Irrigation Technical Specification for Cadden Hill Sports Field

Place Design Group

HYDROPLAN

Client Name	Place Design Group
Project Name	Cadden Hill Sports Field Irrigation
Description	Technical Specification
Project ID	14304
Revision	1

Revision No.	Date	Description	Author	Approved By	Reviewed By
1	21/11/2017	Tender Issue	JN	SJ	

HydroPlan Pty Ltd
Unit 7, The Palms
62-66 Glen Osmond Rd
Parkside SA 5063
Tel: +61 8 8373 4949
Fax: +61 8 8373 0779
adl@hydroplan.com.au
http://hydroplan.com.au

Contents

Tables

1 GENERAL

All plumbing works shall comply with National Plumbing and Drainage code - AS3500

1.1 Alternative Tenders

Alternative tenders may be lodged provided they are accompanied by a conforming tender with completed schedules. If a tenderer wishes to offer alternative 'product packages', the lump sum difference can be listed without the accompanying schedules. After tenders close, the tenderer may be required to submit the completed schedules for one or more of the alternatives.

1.2 Site Location

The site is Cadden Hill Sports Precinct, Cadden Hill, New South Wales.

1.3 Geotechnical Data

1.3.1 Ground Encountered

The Contractor will be deemed to have satisfied themselves, including by site inspection, as to the different kinds of ground likely to be met during the progress of the work, including the extent and nature of wet or bad ground and the nature of any rock, roads, pathways or paving to be encountered.

1.4 Supplementary Conditions

1.4.1 Definitions

- The `Principal' is City of Tea Tree Gully.
- The `Superintendent' will be a representative of City of Tea Tree Gully. The superintendent is the person, persons or company responsible for supervision of irrigation installation.
- The `Contractor' will refer to the persons or company engaged to supply and install irrigation according to the Tender Documents.

1.4.2 Abbreviations and Irrigation Jargon

Where abbreviations and jargon are used in this specification, interpretations shall be in accordance with normal usage in the irrigation industry, or as ruled by the Superintendent.

Table 1: Abbreviations and Irrigation Jargon

PVC	Unplasticised Poly Vinyl Chloride
HDPE poly	High Density Polyethylene, AS4130/AS2033
QCV	Quick Coupling Valve
solenoid	solenoid valve (automatic control valves)
control valves	valves that connect mains to laterals or submains, on/off and pressure control.
common	common wire to valves, normally earthed
Active	switching wire to each valve, normally 24V AC.
Shift	group of valves that are operated together
Station	output terminal of the automatic controller, valve or valve group
L/s, L/min, L/h	Litres per Second, -per Minute, -per Hour (flow rate)
m3/h, kL/h	Cubic Metres per Hour (flow rate), Kilolitres per Hour
kL, ML	Kilolitre (1,000 Litres), Mega litre (1,000,000 Litres)
MPR	Matched Precipitation Rate

CU	Christensen's Coefficient of Uniformity
DU	Coefficient of Distribution Uniformity
mainline	pipes that are constantly pressurised during irrigation pipes that feed water to control valves
Lateral	intermittently pressurised pipe work with outlets attached, downstream from control valves
submain	manifold of controlled pressure to feed laterals
PRV,PSV	Pressure Reducing Valve, Pressure Sustaining Valve
Pitot	pressure gauge attachment to measure velocity head at sprinkler nozzles
BPD	Backflow prevention device
OTR	Office of the Technical Regulator

2 SCOPE OF WORKS

Documents for the Irrigation Works are, in order of precedence:

- The Irrigation Specification which includes the Schedule of Rates which must be completed and included as part of the tender submission
- Drawings: 14304-001, 14304-002 and 14304-004 (Drainage - refer to separate Technical Specification).

Where discrepancies exist between drawings and technical specifications, the Contractor shall clarify these with the Superintendent prior to works commencing.

The work included in this contract comprises the provision of all labour, plant, tools and materials and includes but is not limited by the following:

- All existing irrigation hardware made redundant to be cleaned and returned to the client (includes all sprinklers, solenoid valves, valve boxes and controllers).
- Reinstate excavations to finished grade.
- Supply & installation of new irrigation system as indicated on the drawings.
- Supply & installation of new drainage system as indicated on the drawing (refer to separate Technical Specification).

If work by others threatens to retard progress of the Contractor's works, the Contractor shall inform the Superintendent immediately.

3 VARIATIONS

The Superintendent may, at any time, direct the Contractor to carry out variations but variations do not invalidate the contract.

If a variation deleting part of the works is directed, the Contractor will not be entitled to claim or to be paid any compensation and the client may itself carry out any deleted work or engage others to do the work.

Within two (2) days of a request for a variation, the Contractor must notify the Superintendent in writing of the total cost to carry out the variation, including parts and labour.

If the Superintendent accepts the cost provided by the Contractor, the Superintendent will notify the Contractor to proceed with the variation in writing prior to work on the variation commencing, and the Contract Sum will be adjusted accordingly.

