

Standard Irrigation Specifications

January 2024 Version 1.0

This Irrigation Specification will be subject to a review in June 2027.
The City reserves the right to review and update prior to this date

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Introduction

The City of Wanneroo is committed to the sustainable use of water resources and maximising the efficiency of its landscape irrigation systems. The purpose of this Standard Irrigation Specification is to outline the requirements and expectations of The City of Wanneroo (City) in relation to the design, installation, and maintenance of irrigation infrastructure assets within the City. It will also provide a concise point of reference in the assessment of submissions for approval, for the development of public open spaces and streetscapes.

All work carried out will be as detailed and in accordance with this Standard Irrigation Specification and associated drawings, the whole of which shall be deemed to constitute one document. Any application to deviate from the documented specification and drawings must be submitted to the City in writing for approval by the Parks and Conservation Management business unit.

Should any disputes arise because of discrepancies between individual project drawings and this Standard Irrigation specification, this Standard Irrigation Specification document will be given precedence.

Where this Specification references the City, City of Wanneroo or City representative providing a permission or approval, any such permission or approval will be provided by the City's Parks Technical team through consultation with appropriate City business units.

City of Wanneroo standard drawings referenced in this specification are available from the City of Wanneroo website or will be supplied on request.

Australian Standards

Any reference to Australian Standards within this document implies the use of the current documentation. The current standard issue at the time of irrigation system design is to be the document used in determining requirements.

Design Criteria

1.1 Design of new systems

- 1.1.1. Design of irrigation systems commissioned by the City shall not commence prior to consultation with the nominated City representative and must be based on local conditions observed during a pre-arranged site visit.
- 1.1.2. All systems shall be designed with hydro-zones that require different water requirements and/or sprinklers with different operating pressures and/or sprinklers with distinctly different application rates as far as is practical and to the approval of the City.
- 1.1.3. Sprinklers shall be grouped in accordance with their calculated precipitation rate. Only areas with a matched precipitation rate serving similar plant groups shall be grouped to operate together on a valve section.
- 1.1.4. Only valves with a similar precipitation rate and serving similar plant groups in a similar microclimate shall be grouped to operate together as a station on the irrigation controller.
- 1.1.5. Bore licence information, including construction and abstraction licencing, proposed construction details, and production pump preliminary selection including make, model, motor size, anticipated installation depth and anticipated duty requirements are to be included with the irrigation system design.
- 1.1.6. All irrigation systems being designed for the City must ensure they will not irrigate privately owned properties and that overspray is kept to a minimum as far as is practical.

1.2 Water Source

- 1.2.1 Prior to the design and construction of an irrigation system, a suitable water source must be identified. Ground water from a ground water bore shall be the preferred source of water for irrigation. Alternative water sources will require written approval from the City and may only be granted under extenuating circumstances.
- 1.2.2 It is a requirement that all reserves, parks, streetscapes, and general irrigated areas within the City have an individual ground water supply. If a groundwater bore is immediately unavailable permission may be granted to connect to another reserve or water source near the project area as a temporary measure only. Such permission must be obtained in writing from the City prior to the commencement of installation.
- 1.2.3 The use of groundwater retention basins will not be permitted for irrigation purposes.
- 1.2.4 Groundwater bores shall require a flat and level accessible hardstand. The size and location shall provide for sufficient maintenance access by heavy vehicle and will require approval from the City.

1.3 Hydro zoning

1.3.1 The City of Wanneroo is committed to the sustainable use of its water resources. As a result, to maximise efficiency, hydro-zoning of the City's public open spaces must provide the ability to apply water in accordance with the needs of differing zones water requirements.

Sprinklers servicing the following categories of hydro-zones should be valved separately and stationed according to their respective hydro-zones. Hydro-zoned areas are as follows:

- Active turf areas
- High Profile turf areas
- Passive turf areas
- Exotic garden areas
- Native Garden areas and
- Tree watering systems considering the differing watering requirements of individual species.

1.3.2 Plans submitted for council approval must show the separate watering zones and if required, clarification of watering zones can be determined at this time.

1.3.3 Trees bubblers and garden beds shall be watered on their own individual stations. Active and passive turf areas are to be determined prior to system design.

1.3.4 The design of the system shall be as such to permit the future disconnection of hydro-zoned areas if and where required (e.g., road verges/garden beds) without affecting the balance of the system.

1.4 Mainline

1.4.1 All mainline piping shall be MDPE PE100 PN12.5 pipe and shall be joined by electrofusion welding. Preferred mainline pipe will be MDPE Blue stripe on internal sections of parks and where the mainline continues along streetscapes etc. either MDPE Lilac/Purple stripe or MDPE plain black.

1.4.2 Mainlines shall not be located through treed areas, under any fixtures such as footpaths, play equipment etc. or in any drainage swale or mound. It is preferred that mainlines are located along the edge of turfed areas to facilitate the station valves and valve box locations to be along the edge of all turf areas.

1.4.3 Mainline and valves will not be installed on a slope with a fall greater than 1:6.

1.4.4 Mainline flushing valves shall be installed into the mainline at the lowest point of the mainline or at the termination of mainline runs if topography is flat. If a ring main is being utilised, then the flushing valve must be located close to an isolation valve junction to allow for adequate flushing.

1.4.5 It is preferred that mainline and control valves are not to be installed in medians, road reserves or verges. Where there is a requirement for mainline or control valves to be installed within medians, road reserves or verges written permission must be granted by the City.

1.4.6 Permanent mainline will not be installed to a distance greater than 50m from the boundary of the water source property. The City must approve the route and alignment of the mainline before excavation commences.

