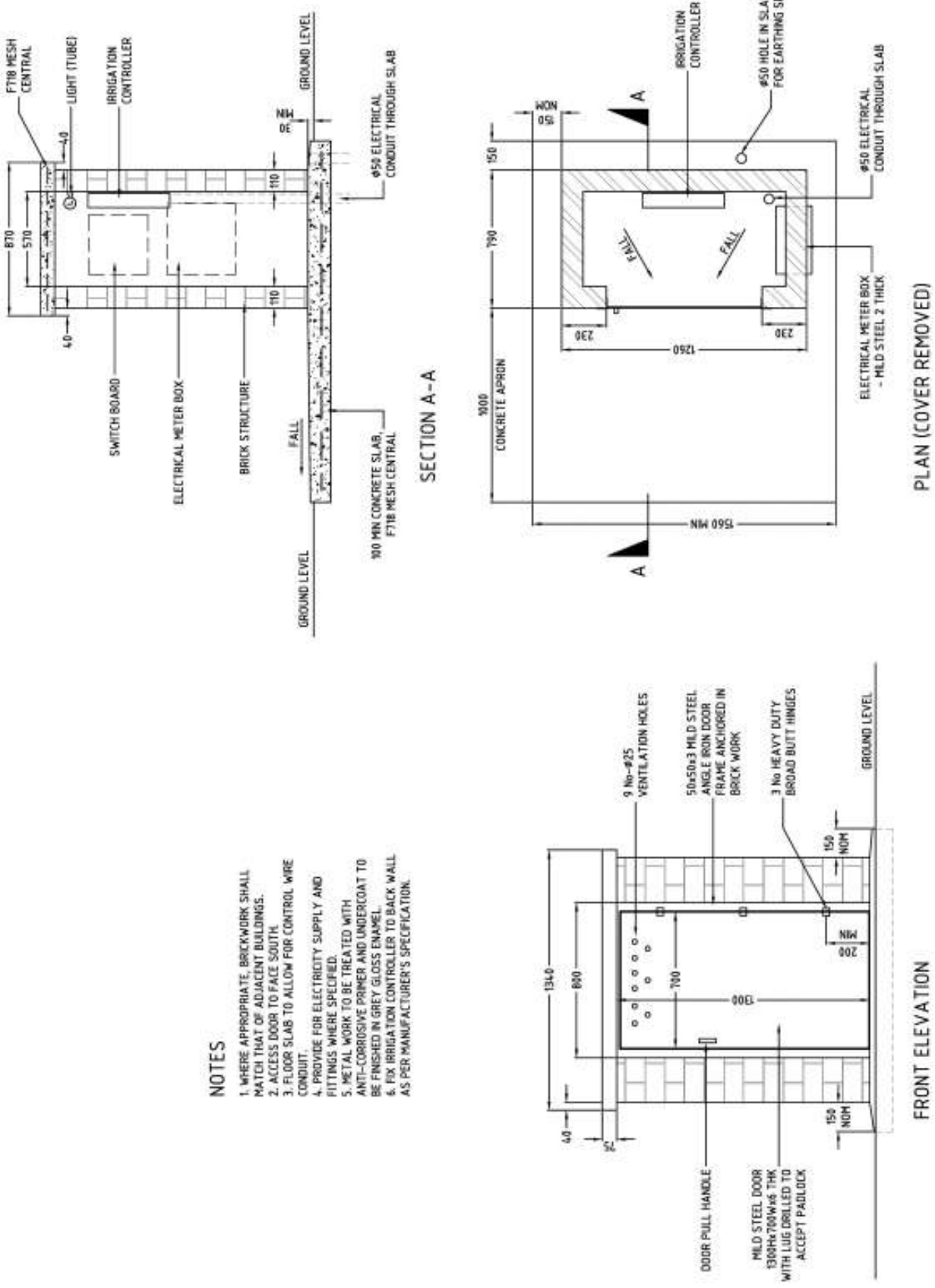
A3 Meter Pit Cover



Appendix B Low Volume Valve Box Equipment

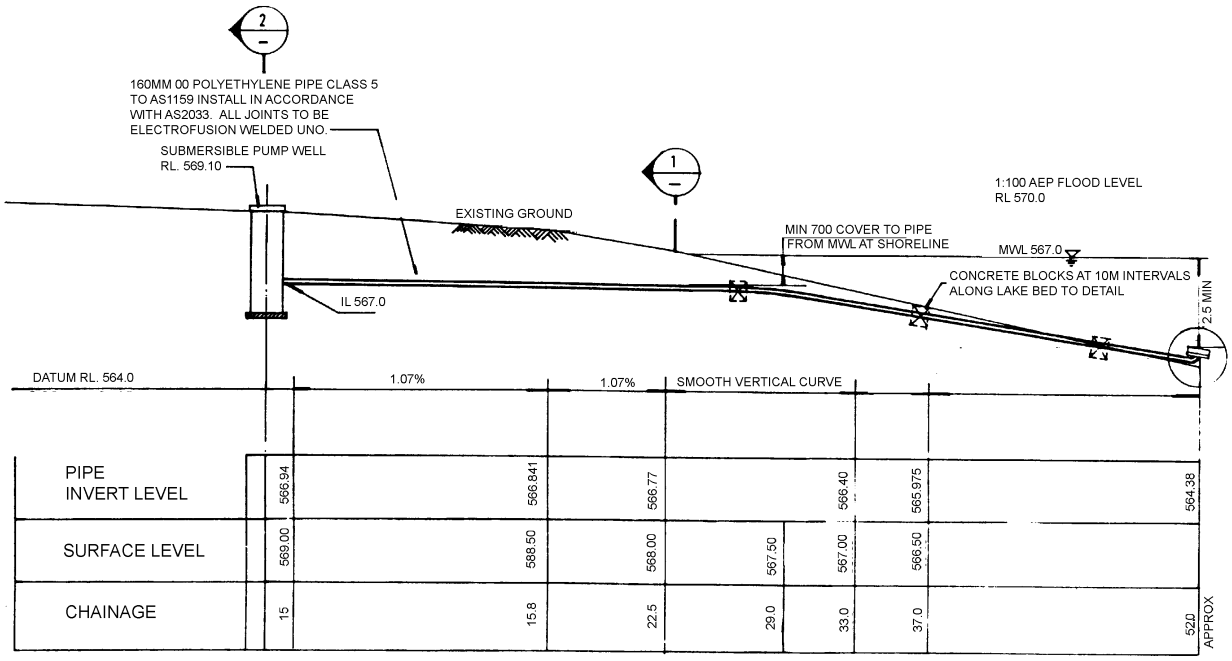


Appendix C Free-standing Controller Housing