The Contractor shall not be entitled to claim or be paid any variation costs where the above pre-approval process has not been followed.

4 WATER SUPPLY

4.1 Water Source

Water is sourced from the existing 50mm Sydney Water, Water Meter. Flows and Pressures from the water meter were not available at this stage. A minimum water flow of 50 L /min will be required to provide adequate water supply to the below ground water storage tank. Flows and pressures were unavailable at the time of writing this specification. This will need to be confirmed by the contractor.

A below ground concrete 150,000 L water tank with 2 galvanised checker plate manhole covers will be installed. This tank is to meet council standards including colour and installation requirements. Mains water will provide reliable water supply to the tank. An appropriate air gap, double check valve caged and a Bermad 700 series Level Control Valve will be required. A solenoid valve, wired to the starter panel 24V will be installed on this mains water line to control tank water filling.

4.2 Backflow Prevention

Where mains water is used in the irrigation system, an approved backflow prevention device must be connected downstream of the water meter as per to the drawings. New installations must be installed by a licensed backflow installer and must adhere to AS3500, Sydney Water requirements. All existing back-flow prevention devices removed from sites must be de-registered with Sydney Water. A double check back flow prevention device will be required.

All new back-flow prevention device installations must be tested and registered with Sydney Water, with documentation provided in the as-constructed documentation package if relevant.

5 SETTING OUT AND CHECKING OF WORK

5.1 Setting out pipe and sprinkler positions

The Contractor shall verify the actual marked out dimensions of the irrigated areas on site. It shall be the responsibility of the Contractor to report to the Superintendent any discrepancies between design drawings, specification and site. Failure to do so prior to installation of equipment may result in replacement or removal of the equipment at the Contractor's expense.

The Contractor shall clearly identify the location of each run of pipe location and location of the sprinklers, using paint or pegs for approval by the Superintendent or their representative prior to trenching. In general, sprinklers locations are critical for uniform coverage, but variations in pipework may be approved to avoid obstacles.

The contractor shall engage HydroPlan to provide corrected GPS survey services to set-out sprinkler locations for sports fields, and station areas for subsurface systems. The contractor shall include any related survey fees.

5.2 Inspection

The Contractor shall give sufficient notice so that the Superintendent can make inspections at the following stages:

- Initial hardware, pipe and cable set-out
- Below ground concrete 150,000 L tank and pump installation
- Mainline installation prior to backfill
- Mainline & lateral flushing
- Mainline pressure test
- Practical completion

5.3 Connections to existing

Contractor shall make all necessary provision for exclusion of water from the pipes while connection is being made, including any temporary connections.

5.3.1 Approval for operation of connection to recycled water service

No operation of the existing recycled water service shall take place without the approval of the Principal and Superintendent as to the time and procedure to be adopted.

5.4 Cleaning up

5.4.1 Cleaning up - general

The Contractor shall progressively clean up and restore works during the progress of the Contract and shall continuously remove any accumulation of waste spoil rubbish and unused materials, whether supplied by themselves or the Principal. The contractor shall allow in their price for the removal of spoil from the site and pay any dumping fees applicable.

5.4.2 Refusal to set out until cleaning up complete

The Superintendent may refuse to set out or permit new work to proceed until clean up and restoration has been completed for works available for clean up more than 10 days previously.

5.4.3 Deposition of materials from clean up

All material, spoil and rubbish removal from the site shall only be disposed as directed by the Superintendent.

6 MAINTENANCE (DEFECTS LIABILITY)

6.1 Period of maintenance (Defects Liability)

Maintenance or Defects Liability Period shall be 52 weeks from the date of issue of a Certificate of Practical Completion.

6.2 Rectification before final certificate

All work required during the defects liability period (including work of obtaining clearances and repair of damage to property) becoming evident during the defects liability period shall be carried out before final certification and the defects liability period shall be extended accordingly.

6.3 Time limits for maintenance by the Contractor

In the event of any required maintenance work not being carried out within two (2) working days (or shorter time if conditions are created that are hazardous to persons or the irrigated area) of the need arising, the Superintendent shall have the same carried out by others and the cost shall be deducted from any moneys due or to become due to the Contractor under the Contract.

7 EXISTING SERVICES

7.1 Location of existing services

The Contractor shall by site investigation, "Dial B4U Dig" service, and by checking with the Principal and local authorities concerned, positively locate and expose all services at least 30 metres ahead of the point being excavated. Advice provided to the Contractor does not reduce the Contractors responsibility to locate services. There are multiple services existing on these sites including optic fibre cables.

7.2 Protection of or damage to existing services

The Contractor shall take every precaution necessary for the protection of private services during the course of the Contract and should any such service be damaged, the Contractor shall immediately:

a. notify the owner affected of the damage to the service,
b. contact the local authority concerned and advise of the damage and arrange for any turning off of the supply and
c. arrange repair of the service by properly qualified and licensed workers.

The Contractor shall make good any damage to any existing services previously identified at their own cost.