1.4.7 Pressurised mainline will not be accepted.

1.5 Mainline installation method

1.5.1 MDPE Poly mainline 90mm and larger and all PVC pipes shall be installed by conventional open trenching techniques. For situations where systems are being upgraded or replaced all MDPE Poly lateral lines shall be installed using the poly plough method for Active sporting field installations and any other open turf areas that suit this method of installation.

1.6 Sprinklers

1.6.1 The City specifies the use of only Hunter and Toro sprinklers as outlined in Table 1 below

Brand Name	Type	Series
Hunter	Pop-up gear drive	'I' series Stainless Steel
Toro	Pop-up fixed head	'570z' series (Non XF models)
	Pop-up tree bubbler	'570z' series (Non XF models)

1.6.2 Toro Sprinklers

Toro 570z series sprinklers installed in turf areas must be a minimum of 4P model and be installed on articulated risers of sufficient length to maintain the specified pipe cover when installed at 45 degrees to the horizontal. Risers to be same diameter as the inlet thread on the sprinkler.

Toro 570z sprinklers installed in garden bed areas must be 12P model and be installed on articulated risers of sufficient length to maintain the specified pipe cover when installed at 45 degrees to the horizontal. Risers to be same diameter as the inlet thread on the sprinkler.

Side inlet sprinklers are not permitted.

1.6.3 Hunter I series gear drive sprinklers must be a minimum 06 model and shall be installed on articulated risers of sufficient length to maintain the specified pipe cover when installed at 45 degrees to the horizontal. Risers to be same diameter as the inlet thread on the sprinkler.

1.6.4 The use of low or high-volume nozzles, or alternative brand gear drive sprinklers shall require written approval from the City.

1.6.5 Alternative sprinklers may be considered for approval by the City should circumstances warrant their use.

1.6.6 Sprinkler Spacing

The system designer shall consider the effects of localised prevailing wind conditions regarding optimal location and spacing of sprinklers. The spacing of sprinklers designed in any pattern shall be 20% less than their rated radius at the designed operating pressure.

1.6.7 Sprinklers installed in Road Verges shall be low angle, radius adjustable, commercial gear drive sprinklers with a maximum radius of 14m.

1.6.8 Gear driven sprinklers installed on road verges shall be offset 300mm from the back of the concrete kerb.

1.6.9 Gear driven sprinklers installed adjacent to hardscapes shall be offset 100mm-150mm from the hardscape edge including any mowing kerb.

1.6.2.1. Pop-up spray sprinklers installed in road verge garden beds or median strips shall be offset a minimum of 100mm from the back of the concrete kerb.

1.6.2.2. Sports Field Sprinkler Layout

The designer shall analyse the proposed works area to determine suitable sprinkler spacing's with reference to clause 1.6.6. Where possible, the sprinklers shall be uniformly spread across the proposed area. Lateral lines shall be designed so that stations run in straight lines parallel to the line of play of the sports field. Each and all stations must be designed as to only incorporate either full or part circle sprinklers, with a combination of both full and part circles only allowable with written permission from the City.

Care shall be taken to avoid sprinklers in the following areas:

- Exact centre of field and
- Goal squares / goal mouths.

The sprinkler, nozzle, operating pressure selected shall achieve the following minimum criteria:

- Scheduling Co-Efficient: ≤ 1.2 and
- Distribution Uniformity: $\geq 85\%$

The statistical analyses used to confirm the above minimum requirements shall be carried out using the Centre for Irrigation Technology (CIT), SPACE for Windows software or appropriate software approved by City. The uniformity software shall be configured for analysis in the 5% Critical Window and the Uniformity Criteria (Du, Cu & Sc) shall be calculated.

1.6.10 Sprinklers installed in median strips shall be installed to minimize overthrow onto roads due to strong winds. Sprinklers shall have a 3m maximum radius and shall be radius reducible by at least 25%. Drip irrigation is not permitted.

1.6.11 Any sprinkler located against a road shall be supplied by a single spur lateral running perpendicular to the road. Distribution lateral pipes running parallel to the road are to be a minimum of 600mm from the kerb.

1.6.12 A distance of 200mm from all road curbs (Furthest side from the road that has contact with soil/turf) to the closest edge of any Rotor type sprinklers is to be maintained.

1.6.13 Matched Precipitation Rate

All sprinklers installed on each station shall be matched precipitation to ensure an even amount of precipitation is applied across the entire station area. Only sprinklers with a matched precipitation rate shall be grouped to operate together on a valve section. Similarly, only stations with identical precipitation rates may be grouped to operate as a simultaneous station group (SSG) at the irrigation controller.

1.6.14 Arc Selection

In all cases of diverse planting (turf, garden, temporary), the arc selection shall minimise over-spray onto paving and adjacent areas by utilising part circle spray head patterns to the perimeter of all such areas.

1.6.15 Nozzle Selection

Standard issue nozzles shall be the preferred option in all irrigation design. The only standard departure from this specification is low angle nozzles shall be utilised along road verges and the perimeter boundaries of the project property which abut any residential properties. Any other non-standard or special-order nozzles may only be considered in consultation with the City during the design stage.

1.6.16 Any instance of non-standard or special-order nozzles being selected must be highlighted on the design drawings to assist with design review and approval by the City. Written approval must be obtained confirming the use of these nozzles in the irrigation design.

1.7 System pressure

1.7.1 Pressure Loss

The pressure loss through any solenoid valve is not to exceed 35 kilopascals. The design must maintain pressure losses in laterals within valve sections to less than 10% between best- and worst-case sprinklers and of the nominal sprinkler operating pressure of that valve or station.

1.7.2 Operating pressure

The Certified Irrigation Designer shall select valves and any system components required to be attached to the distribution mainlines to be able to operate satisfactorily within a maximum mainline pressure in accordance with the rated working pressure of the irrigation mainline.

The maximum operating pressure is not to exceed 800Kpa.