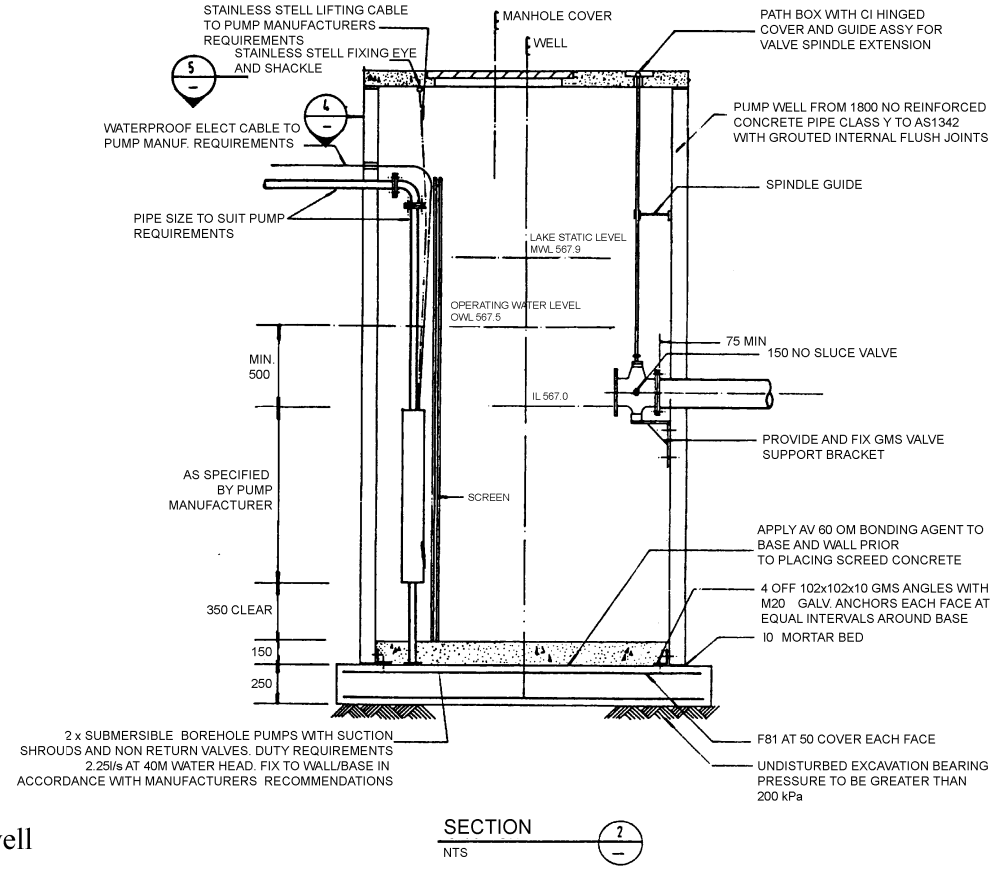


Appendix D Second Class Water Systems

D1 Pump Well & Gravity Intake

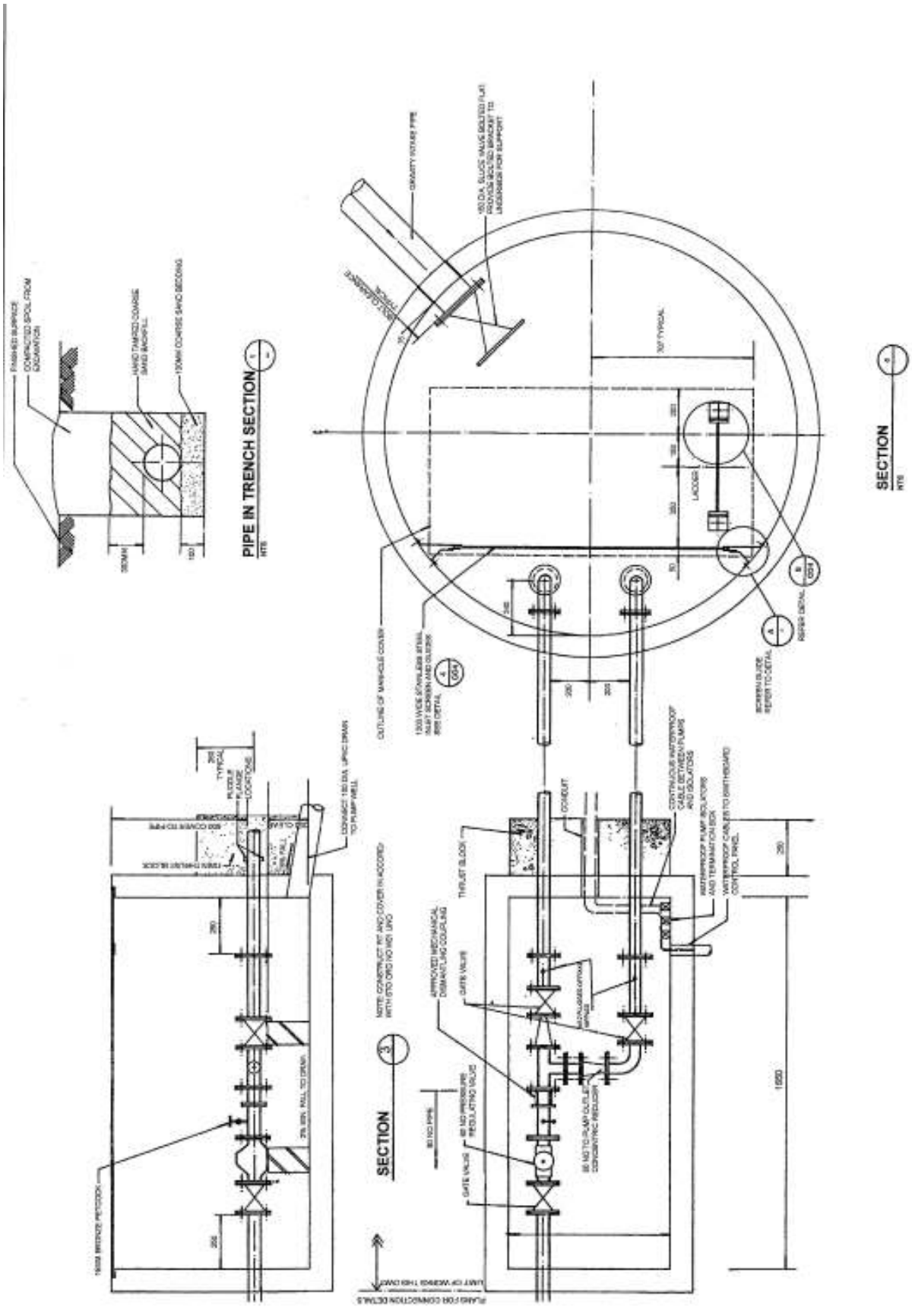