8 SALVAGED MATERIALS

8.1 Removal of existing irrigation equipment

All existing irrigation hardware that does not form part of the new system shall be exhumed, cleaned and returned to the Principal. This includes, but may not be restricted to, all solenoid valves (with cables trimmed as long as practical), sprinklers, pumping equipment, filters, controllers and controller housings. Any excavations required to exhume existing hardware shall be reinstated to finished grade as for backfilling and top treatment of trenches.

8.2 Salvaged materials to be property of principal

All salvaged materials shall remain the property of the Principal. The Contractor shall recover them intact, clean them, store them where directed and protect them from damage.

9 ROCK EXCAVATION AND REFILLING

9.1 Rock definition

Rock is defined as material that, in the opinion of the Superintendent, cannot be removed by manual tools and/or a standard back-hoe with appropriate attachments.

9.2 Payment for rock excavation

Payment for excavations defined as being rock shall be according to the rates tendered. In the absence of such rates, day labour rates will be applied by the Superintendent. Payment for rock excavation excludes costs incurred by the Contractor whilst determining the presence and extent of rock. The Contractor shall inform the Superintendent of the existence of rock and gain written approval before proceeding.

9.3 No payment for 'Hard-dig' excavation

All ground material encountered is defined as either normal ground conditions, or rock as defined above. The Contractor shall be deemed to have satisfied themselves as to both the nature and the extent of all digging to be met with during the progress of the work. The scheduled rates or prices for excavation and refilling shall be deemed to cover excavation and refilling in all kinds of normal ground conditions notwithstanding the actual nature and extent of the ground encountered. No claims for extras due to hard dig will be approved unless the conditions can be considered rock as defined above.

9.4 Refilling of rock excavations

With the exception of some trench refilling as specified therein, rock excavations shall not be used for refilling. The scheduled rate for rock excavation shall include the cost of loading, cartage and removal of the rock to the nearest tip as specified and the replacement of the rock removed with other refilling material. In general, this material shall be surplus material obtained from normal excavation on the job however, the Contractor shall allow to import suitable material for refilling if necessary the cost of which shall be included in the rate for excavation.

10 EXCAVATION OF TRENCHES - GENERAL

10.1 Dust Suppression

The Contractor shall ensure that dust is suppressed in accordance with local regulations.

The Contractor shall be responsible for, and pay all costs related to the control of dust on the site.

10.2 Dimensions of trenches

The Contractor shall excavate and effectively maintain all trenches, shafts and drives to the dimensions required to enable the pipes to be laid to the levels and grades shown in the drawings forming part of this specification. All excavations for pipe laying shall be taken out below the pipe invert. All trenches shall allow for a minimum of 450mm depth of cover over all pipes unless indicated otherwise on the drawings. Trenches shall be a minimum of 150mm width. In some places the depths of cover may not be achievable. Where depth of cover cannot be achieved due to local conditions, the Contractor shall notify the Superintendent. The Superintendent will advise the Contractor on how to proceed.

10.3 Alignment of trenches

In general, trenches shall be aligned with surface visible items such as kerbs, plantings, sprinklers or valve locations.

The Contractor shall peg all mainline and lateral paths and use string lines where instructed, for straight line trenching. The trench shall not vary by more than one trench width from the string line.

When there is a need to divert around obstacles, the trench shall be offset parallel to the first trench and 45° angles used to join the pipes. Deflecting the pipe will be allowed when the radius is not less that the recommended 130 times the nominal pipe diameter, or within the manufacturer's joint deflection tolerances.

10.4 Significant Trees

No excavation shall be carried out beneath the canopy of a legislated significant tree without written clearance from the Principal or their nominated and qualified representative.

Where the system design requires modification to avoid nominated significant trees, such modifications shall be treated as variations to the contract (Refer to Clause-3 Variations).

10.5 Drives beneath buildings, gardens and other places

The Superintendent may direct the Contractor to drive under any existing path, road, building, tree, lawn, garden plot or other place. Trees required to be preserved shall be protected at all times and pipelines adjacent to or under such trees shall be laid without interference to the limbs and roots. The Contractor shall hand excavate past or drive under these trees and tree roots as required by the Superintendent.

10.6 Adjustment to widths and depths of trenches - general

The width and depths of trenches shall be increased or decreased (by gradual transition where possible) to the satisfaction of the Superintendent to facilitate all work associated with the jointing of pipes and the installation of fittings or to accommodate special bedding, drainage or foundations for standard bedding types as shown on the drawings. Abrupt changes in horizontal alignment shall be made only where specified bends are provided. Nominated bend angles will often differ from the pipeline direction change and the Contractor shall allow for additional deflection or trench width to accommodate these bends. Minor changes in alignment shall be made with long horizontal curves by deflection of joints or as otherwise directed.

10.7 Cost of excavation

The cost of all excavation above, including drive, widening or deepening shall be deemed included in the tender sum for excavation, refilling and bedding type. For the purposes of payment according to a scheduled rate, depths of construction shall be measured to the invert of the pipes.