1.8 Water velocity

1.8.1 The Certified Irrigation Designer shall accomplish the hydraulic design of the irrigation system to conform to the following:

Maintain water velocities in all mainline pipe work to below 1.5 metres per second and
Maintain water velocities in all lateral pipe work to below 2 metres per second.

1.9 Programmed watering times

1.9.1 Watering times are to be from 10.00pm to 6.00am.

1.10 Watering requirements

1.10.1 Unless specified otherwise, design watering requirements shall be based on a peak application of 50mm per week evenly distributed over all surfaces within 40 hours (7 days per week). If the available water supply does not make this possible, the total weekly watering time shall be the minimum possible with the available supply.

1.10.2 Systems designed with a watering time exceeding 40 hours per week must have written City approval before installation commences.

1.11 Overspray

1.11.1 Overspray will be kept to an absolute minimum on adjoining zones, properties, roads, hardstand, or buildings.

1.12 Pressure control

1.12.1 Where pressure regulation is required on a complete station of sprinklers, this shall be by means of a pressure reducing solenoid valve. Where pressure regulation is required on a portion only of a station, a separate pressure-reducing valve shall be used.

1.13 Iron filtration units

1.13.1 Where water analysis confirms that an unacceptable concentration of iron is present, as determined by the City, an iron filtration system shall be installed as part of the irrigation system. A water sample analysis report is to be provided with the irrigation detailed design submission. Water samples shall be taken from the location on site of the proposed bore. Water sample analysis need to be showing >1mg/L Iron to warrant consideration.

1.13.2 The City of Wanneroo's preferred iron filtration manufacturer is Elliott's Irrigation (Filtration). Any alternate filtration system will be considered for use but must be approved by the City. All iron filters require compliance with Environmental Noise Regulations which can be verified by a consultant.

1.13.3 The iron filter system is to include the iron filtration unit, booster pump and associated electrical components, concrete pad and all backwash components. A post-filter pressure meter is to be installed in the control cubicle.

1.13.4 Installation of the filtration unit shall not be less than 40m from a cadastral boundary of adjacent properties. Where a 40m separation is not achievable written permission must be sought from the City of Wanneroo. If permission is granted to install an iron filter within the 40m separation from a cadastral boundary, the use of sound abatement may be required to ensure sound levels meet the requirements of Local Laws.

1.13.5 The system is to be housed in an appropriately sized lockable compound, which complements the site landscape.

1.13.6 The compound shall be of galvanised steel construction with a suitable slatted screen material and mesh roof. Garden sheds, or similar type structures and brushwood fencing will not be accepted.

1.13.7 The technical specification and design of any proposed iron filtration system and compound is to be approved by the City as part of the detailed design approval process.

1.13.8 The filtration system is to be maintained as per manufacturer recommendations during the maintenance consolidation period and, where appropriate, training provided to the City's representative at time of handover.

1.13.9 The filter controller shall be electronic and allow backwash operation to be programmed to a set schedule, which is not to interfere with irrigation program schedules.

1.13.10 All backwash is to be contained within a suitable capacity soak well system. Discharge to landscaped or natural areas will not be accepted. Backwash pits are to have accessible lids and positioned to not impede maintenance access for future periodic cleaning.

1.13.11 All as-constructed drawings, manuals, procedures and warranties are to be electronically submitted to the City as part of handover application.

1.14 Dosing pumps

1.14.1 The City has a requirement that all active sporting fields are to be serviced by a dedicated dosing pump. The size of the sporting field will determine whether a single bund or dual bund dosing unit is to be installed.

1.14.2 Where dosing pumps are required, they are to be of a Grundfos manufacture, model DSB-1-100-B1-1-L02-P01-02-DDA 7.5-16FCM, or approved equivalent. Installation of the dosing pump and all required equipment shall not be more than 10m from the bore headworks and control cabinet.

1.14.3 The dosing injection point shall be immediately downstream of the bore headworks, housed in a lockable jumbo valve box. Where installation is not achievable within a 10m radius written permission must be sought from the City.

1.14.4 The dosing pump shall be housed in a dedicated aluminium cabinet. Single bund, single pump dosing unit cabinet dimensions - 800D x 800W x 1600H with two 10amp GPO's one for the dosing pump and one for a dual thermostat fan. Dual bund, single pump dosing unit cabinet dimensions 800D x 950W x 1600H with two

10amp GPO's one for the dosing pump and one for a dual thermostat fan. The dosing pump shall be mounted on an internal shelf above the reservoir drums and be wired to the irrigation controller located in the irrigation cabinet. The dosing pump must be supplied with 2 x foot valves to accommodate dosing from 2 separate reservoirs if installed or single foot valve for single bund option. See City of Wanneroo Standard drawing TS40-26-0 and TS40-27-0 for details.

1.14.5 The dual bund dosing pump shall have two (2) reservoir drums 790mm x 595mm x 395mm with a 50mm threaded and capped fill point installed side by side. The reservoir drums must be installed with the fill point facing out and easily accessible. The single bund unit utilises the same type of reservoir drum only singular.

1.14.6 Each reservoir drum must have a 10mm suction hose installed and be connected to a three-way valve feeding product to the dosing pump via a single suction hose. All products and methods to be used in the installation of the dosing pump assembly are to be submitted to the City for approval.

1.15 Design drawings

1.15.1 Certified Irrigation Design 'Landscape Turf/Commercial' (CID) drawings (shop drawings) are required to be submitted to the City for approval prior to the commencement of any manufacture or installation.