Typical gravity intake pipe - longitudinal section



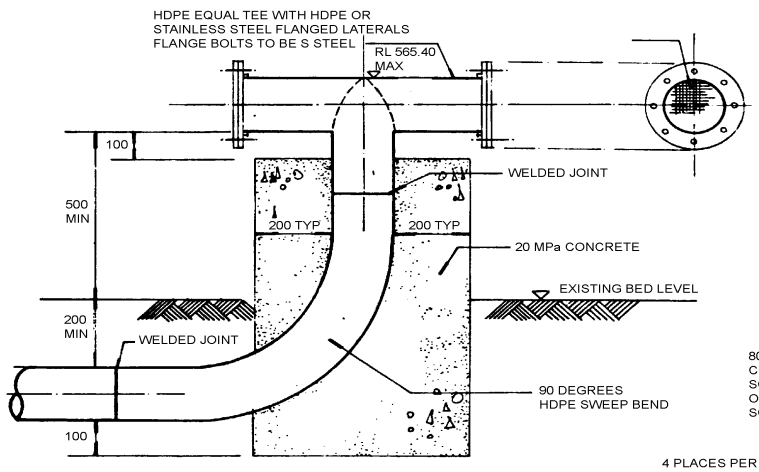
Irrigation pump well

D2 Pump Well & Valve Pit at Discharge

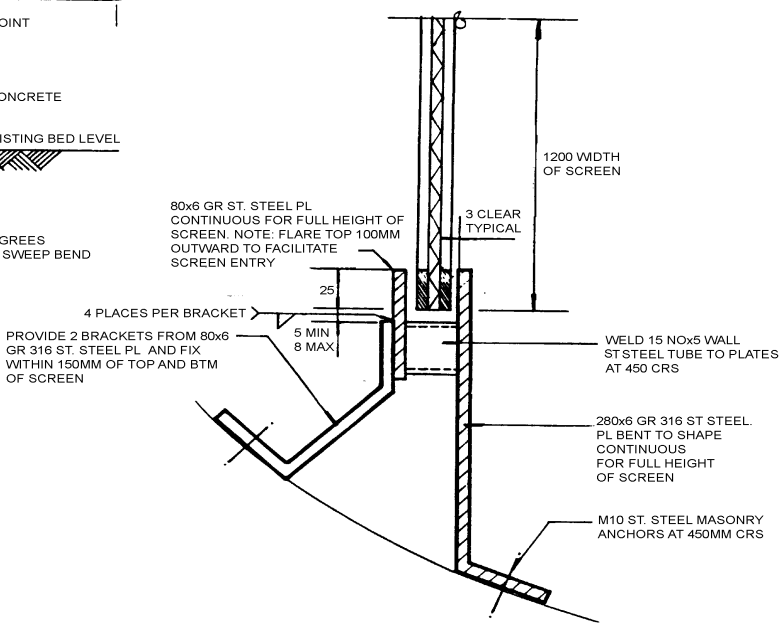