10.8 Excavation - excavated material

10.8.1 Obstruction by deposition of excavated material

Excavated material shall be deposited in such a manner as to not obstruct any drain, roadway, right of way or access to any building or premises. No public street, path or right of way, which is in normal everyday use shall be blocked by the Contractor's plant or excavated material unless written permission to do so has previously been obtained from the local council or other controlling authority. The Contractor shall seek and obtain such approval in ample time to prevent delays in construction while awaiting approval. The Contractor shall comply with all Occupational Health and Safety policies of local authorities.

10.8.2 Separation of excavated material types

The different types of excavated material shall be kept separate from one another and shall be submitted to the Superintendent for decision as to which may be used for refilling and which shall be removed. If the machinery used for construction of trenches allows separate excavation, top soil shall be kept from all other material.

10.8.3 Removal of material unsuitable for refilling

The Superintendent may order the removal from the site of excavated material, which is considered unsuitable for refilling. This material shall be deemed surplus material. If so directed by the Superintendent, the Contractor shall temporarily remove all material from the working area immediately when excavated and place it in position to prevent traffic hindrance. No additional payment shall be made for any such work.

10.8.4 Deposition against walls and fences

No excavated material shall be deposited against the wall of any building or fence unless the Contractor has first obtained the written permission of the owner and occupier of such property. Notwithstanding such permission obtained, the Contractor shall make good all damage immediately after the removal of material.

10.9 Excavation - surplus material

10.9.1 General

All surplus material from the excavation shall be removed from the site as soon as practical or within 48 hours of receiving instruction to do so from the Superintendent.

10.9.2 Retention of surplus material by property owner

Where the Principal desires to retain surplus materials from the excavations for their own use the Contractor may leave such surplus materials deposited as requested in writing by the Principal. A copy of such request shall be lodged with the Superintendent.

10.9.3 Surplus material not removed by Contractor

Should the Contractor fail to effectively remove surplus material within 48 hours of having been directed in writing by the Superintendent to do so, the Superintendent may without further notice cause the material to be removed. The cost of such removal shall be deducted from any moneys due or to become due to the Contractor under the Contract.

10.10 Refilling - general

10.10.1 Classification of refilling

The Contractor shall refill the excavation for the pipe or structure in a manner complying with the table of trench construction (Section 10.11.8). The Contractor shall also refer to the standard drawings showing bedding and refilling.

10.10.2 Saturation of bedding during refilling

The pipe bedding and refilling material cannot be saturated until refilling of the trench is fifty per cent completed. Bedding and refilling material that becomes saturated prior to this stage shall be replaced with dry material to the satisfaction of the Superintendent.

10.10.3 Refilling trenches during hot weather

Allowance shall be made to fully contract pipes in hot weather by either filling with water, partial backfilling or waiting for cooler ambient temperatures.

10.11 Refilling materials and methods

10.11.1 Preparation of trench bottom

The bottom of trenches shall be straight, continuous, firm, relatively smooth and free from rocks. Where trenching machinery allows spoil to remain in trenches, the Contractor shall allow for cleaning out and/or levelling by hand.

All mainline pipes shall have a depth of 50mm clean bedding sand below and 150mm above all pipework (unless noted otherwise on the drawings).

10.11.2 Bedding sand

The bedding sand shall consist of inert, hard, durable, siliceous, natural material which is capable of forming a firm compacted support and which will not flow under load or when saturated. Materials containing excess fines will not be approved.

10.11.3 Samples of refilling material

The Contractor shall provide sieve-passing data of various materials imported to site. The Contractor shall supply at no cost such samples as required by the Superintendent.

10.11.4 Selected excavated material

Where selected excavated material is approved for refilling, the Contractor shall select the best material available for the first refill around pipes. All such material shall be free from rocks, lumps of clay, or other material that may be injurious to the pipe.

10.11.5 Compaction methods

Where refilling layers are specified, depth measurements refer to lose material.

Where a compaction percentage is specified, it shall refer to a minimum relative compaction percentage according to AS1289-1977 “Testing of Soils for Engineering Purposes”. It shall be the responsibility of the Contractor to ensure that the moisture content enables the level of compaction to be attained.

Where general compaction is specified using hand tamping, vehicle tyre or other means, the level of compaction shall be attained to the satisfaction of the Superintendent.

10.11.6 Refilling tunnels and drives

Unless specified otherwise, all tunnels created by boring or drives under sealed roadways shall be refilled with sand or gravel to a minimum relative compaction of 95%, using air blasting, slurry or other approved methods.

Unless specified otherwise, all tunnels under turf, trees or lightly loaded tracks shall not require refilling. If excavation is considered excessive by the Superintendent, the Contractor shall refill the tunnel with excavated material to the satisfaction of the Superintendent.

10.11.7 Shared trenches

Where trenches are shared with other cables, conduit, pipes or detection tape, the Contractor shall ensure proper placement according to the specifications and drawings.