Shop drawings submitted for approval are to be:

- electronic irrigation drawing submissions are to contain A1 PDF's only and all information is to be legible if printed at A3 in Black and White
- provided with a legend of symbols in large font where applicable
- provided in electronic PDF and CAD drawing format; and
- provided with peripheral items and any shadings on the CAD drawing turned off e.g., general landscaping items. Only essential out lines of garden beds, paths, roads and playgrounds etc. shall be shown in conjunction with the irrigation plans. Separate tabs must be included showing the irrigation for each hydro-zone. For example, mainline route, tree lines, garden bed or turf areas.

1.15.2 Only CID shop drawings are acceptable, and all submitted drawings must show current Australian CID approved stamp.

1.15.3 CID shop drawings shall all be on the same size drawing sheet ("A" size) and shall be to a maximum scale of:

- 1:2000 for site, mainline, and sleeve plans
- 1:500 for rotor irrigation layouts
- 1:200 for spray irrigation layouts

1.15.4 CID Shop drawings shall show the location of and cover the following parts of the work:

- Irrigation cabinet and Dosing cabinet location if installed
- Bore and headworks
- Irrigation pump
- Filters

- Mainline pipe including material and size with sections showing the flow valves for each section, as entered in the flow manager data base
- All valves and Irrigation control valves, with valve number, flow (L/sec) and precipitation rate (mm/hour) for each valve and valve decoder number
- Lateral pipe including material and size
- Sprinkler locations including make, model, nozzle size, output and radius at expected pressure
- Electrical components including conduit and wire paths, surge protection and cable pits
- All surge/lightning protection devices installed
- All road and/or path crossings
- A legend showing details of all components of the installed irrigation system
- A valve table showing details for each valve or other decoder activated component and including decoder address for each decoder
- A table showing each sensor decoder and condition monitored and any simultaneous station groupings
- The full extent of any existing infrastructure located externally to the project area proposed to be utilised
- Any existing services to be anticipated
- Circuit diagram of sprinkler sequence
- Hydro-zoned areas
- Schedule of valve locations and flow rates
- Full schedule of precipitation rates for each valve
- Supply current watering program if connecting to an existing system
- The Distribution Uniformity (DU) with a minimum of 75%

NOTE: CID shop drawings are reviewed for general principles of design only and a review of shop drawings by the City of Wanneroo in no way relieves the Contractor of his responsibility to comply with the requirements of the Specification, associated drawings and relevant Australian Standards.

1.16 Design approval

1.16.1 All designs must be submitted to the City for assessment and approval. Installation **MUST NOT** commence until the City provides approval.

2 GROUNDWATER BORES

2.1 Licence to construct and extract

2.1.1 The Contractor shall:

- Allow for making all applications for the construction of a new Groundwater bore with the Department of Water
- Abide by the standard terms, limitations and conditions noted on the Well (Bore) Construction Licence once issued
- Complete and return all additional forms required by the Department of Water on completion of construction of the new bore.

New bore locations must be approved and verified with the City of Wanneroo.

2.1.2 The City of Wanneroo expects that all bores within its boundaries shall be metered and hold their own extraction license. There shall be no more than a single bore constructed per reserve; park or irrigated area and/or sharing of extraction licenses over multiple bores will not be permitted unless written permission is granted from the City of Wanneroo.

2.2 Drillers licence

2.2.1 The driller shall hold an appropriate, valid Driller's Licence as issued by the Australian Drilling Industry Association Ltd applicable to the type of bore, aquifer to be accessed and construction methods expected during construction of the new bore. Drillers Licence class and number shall be submitted to the City of Wanneroo prior to the commencement of bore construction.

2.3 MCRWBA

2.3.1 The works shall be undertaken in accordance with the Minimum Construction Requirements for Water Bores in Australia (MCRWBA), standard drilling industry practice, Department of Water and Environmental Regulation requirements and applicable Government Environmental guidelines.

2.4 Drilling method

2.4.1 Bores shall be constructed using either cable tool or mud rotary drilling as required. The driller shall collect drill cuttings at 1.0 metre intervals, or upon changes in the formation. Samples should be used to develop a documented profile of the soil strata levels.

NOTE: If any samples of strata or water give rise for concern during the drilling process, the Contractor must contact the City before installing any equipment in the bore.

2.5 Verticality and alignment

2.5.1 The bore shall be drilled and cased straight and vertical and all casings shall be set round, plumb and true to line. The maximum out of vertical tolerance allowable shall be 100mm per 30 metres of depth.

2.5.2 The Contractor shall supply all equipment necessary to test the cased bore for verticality and alignment, and shall, on request, carry out such tests to the satisfaction of the City of Wanneroo's representative.

2.5.3 Should the Contractor fail to correct a faulty alignment; the City of Wanneroo may refuse to accept the bore. Any delays encountered in any such correction shall be at the Contractor's expense.

2.6 Gravel packing

2.6.1 The annulus surrounding the casing and screen shall be packed with 50mm of suitably sized washed and graded sand from the static water level to the base of the bore hole. The annulus surrounding the casing shall be backfilled with drill cuttings from the surface to the static water level.

2.7 Casing

2.7.1 Bores shall be constructed using a minimum standard of 200mm Class 12 PVC pipe manufactured to AS1477 and utilizing the solvent weld method of jointing (SWJ).

2.7.2 Where production rates under 2.5L/s are required, or requested, a smaller 150mm Class 12 PVC casing size may be considered for approval.

2.7.3 Where an artesian bore is being constructed to a depth of 120 metres or deeper casing should be constructed of Permaglass.

2.7.4 Steel casing shall not be used.

2.8 Screen

2.8.1 The bore screen assembly shall consist of a 12-meter IN-LINE type Grade 304 stainless steel wedge wire screen with a diameter to suit the bore casing and an aperture of 0.5mm or finer if required by silt testing.

NOTE: Slotted PVC screens are not acceptable under any circumstances.

2.9 Development

2.9.1 On completion of construction, the bore shall be developed to a maximum yield of water, clean and free of suspended materials.