Irrigation pump well and valve pit at discharge

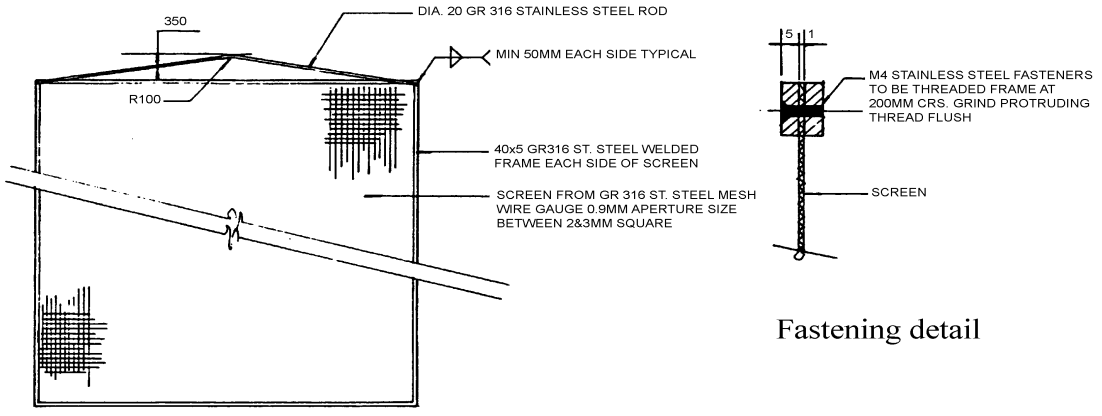
D3 Pump Well – Intake & Screen Details



Intake structure detail