If two pipes are installed in the one trench, they shall be placed apart at least by the greater of 50mm and the diameter of the smallest pipe.

10.11.8 Table of Trench Construction

Construct trenches to the following table:

Table 2: Table of Trench Constructions

	#	VARIABLE	TREATMENT
Preparation	1	Turf	N/A
Shared Trenches	2	Detection tape	mainlines only
	3	Cables, tubes or small pipes	in trench corners, at same level as pipe
Bedding around pipe	4	Bottom preparation	clean out by hand, remove stones, make level
	5	Mainlines	Bedding Sand
	6	Laterals	Approved excavated material
	7	Compaction by air tools, tamping or other means	90% compaction to AS1289, in layers not more than 150mm
	8	First 150mm overlay	Bedding Sand (Mainlines)
Refilling	9	Refilling operations	layers less than 150mm loose measurement, compact each layer
	10	Refill material	excavated spoil with less than 10% rocks less than 50mm
	11	Mainline	150mm cover of approved selected excavated material
	12	Last refill	Mechanical air tools
	13	Compaction	Mechanical air tools
Top finish	14	Finished grade	levelled to grade
	15	Trench topping	Import topsoil, before practical completion and as often as needed during defects period

10.12 Top finish

10.12.1 General surfaces

Unless specified otherwise, the Contractor shall level off the surface and remove stones, debris and other undesirable materials. The Contractor is responsible for the reinstatement of all trenches, holes and areas denuded of vegetation by the Contractor's operations.

10.12.2 Turf Sod-Cutting

In Formal Turf Areas (as indicated on the drawings), turf sods shall be cut (using a purpose built sod-cutting machine), rolled and stored ready for reinstatement. On completion of installation for that stage, trenches shall be compacted and the turf reinstated. Turf sods should be exhumed for shortest time practical, and hand watered if necessary, to maintain effective moisture levels. The contractor shall reinstate the turf to match existing, including any compaction, topdressing and clean-up required.

Valve box locations are to be either sod cut and replaced or laid with fresh kikuyu sods. Watering of sods is the responsibility of the contractor to maintain health until sprinkler system functional.

Care must be taken to minimise mechanical (vehicular) damage to existing turf.

10.12.3 Bitumen and concrete surfaces

Bitumen and concrete surfaces shall be neatly cut and excavated to allow the installation of pipes and cables. Excavations shall be backfilled and compacted to match adjacent profile. The Contractor shall be responsible for reinstatement of any bitumen or concrete to match adjacent surfaces.

10.12.4 Paved walkways

Unless specified otherwise all trenches crossing through paved walkways, shall have the minimum amount of pavers removed to provide the necessary clearance for the installation of pipework and cables. The Contractor shall reinstate the pavers to the original condition on a compacted sand/gravel base.

10.12.5 Kerb Replacement

Where existing kerbs are damaged as a result of works, they shall be replaced to match existing.

10.12.6 Trench topping and maintenance

Subsidence of trenches after completion of the works shall be the responsibility of the Contractor. The Contractor shall ensure trenches are kept "topped up" and re-compacted for the duration of the defects liability period.

11 LAYING AND JOINTING OF PRESSURE PIPES

11.1 General

Pipes shall be laid complete with all valves and fittings required for completion of the functions described on the drawings and specification. The methods used for laying and jointing pipes and fittings shall be to the satisfaction of the Superintendent.

Manufacturer's markings and labels indicating pipe class and standard shall face upward after installation to allow inspection and verification.

11.2 Witness marks and pipe markings

Where the use of witness marks are recommended by pipe manufacturers, they shall be marked on the pipe spigot and shall remain visible after making the joint.

11.3 Making joints and tolerances

Pipes shall be laid by inserting spigots into sockets. Manual jointing only will be permitted, and excavation plant shall not be used to push pipes into socket. Tolerances and deflections shall not exceed those defined by manufacturers and the appropriate Australian Standard. PVC and poly pipe shall be cut square with a fine tooth saw or tube cutter, and burrs shall be removed prior to making joints.

11.4 Prevent dirt from entering pipes

The Contractor shall ensure before laying pipes or fittings that they are free from dirt or foreign matter. All pipe ends left open overnight shall be taped or bagged off.

11.5 Flushing

All pipes shall be purged at the maximum velocity that is possible, using whatever valving, pump or mains pressure is available. Flush repeatedly using start-up surges to move debris downstream. If the debris is a result of the Contractors installation, and purging using existing equipment is unsuccessful, the Contractor shall provide any other equipment necessary to purge pipes to the satisfaction of the Superintendent.

11.5.1 Flush upstream pipe work before connecting outlets

Before connecting sprinklers, flush lateral pipework through risers. The extent to which pipework must be free of foreign matter is related to the size of outlets and orifices.

12 EQUIPMENT BRAND NAMES AND APPROVALS

12.1 Use of trade names

Where trade and brand names, catalogue or reference numbers are referred to, they shall indicate the product required. Alternatives may not be used without the written approval of the Superintendent.