2.9.2 Development of the bore shall be carried out by high pressure water jetting, air surging and backwashing. Airlift pumping, chemical treatment using mud dispersants and breakdown agents, or such other standards techniques as may be directed by the City of Wanneroo.

2.9.3 Appropriate pipe fixtures and flexible discharge lines shall be required to direct airlift discharge away from the rig and personnel as well as to avoid nuisance at the bore site.

2.9.4 The discharge point is to be established in consultation with the City of Wanneroo prior to commencing development. Any residue or staining shall be removed by the Contractor to the City of Wanneroo's satisfaction and shall be completed at the Contractors cost.

2.10 Bore water level measurement

2.10.1 Water Level Probe Tube

A continuous probe conduit of 25mm PVC shall be installed, terminating level with the top of the pump(s) to enable water level measurement using an electrical probe.

The bottom of the conduit shall be capped, and water inlet holes drilled along the bottom 1.0 metre of pipe. Bottom of the probe conduit shall be set at the top of the submersible pump.

Access to the probe conduit shall be through one of the junction boxes located on the discharge plate, and in a separate junction box to the motor lead / drop cable connection. The probe conduit shall be installed in such a way as to ensure that the two-wire probe can be moved freely within the conduit for adjustment.

2.11 Concrete plinth

2.11.1 The Contractor shall allow for all necessary form work, concrete, and site labour to construct concrete plinth of sufficient size to allow for installation of all down hole and discharge components.

2.11.2 Concrete plinths shall be of at least 20 MPa at 28-day strength, free of surface defects or honeycombing. Minimum 40mm steel cable conduit cast into plinth. High voltage (pump) and low voltage (probes) are to be separated.

2.12 Bore discharge assembly

2.12.1 All bore discharge assemblies are to be approved by City of Wanneroo with recirculation capability available dependent on water test results.

2.12.2 Bore discharge assemblies must only be installed with a recirculation spool where water iron content exceeds 0.3 ppm and or Iron fixing bacteria, such as Gallionella spp., Leptothrix and Sphaerotilus Pseudomonas Enterobacter, have been detected in water samples taken from the production bore.

2.12.3 If a recirculation spool is required the conduit that transcends from within the two electrical junction boxes and running through the concrete plinth is to be made from 25m OD aluminium pipe with a wall thickness of not less than 6mm.

2.12.4 The Contractor shall supply and install the bore discharge head assembly and discharge pipework and fittings including all gaskets, nuts and bolts and valves.

2.12.5 Discharge pipework and fittings shall be flanged galvanised steel sized as detailed on the drawing, ending 450mm below ground level to connect to the irrigation system mainline. All flanges shall be a minimum of PN14 to current Australian standards.

2.13 Test pumping

2.13.1 Test Pumping shall occur upon completion of bore development and shall consist of a two (2) hour step test, followed by an 8-hour continuous water supply test using dedicated testing equipment. Test equipment must have capacity to pump at a rate equal to 150 % of irrigation design requirements.

2.13.2 Throughout the test a log containing the following data shall be maintained:

- Reserve Name & Location

- Bore Licence Number
- Drillers Name
- Date of Test
- Bore casing diameter material
- Diameter, mesh size, length and material of screen
- Depth of bore to top of screen
- Static Water Level prior to test
- Pumping rate of water supply test
- Drawdown from Static water Level at nominated continuous test rate
- Depth to pump inlet and
- Water Level and flow rate readings during constant rate test as follows:
 - (i) 0 to 15 minutes - every minute.
 - (ii) 15 to 60 minutes -every 5 minutes.
 - (iii) 60 to 120 minutes - every 15 minutes.
 - (iv) 120 to 600 minutes - every 30 minutes.
 - (v) 600 minutes - every 60 minutes.

2.13.3 Results of these tests shall be forwarded to the City upon practical completion of bore construction.

2.14 Water analysis

2.14.1 An air free water sample is to be taken at the completion of the water supply test for analysis (within 24 hours) by a recognised laboratory capable of performing relevant tests.

Analysis shall include a complete report on the quality and suitability of the water for irrigation purposes and include the following information:

- pH
- Conductivity (preferably compensated to 25°; report value measured; compensation factor and complete units (e.g., mS/cm, not mS)
- Total dissolved solids (calculated @ 180°C)
- Total hardness (as CaCO₃)

(Elements below to be expressed as mg/L)

Calcium Ca	Magnesium Mg
Sodium Na	Potassium K
Ammonia NH ₃	Phosphate PO ₄
Carbonate CO ₃	Bicarbonate HCO ₃
Chloride Cl	Sulphate SO ₄
Nitrate NO ₃	Nitrite NO ₂
Silica SiO ₂	Iron Fe ²⁺
Zinc Zn	

2.14.2 All reports shall be presented to the City of Wanneroo Representative immediately upon receipt.

NOTE: If any samples of strata or water give rise for concern during the drilling process, the Contractor must contact the City of Wanneroo Representative before installing any equipment in the bore

2.15 Construction verification

2.15.1 The Contractor shall allow on completion of bore development and test pumping operations to have the borehole inspected by C.C.T.V. to verify construction. The footage shall be unbroken and show the bores construction at 100mm intervals. The first frames of footage shall show a white board detailing the Date, Location, Contractor, and Bore Construction Details.

2.16 Casing termination

2.16.1 On completion of bore development and test pumping operations, the bore casing shall be cut to 400mm above finished ground level and fitted with a galvanised steel, drilled Table E flange and a blank galvanised steel top flange with rubber gasket, to prevent unauthorised access to the bore. The bore casing shall be fitted with a casing clamp 200mm to 300mm below the flange.