Screen guide construction and fixing detail

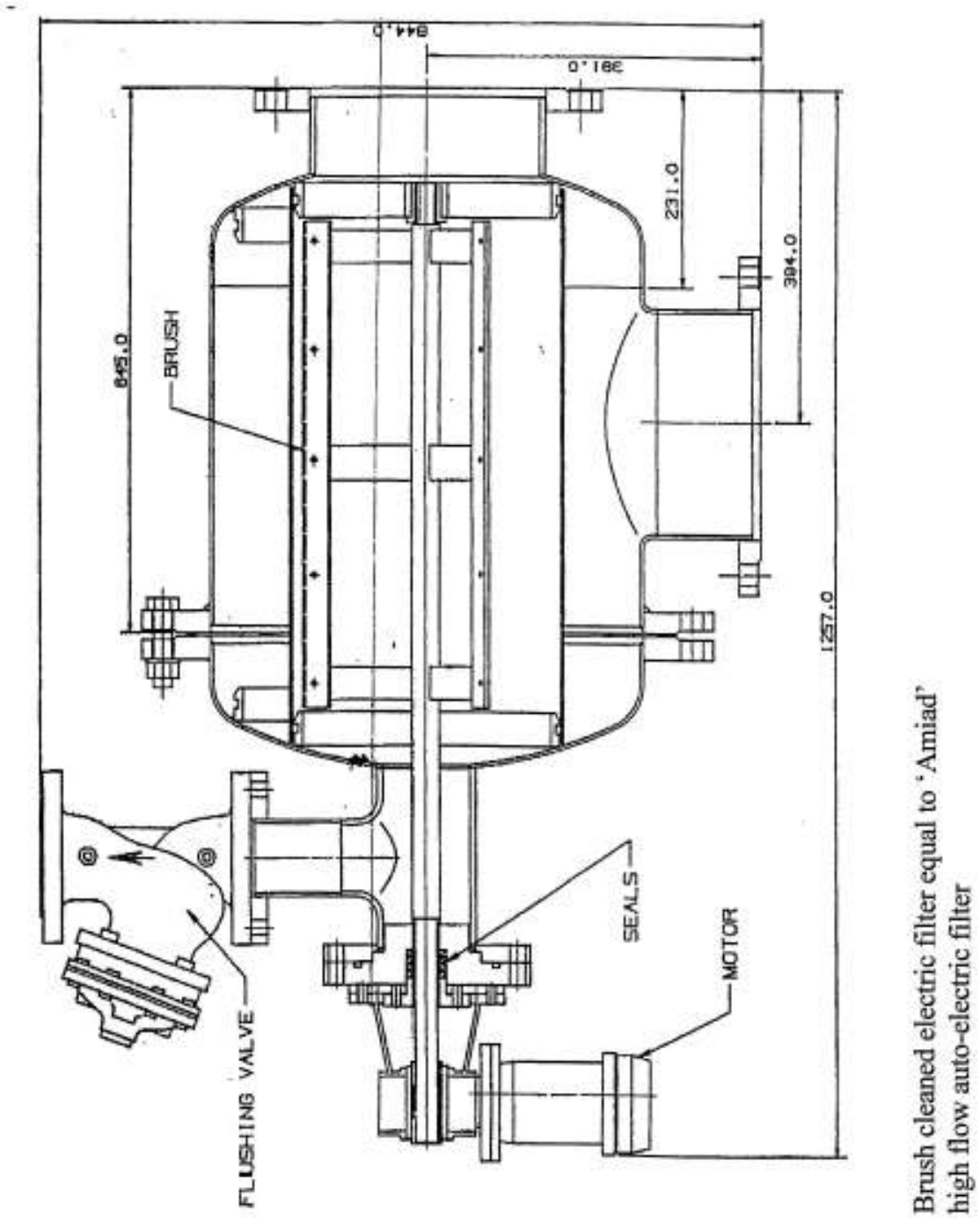


Fastening detail

NOTE: PROVIDE 1 INSITU SCREEN AND 1
SPARE FOR THE PRINCIPALS USE.