12.2 Contractor to notify of reservations

The Contractor shall notify the Superintendent in writing, prior to installation, if they have any reservations whatsoever as to the suitability of specified product, or their ability to properly warrant the product.

12.3 Certification for use

Where water, power or other authorities require that equipment be approved for connection to their utilities, the Contractor shall verify that certification/approval is current for the brand, model, style and class of equipment proposed for use. Evidence of approval shall be provided to the Superintendent on request.

12.4 Reclaimed Water – Product Identification

Where it is intended for a project to use non-potable water, products including sprinklers, valves, valve boxes, pipes, tubes, etc. shall include lilac coloured warnings in accordance with local water supply authority requirements.

13 PIPES AND FITTINGS

13.1 PVC pipes and fittings

All PVC pipes and fittings shall conform to AS1477 and shall be installed according to AS2032. Solvent weld joints shall be made using cement to AS3879.

All mainline pipes shall be Class 12 minimum unless otherwise indicated on the drawings. PVC pipes less than 80mm nominal diameter shall use solvent welded joints. All fittings shall be PVC to class 18 and solvent weld jointed.

All pipes of 80mm or greater shall use rubber ring joints unless otherwise specified.

Lateral pipes (down-stream of a zone control valve) may be class-9 PVC - SWJ, regardless of diameter.

All mainline trenches to have MARKER DETECTION TAPE (with trace wire) installed 250mm below surface level.

13.2 Polyethylene pipes and fittings

All polyethylene pipes shall conform to AS/NZS 4130:2009.

All polyethylene pipes with nominal diameter greater than 50mm (DN50) shall be minimum PE100 PN12.5 and use electro-fusion welded joints in accordance with manufacturer's specifications.

All polyethylene pipes with nominal diameter 50mm (DN50) or less shall be minimum PE100 PN12.5 and use either Electro-fusion welded or compression joints in accordance with manufacturer's specifications. All polyethylene pressure pipes shall conform to AS/NZS 4130 Polyethylene (PE) pipes for pressure applications and installed to AS2033.

13.3 Depth of cover to top of pipes:

450mm depth for mainline pipework

450mm depth for lateral pipework

Unless noted otherwise on the drawings.

13.4 Other pipes and fittings

Table 3: Other pipes and fittings

AS/NZS 2280:2004	Ductile Iron pressure pipes and fittings
AS 2129-(2000)	Flanges for Pipes, Valves and Fittings
AS 1572-(1998)	Copper and Copper Alloys - Seamless Tubes for Engineering Purposes
AS 1432-(2004)	Copper Tube for Plumbing, Gas Fitting and Drainage Applications
AS 1074-(1989)	Steel tubes and tubulars for ordinary service
AS 1628-(1999)	Water supply - Copper alloy gate, globe and non-return valves
AS 1830-(2007)	Iron Castings - Grey Cast Iron
AS/NZS 2566.2:2002	Buried flexible pipelines – Installation
AS/NZS 4765(Int):2007	Modified PVC (PVC-M) pipes for pressure applications
AS 2698.1:1986	Plastics pipes and fittings for irrigation and rural applications – Polyethylene micro-irrigation pipe
AS 2698.2:2000	Plastics pipes and fittings for irrigation and rural applications – Polyethylene rural pipe
AS 2698.3:1990	Plastics pipes and fittings for irrigation and rural applications – Mechanical joint fittings for use with polyethylene micro-irrigation pipes
AS/NZS 4129:2000	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2009	Polyethylene (PE) pipes for pressure applications
AS/NZS 4131:2003	Polyethylene (PE) compounds for pressure pipes and fittings
AS 4181-1999	Stainless steel clamps for waterworks purposes

14 VALVES

14.1 Isolating Valves

Valves with Nominal Diameter greater than 50 mm:

- Valves shall be to AS2638.2 (and approved by local authorities)
- Resilient seat sluice gate valve similar to AVK model 57/40
- For valves 80mm and above, use flanged connections with 316 stainless steel backing rings, nuts and bolts

Install the valve assembly within 250mm round valve box, supported away from the pipes with brick supports on a gravel base.

Install an inner 200mm diameter PVC sleeve to allow access to the valve hand-wheel device.

Provide one (1) "T-Bar" device per project, to the Principal to operate sluice valves.

Valves with Nominal Diameter 50mm or less:

- Valves shall be De-Zincification Resistant approved ball valve including stainless steel handle, sized to suit pipe diameter.

Install the valve assembly within a 1419 valve box, supported away from the pipes with brick supports on a gravel base or as indicated on the detail drawing.

For systems connected to recycled water, valve boxes shall include a lilac lid.

14.2 Solenoid Valves

Solenoid Valves shall be the brand and model indicated on the drawings.

Nominal size of each valve assembly shall be as indicated on the drawings.