2.16.2 Upon completion of the bore construction the Contractor shall complete the DWER bore completion report (Form 2) and provide a copy of the completed form to the City of Wanneroo.

3 IRRIGATION PUMP

3.1 Whiteboard / photograph

3.1.1 The City have a requirement that every pump that is installed new or following servicing shall be photographed at the borehole prior to installation with a whiteboard showing the Date, Location, Contractor, along with the make, model, and serial number of both the pump and motor. With the photograph submitted to the City of Wanneroo for record keeping.

3.2 Pump efficiency

3.2.1 Pump shall be selected to operate at B.E.P (best efficiency point) or at a performance level within the envelope of 70% to 110% of the B.E.P.

3.3 Construction materials

3.3.1 The City's preferred irrigation pump shall be of Grundfos manufacture and shall be stainless steel in construction.

3.3.2 Alternative pump make, or construction shall be at the approval of the City of Wanneroo.

3.3.3 Pumps installed in bores must be fitted with an appropriately sized cooling shroud or flow induction tube where the pump is installed inside the bore screen.

3.3.4 Pumps installed in wet well must be fitted with an appropriately sized cooling shroud.

3.4 Submersible motor

3.4.1 The submersible motor shall be 415-volt 50 cycle, capable of operating continuously at a power suitable for the peak of the pump power characteristics.

3.4.2 The motor shall be fitted with non-corrosive end bells.

3.5 Motor lead / drop cable

3.5.1 Motor leads are to be Hydrofirm, Eucahydro or Aflex EPR/PUR cable, sized appropriately for the power requirements of the motor and terminating in the bore head metal junction box. The bore pump shall have a 2-metre surplus loop neatly strapped to the pump column.

3.6 Safety cable

3.6.1 The Contractor shall install two (2) appropriately sized stainless steel safety cables attached to the pump outlet and secured to the bore cover plate.

3.7 Discharge column

3.7.1 For submersible pumps, the discharge column shall consist of Class 18 PVC with stainless steel couplings or Permaglass pump column. PVC Column shall have parallel threads with pipe ends butting up against each other.

3.7.2 Column centralisers shall be installed at the pump and at a minimum of 12 metre intervals of columns to protect electrical cables.

3.7.3 All conduits and cables shall be installed and clipped to the column at regular intervals. Allowances shall be made for any likely expansion or twisting of the pump column.

3.8 Pump performance test

3.8.1 On completion of the pump installation the Contractor shall perform a pump performance test and submit the results to the City. The following minimum information is required:

- Clear bore location/name/pump description
- Casing diameter and material if known
- Discharge fittings and material: Schematic sketch showing layout/arrangement, size and condition of components
- All pump detail available: e.g., Make, size, model

- Pump electrical control information available: e.g., VFD/Star Delta/DOL/ Soft Starter
- SWL to be recorded before test
- Flow/pressure test to be performed starting from closed discharge valve pressure in 100kPa decreasing increments to fully open discharge valve position
- Pressure at GL and Flow rate recorded for each step
- DWL/Draw down to be recorded for each step
- Each step to run for 4 minutes before WL and flow rate readings
- Results to be tabulated and submitted to City of Wanneroo
- Method of flow measurement to be noted
- Existing flow meter information/make /model/serial number if available
- Existing flow meter readings compared with test flow meter readings (suggested at three different flow rates)
- Low water level probe depth/set point and
- Any concerns or suggestions on installation

4 ELECTRICAL SPECIFICATIONS

4.1 General

4.1.1 The works comprise the provision, installation, testing, commissioning and maintenance of the Electrical Services required for the nominated site.

4.1.2 Whether or not the words “provide,” “supply” and/or “install” appear in the tender documents, all equipment for the complete installation shall be provided and installed by the Irrigation Contractor’s Electrician.

4.1.3 All workmanship and materials shall be in accordance with S.A.A. wiring rules AS/NZS 3000:2018 or subsequently revised editions. In addition, the electrical installation shall comply with the State Electrical Act, Local Supply Authority requirement and Uniform Building by-laws.

4.1.4 All equipment, material and accessories supplied by the Contractor in this Contract shall be new, shall conform to the appropriate current Australian Standard.

4.1.5 Where a trade name, brand and/or catalogue number is referred to in this Specification the Contractor shall include such products or seek written approval from the City.

4.1.6 Only products which have been commercially available for a minimum period of twelve months and have been proven in the Western Australian marketplace shall be used.

4.1.7 All materials specifically required shall be supplied by the contractor.

4.2 Electrical contractor

4.2.1 All work shall be carried out by a suitably experienced Electrical Contractor employing licensed Electricians. Because of the critical need for reliability and a comprehensive understanding of motor pump performance characteristics, the

Contractor shall only sub-contract the design and construction to an Electrical Contractor who has had previous experience with pump controls.

4.3 Regulations and standards

4.3.1 The installation and materials provided shall comply with the relevant rules and requirements of the following, including payment of all and any fees required:

- The Supply Authority (Western Power), including compliance with the latest issue of Western Australian Service and Installation Requirements (WASIR)
- Electrical Act and Regulations
- Workplace Health and Safety Act & Regulations
- Local Authority
- Australian Standards
- Pay all fees due to the above Authorities
- Any other Authority having jurisdiction over the works and
- The latest edition of the Standards, Rules and Requirements current at the time of calling tenders shall apply.

4.4 Disturbances in mains supply networks

4.4.1 Electrical equipment shall comply with AS/NZS 61000.3.3:2012 Disturbances in Mains Supply Networks, including limitation of voltage fluctuations and harmonics.

4.5 Electromagnetic interference

4.5.1 Electrical equipment shall comply with limits of electromagnetic interference defined in AS CISPR 11:2017 to Class B.