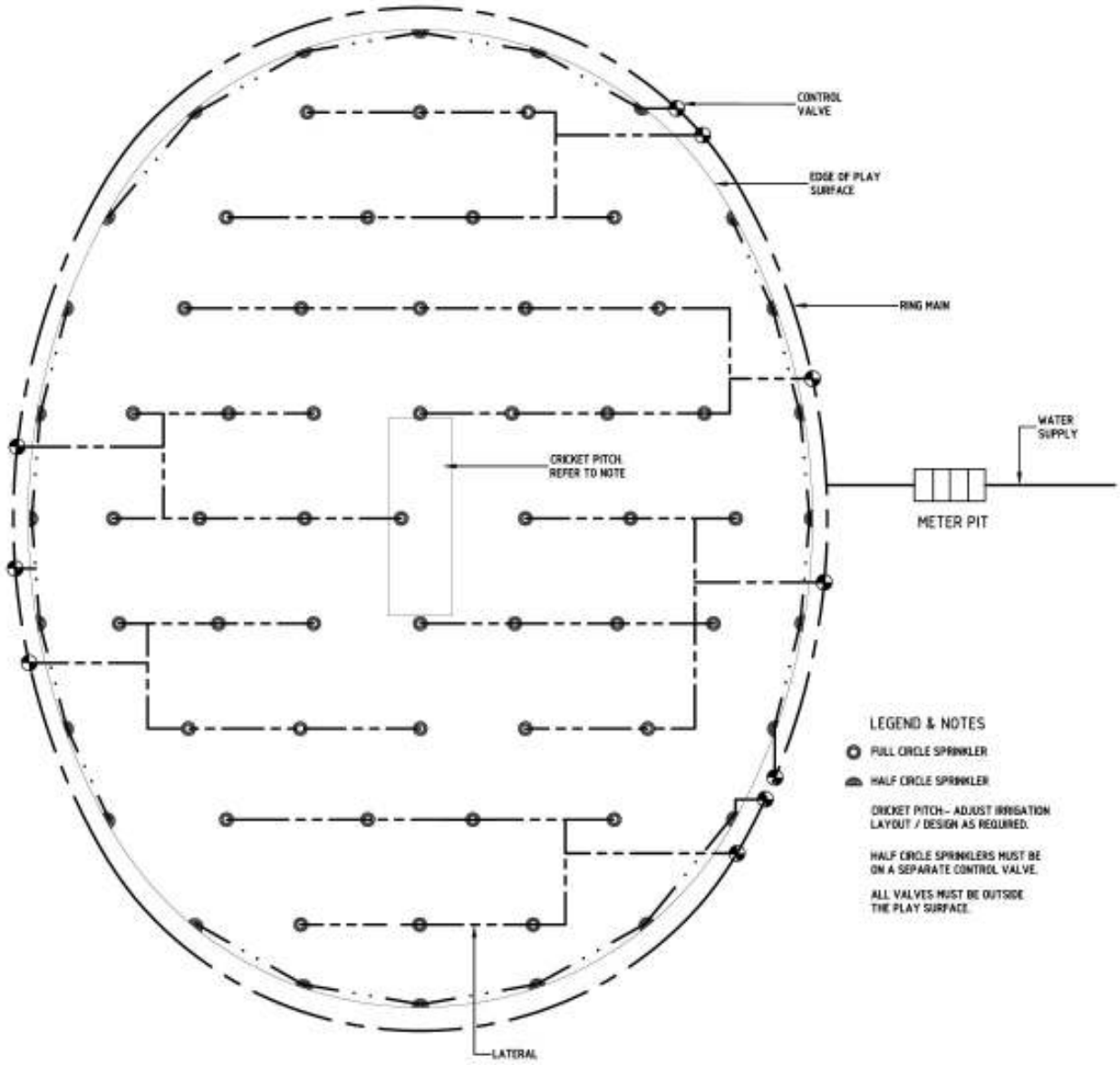
Intake screen detail

D4 Pump Well – Electric Filter Detail



Brush cleaned electric filter equal to 'Amiad'
high flow auto-electric filter

Appendix E Typical Irrigation of Sports Field



TYPICAL RING MAIN & VALVE ARRANGEMENT