14.2.1 Installation of solenoid valves

- Install the valve assembly within a 1419 x 300 deep bolt lockable valve box, supported away from the pipes. The valve shall be installed in the box to allow easy access for servicing and manual operation.
- Install upstream of the solenoid valve a dezincification resistant approved ball valves including stainless steel handles, sized to match solenoid valve diameter.
- Install the assembly according to the detail shown on the irrigation drawing.
- All valve chamber lids are to be installed to minimum 150mm below finished grade.

For systems connected to recycled water, valve boxes shall include a lilac lid.

14.2.2 1.1 Valve Boxes

All valve boxes shall be heavy duty commercial Carson (or similar approved) including an extended upper flange/lip on the lid and bolt lockable, supported away from the pipes, as indicated on the detail drawings. The valve(s) shall be installed in the valve box to allow easy access for servicing and manual operation.

For systems using reclaimed water, all valve boxes must include Lilac lids.

All valve boxes must be installed with the top of the lid at finished grade, unless indicated otherwise on the drawings.

15 ELECTRICAL

15.1 General

All electrical installations shall be in accordance with AS3000, excluding voltage drop requirements for extra low voltage systems (<32v).

All installations shall be in accordance with requirements of the local power authority.

All new installations of low or medium voltage (240v/415v) shall be installed by an electrician who is experienced and licensed for such work.

15.2 Grounding and lightning protection

Where earths are required by inspectors or manufacturer's recommendations, copper earthing devices shall be installed so that resistance is less than 8 Ohms to ground. If the manufacturer of the irrigation controller has lightning protection equipment as an optional extra, the Contractor shall supply and install all equipment recommended by the manufacturer to achieve stable and reliable operation.

Grounding resistance shall be tested by a licensed electrician with a signed validation certificate provided at the practical completion inspection and included in as-constructed documentation.

15.3 Solenoid wiring

All wire joints shall be made with 3M-DBR/Y connectors. Allow a minimum of one (1) metre slack of wire at each solenoid valve to facilitate the removal of the coil when maintenance work is carried out.

Minimum wire size for low voltage cables shall be 1.5mm^2. All cable shall be polyethylene insulated and multi-stranded. Common cable (black) shall be 2.5mm^2 single-core, unless noted otherwise on the drawings. Station cables shall be minimum 1.5mm^2 multi-strand cable (unless specified otherwise) with colour coding which must not change between the controller and the solenoid valve. Provide expansion loops at intersections, bends and pipe crossovers.

Cable runs shall be continuous between the controller and its destination valve, intermediate cable joins are unacceptable.

All common cables shall be black. All station cables shall be colour coded in any colours excluding the common colour. Colour must be continuous between the controller and each valve. Supply and install cable size and quantity to each valve as shown on the drawings.

15.4 Spare Cables

All spare cables shall be installed in continuous lengths from the controller to the location noted on the drawings and shall be terminated and sealed using resin lined heat-shrink caps.

All spare cables shall include permanent labels at the both ends indicating the field termination location (e.g. "Spare Cables to Valve Box 12").

16 CONTROL SYSTEM AND PUMP

16.1 Irrigation Controller and Pump Starter Panel

The irrigation controller shall be Rain Bird ESP12LXMEF with a Rain Bird WR2 rain sensor to be installed in a suitable location.

The Pump Starter Panel should be DOL or Star Delta but will be suitable to run a 7.5 kW 415 V submersible Grundfos SP providing a flow of 420 L/min and pressure 700kpa and level transducer, to be placed inside the tank. The starter panel will also control the sump pump 4 kW 415V with a float switch. The level transducer will maintain a suitable storage area for drainage water for when available. A solenoid valve 24V AC on the mains water inflow to the water tank, will be controlled by the starter panel and level transducer. Irrigation controller will start the irrigation pump via the 24V output. The pump shall be a Grundfos SP30-7, 7.5kW 415V mounted horizontally in a shroud at the bottom of the tank with a Swirl Plate to stop cavitation.

The concrete below ground tank will be 150,000L, for tank configurations refer to the detailed drawings.

16.2 Controller and Starter Panel Housing

The contractor is to supply and install the irrigation controller inside the amenities block along with the pump starter panel. This will be in proximity to the electrical box.

The contractor shall allow for the supply and installation of wall/pole mounts as necessary. The pump starter panel should have a double door with indicator lights visible on the outer door in weather proof enclosures.

Solenoid valve field cables shall include a 300mm diameter service loop and be connected to a heavy-duty terminal strip, mounted behind the enclosures internal mounting board. Each cable coming into the terminal strip shall be clearly and permanently marked with its station number or sensor, using commercially available permanent cable marking systems.

Cable from the terminal strip to the station output strip inside the controller shall be coloured the same as cables coming in from the field.

Additional 1.5mm^2 cables shall connect the terminal strip to the controller terminals.

Controllers must be grounded to manufacturer requirements. The enclosure shall include a double GPO.

Electrical supply to the enclosure shall be by others (unless indicated otherwise).

17 PRACTICAL COMPLETION

17.1 Practical Completion

Practical completion includes commissioning, testing and site clean-up. Following a successful inspection and compliance with the specification, a Certificate of Practical Completion shall be issued by the Principal.