4.6 Existing services and associated equipment

4.6.1 The Contractor shall immediately repair any damage to existing systems not within the area of modification of the new system. These works shall be at the Contractors expense.

4.7 Power supply and liaison with supply authority

4.7.1 The Contractor shall allow for carrying out all liaisons with the Supply Authority and the City. This shall include obtaining all Supply Authority approvals as required and arranging for Western Power connections at pillar unit.

4.7.2 Complete and submit all notices as required by Western Power and the City.

4.7.3 Should a Western Power pillar exist the Contractor shall allow for connection over no more than ten metres from the irrigation control cabinet.

4.7.4 Should a Western Power pillar not exist the Contractor shall allow for all applications required by Western Power to have a pillar installed at a location approved by the City.

4.8 Conduits and cable pits

4.8.1 Generally AS/NZS 2053:1:2001 (R2016) conduits and fittings shall be used except where exposed to mechanical damage or sunlight where galvanised screwed steel conduits or G.W.P. shall be used.

4.8.2 The minimum size conduits shall be 50mm diameter, except where the conduit size is specified. If corrugated conduits are being used, select the size to give an equivalent internal diameter.

4.8.3 Unless otherwise specified, all joints in PVC conduit shall be solvent weld jointed.

4.8.4 One make of conduit, fittings and welding solution shall be used throughout.

4.8.5 Couplings on conduits shall be glued. Conduit ends shall be bushed throughout. Make joints between conduits and between conduits and accessories solid and waterproof.

4.8.6 Conduit boxes shall be proprietary units with conduit access facilities.

4.8.7 The ends of conduits shall be internally reamed clear of sharp edges and projections.

4.8.8 Install electrical conduits 600mm below finished ground level and in accordance with the manufacturer's preferred recommended practice.

4.8.9 Excavate trenches straight and true and to an adequate depth to provide the required cover for conduits. Ensure that the bottom of trenches are flat and clear of protrusions such as rocks, tree roots and the like, prior to installation of conduits.

4.8.10 Arrange conduits so that the maker identification and the conduit category are uppermost in clear view.

4.8.11 Whether containing cables or not, underground conduits shall be provided with a 7/0.67 (2.5 sq.mm) PVC covered draw wire.

4.8.12 Cover conduits with 150mm depth of rubble free sand and place an identification tape, 150mm above the conduit continuously along the entire length of the installation. Use orange plastic tape, approximately 150mm wide and indelibly marked "DANGER ELECTRIC CABLE BELOW".

4.8.13 Complete backfilling of trenches using clean fill and compact to match surrounding material.

4.8.14 Backfilling and tamping of trenches where passing under footpaths, car parks and other load bearing areas shall be carried out in layers, 200mm maximum thickness.

4.8.15 Electrical services cable pits are not to be installed unless prior approval has been granted by the City of Wanneroo. Should approval be granted for the

installation of cable pits, they are to be installed in accordance with manufacturer's preferred recommended practice.

4.9 Irrigation electrical control cabinet

4.9.1 The irrigation electrical cabinets shall be supplied, installed and connected in accordance with Western Power's requirements, AS/NZS 3000:2018, AS/NZS 3008:2017 and all relevant authority codes, and the City of Wanneroo specifications. The following will also apply:

4.9.2 A licensed electrical contractor, experienced in commercial irrigation pumping systems, shall complete the electrical installation and cabinet wiring. Circuit to be designed and wired to include correct operation of all equipment listed in this specification and scope of works.

4.9.3 The irrigation control cabinet is to be designed to allow front access to the irrigation control cabinet for non-qualified personnel for the operation of irrigation control systems, and access to all field cabling. Rear access to the irrigation control cabinet shall require the removal of a minimum of three (3) Fixing that requires opening with a security or specialised tool – i.e., Allen Key head and be for qualified electrical personnel only and labelled accordingly.

4.9.4 The City of Wanneroo may elect to arrange a final inspection of the electrical installation for the irrigation system by a consultant prior to final handover, to ensure conformance with specification requirements.

4.9.5 Any non-conformance items must be corrected at the contractor's expense prior to acceptance of the whole system by the City of Wanneroo.

4.9.6 The irrigation control cabinet shall be a fully weatherproof, freestanding, cabinet type enclosure of 2.5mm (minimum) marine grade aluminium sheet H34-5005 construction. The overall size is to match the City's standard drawings.

4.9.7 Standard Drawings for either "Soft Starter" TS40-25-0 or "Frequency Drive" TS40-24-0 depending on the individual pump requirements.

4.9.8 The irrigation cabinet shall be complete with meters, automatic circuit breakers, contactors, time clocks, pressure gauges, controllers etc., as required for a complete and operational system.

4.9.9 All escutcheons and panels etc. shall be of 2.5mm (minimum) marine grade aluminium sheet H34-5005 and shall have double turned edges for rigidity.

4.9.10 External finish of the irrigation control cabinet and all escutcheons etc. shall be of a brushed aluminium finish and be coated with an approved anti-graffiti coating.

4.9.11 All metal work shall be of machine folded and welded construction and shall be rigid, symmetrical, and neat in appearance with all visible joints filled and ground smooth. Cabinet doors shall be adequately constructed with stiffeners to protect against unauthorized entry.

4.9.12 The front irrigation cabinet door (for non-qualified personnel) shall be complete with two pad locking swing handles fitted with two heavy duty external padlocks keyed to 1433/ SEC. Two 100mm gas struts to top and bottom to hold the doors in the open position to eliminate possibility of wind damage to doors and hinges. The rear irrigation cabinet door (labelled – ACCESS BY QUALIFIED ELECTRICAL PERSONNEL ONLY) shall be secured closed by non-standard bolts (Allen head types are suitable) and have one facility to hold the doors in the open position to eliminate the possibility of wind damage to doors and hinges. The front and rear cabinet doors shall have lift of type 135-degree full swing hinges. Hinges shall be chrome-plated brass with steel pivot pins and plastic bearing washers. All hinged panels and removable sections shall close onto 23mm D 'Pinch Weld' resilient full hollow perimeter rubber seals to exclude dust and water penetration - such seals being fixed within deep channel frames around the perimeter of all openings and arranged so as to be reasonably compressed at all points when the panel is secured.