17.2 Preparation for Practical Completion inspection

Prior to calling for the inspection, the Contractor shall:

- complete several automatic cycles without fault
- test all components to ensure proper function
- submit the documentation required by contractual specifications
- completely clean-up the site
- reinstate all surfaces affected during construction
- remove machinery and all surplus equipment/materials
- be satisfied that the system is ready for final inspection

If the system fails Practical Completion inspection more than once, the Principal may deduct inspection costs from the final payment.

The Practical Completion inspection by the Superintendent shall include checks for compliance with the specification and in particular:

- nozzle size and arc setting
- sprinkler positioning
- vertical alignment
- height relative to finished grade
- pop-up and retract function
- valve pressure settings
- valve diameters
- cable installation and labels
- valve box type and installation method
- controller and sensor installation

17.3 Mainline pressure test

The Contractor shall run a successful pressure test in the presence of the Superintendent. The pressure test shall be deemed successful if after applying a pressure of 1,000 kPa to all mainline pipework, the pressure has not dropped over fifteen minutes, or leakage has not exceeded 0.2 litres per hour per hectare (L/h/ha). Pressure tests must not be performed earlier than 48 hours after pouring thrust blocks. Pressure testing may be done for separate sections of pipe-work.

17.4 As constructed drawings

The Contractor will be required to engage HydroPlan services for the provision of GPS surveys of as-constructed systems and preparation of “as constructed” drawings. The contractor shall coordinate with HydroPlan to conduct site visits and surveys at critical installation times (main pipe and valve installation, and system completion). The contractor shall allow for related HydroPlan fees in the tender submission. The contractor shall also provide HydroPlan with a marked-up site drawing of each system indicating any changes to the original design.

17.5 Manuals and documentation

The Contractor shall provide, to HydroPlan, hard or soft copies (CD or USB device) of the service/operating manuals and spare parts lists of the primary equipment prior to or at the

Practical Completion inspection. It shall include details of all certificates, approvals and guarantees relating to materials or services included in the works.

HydroPlan will collate the documents and prepare final documentation and submit to the client for their records.

All manuals and documentation must be submitted to HydroPlan at least two weeks prior to the Practical Completion inspection.

18 FINAL INSPECTION

A final inspection shall be carried out at the end of the nominated Defects Liability Period and shall include the Contractor, the Superintendent and the Principal or nominated representative(s). Following a successful inspection and compliance with the specification, a Certificate of Final Completion shall be issued by the Principal.

If the system fails final inspection test more than once, the Principal may deduct inspection costs from the final payment.

Final inspection by the Superintendent shall include checks for compliance with the specification and in particular:

- general system operation
- controller scheduling
- nozzle size and arc setting
- vertical alignment
- height relative to finished grade
- pop-up and retract function
- valve pressure settings
- valve box installation method

19 SCHEDULE OF RATES

The following list of rates will be used for calculating variations. This form must be completed and returned with the tender. All rates shall be GST exclusive.

Table 4: Schedule of Rates

ITEM	DESCRIPTION	RATE/ITEM
MAINLINE and LATERAL PIPE (rate to supply & install)		
A1	DN90 PN10 PE100 lilac Mainline Pipe (incl. fittings)	/m
A2	90mm PN8 PE100 lilac Lateral Pipe (incl. fittings)	/m
A3	63mm PN8 PE100 lilac Lateral Pipe (incl. fittings)	/m
A4	50mm PN8 PE100 lilac Lateral Pipe (incl. fittings)	/m
VALVES (rate to supply & install, including valve chamber)		
B1	50mm Solenoid Valve assembly (Rainbird 200-PESBR-PRS-D) with Filter Sentry and Reclaimed Water ID handle)	/ea.
24VAC CONTROL WIRING (rate to supply only)		
C1	Single Core 2.5mm^2 multi-strand cable HDPE insulation	/m
C2	5 Core 1.5mm^2 multi-strand cable HDPE insulation	/m
C3	7 Core 1.5mm^2 multi-strand cable HDPE insulation	/m
C4	9 Core 1.5mm^2 multi-strand cable HDPE insulation	/m
CONTROL SYSTEM (rate to supply only)		
D1	Rain Bird 12-Station Controller, including Flow Smart Module (Model: ESP-12LXMEF).	/ea.
D2	Rain Bird 12-Station Controller Module (Model: ESPLXMSM12)	/ea.
D3	Rain Bird FS-200P Flow Sensor	/ea.
MISCELLANEOUS ITEMS		
F1	Foreman	/hr
F2	Labourer	/hr
F3	Trenching - Chain dig	/Lin. M
F4	Trenching - Backhoe	/Lin. M
F5	Excavation in Rock as defined in Item 8 (includes Refilling and Disposal)	/Lin. M
F6	HydroPlan fee for GPS surveys and preparation of as-constructed drawings. This must be included in the tender price.	$1,200.00 plus GST.