4.9.13 The front internal cover of the irrigation control cabinet shall be suitable to house two pressure switches or two pressure transducers, electrical overload reset and solenoid terminals. The irrigation control cabinet shall include a 100 mm x 50 mm x 8 mm aluminium channel base fixed to the irrigation cabinet with six number 10mm x 25mm galvanised bolts with spring washer NYLOC nuts spaced over the full bearing area of the base. Aluminium channel base shall be fixed to the concrete foundation with six 100mm x 10mm galvanised bolts.

4.9.14 The irrigation control cabinet shall be complete with either a programmable Danfoss soft starter MCD 201 range or Aucom equivalent e.g., CSX range, VFD IMO VXA range or SEW Movitrac Variable Frequency Drive (VFD) or Danfoss VLT Aqua VFD depending on the application at individual locations. Electrical wiring to the soft starter or VFD shall be complete with flexible wiring and approved connectors. ACBs, switches etc., shall be mounted on brackets (insulated where necessary) and shall protrude through neatly formed individual openings in escutcheons these shall solidly engage with the escutcheon. In all cases, covered, escutcheon cut-outs and drilled mounting brackets shall be provided for an extra 30% of future additional equipment. Proprietary snap-in pole fillers shall be used throughout. Where lift-off access panels are provided, they shall incorporate two lifting handles and a centrally located (on vertical centre line of panel) dowels and receptacles to assist in locating the panel on the main frame of the irrigation control cabinet. Escutcheons shall be fitted with knurled, captive, thumbnuts with screwdriver slot and fibre washers and with two "D" type handles located centrally top and bottom of each escutcheon.

4.9.15 Cable, ducting and covers shall be fabricated and finished for and to match the irrigation control cabinet. All hardware shall be chrome plated externally and chrome or cadmium plated internally. After fabrication metalwork shall be cleaned of rust, scale, oil, etc.

4.9.16 A new concrete base will be required, and the existing base will be removed at the Contractor's expense. The new concrete base shall be sized to suit the requirements of the irrigation control cabinet. Exact location to be verified with the City of Wanneroo representative prior to installation.

4.9.17 The finished level of the concrete base shall be a minimum of 150mm above finished ground level and 250mm minimum below finished ground level. All visible edges shall be completed with a 25mm bevelled edge.

4.9.18 The concrete base shall be constructed from a minimum of 20-20-80 MPa concrete and shall conform to all relevant standards.

4.9.19 All electrical conduits shall be complete with sweep bends installed below the concrete base. Size of sweep bends shall be in accordance with cable manufacturer's recommendations.

4.9.20 Earthing

Supply and install green PVC insulated copper earth conductors enclosed in conduit from the irrigation control cabinet to the earth connection points. The complete earthing installation shall be in accordance with AS/NZS 3000:2018 and Western Power requirements.

4.9.21 At the earth connection points, supply and install 12mm diameter copper clad steel core electrodes. Provide the number of electrodes to achieve the level of resistance in accordance with AS/NZS 3000:2018.

4.9.22 Earth tests shall be carried out in accordance with AS/NZS 3000:2018. Should the result not meet the standard, additional earth rods shall be supplied and installed to achieve the standard required. The earth resistance shall be recorded, and certification provided prior to energisation.

4.9.23 The MEN connection between the earth and neutral bars shall be at the Main Switchboard with a readily removable connection for testing. The connection shall be clearly labelled "MEN link".

4.9.24 The earth bars shall be ALUMINOX or equivalent and shall be predrilled with an adequate number of holes. Each hole shall be clearly numbered accordingly.

4.9.25 Protection Requirements

The irrigation control cabinet shall be constructed to provide the following protection requirements:

- VFD fault light If applicable with reset facility
- Low Level Indicator light and reset facility
- High Pressure Indicator light and reset facility
- Low Pressure Indicator light and reset facility
- Thermal Overload Indicator light and manual electric reset on power reinstatement
- Over current Rated at above FLC of motor
- Ventilating Fans Thermostat set to start fans at 18 degrees C or when pump starts
- RCD Protection For outlet mounted in Circuit breaker rack

4.9.26 Equipment - General

All equipment shall be neatly and logically arranged in groups, rows, etc. Equipment shall be mounted to a height in accordance with relevant Standards above the surrounding floor level of any switchboard location.

The irrigation control cabinet main switch shall be 3 pole suitably sized 100A mains switch. Smaller series main switches will not be accepted.

All submersible pumps shall be protected by a suitably rated circuit breaker designed specifically for protection of submersible pumps and through a Danfoss or equivalent soft starter or VFD. For pump warranty purposes the Contractor is to verify acceptance of proposed circuit breaker type with the pump manufacturer to ensure compatibility with overloads.

4.9.27 Pump Starter - Pump starters for the irrigation system shall be as follows:

- 4 kW and under shall be DOL (direct online) or VFD type starter.
- 5.5kw and over shall be Danfoss soft starter or Aucom equivalent, or VFD approved by the City. Installation is to be as per manufacturers specifications.
- All electrical starts to have a manual start override key or switch.

4.9.28 Indicating Lights - Indicating lights shall be 240v, LED 22mm or equivalent and visible when activated in outside daylight conditions. The indicator lights shall be activated and illuminate on the following fault conditions:

- High pressure
- Low Pressure
- Motor overload
- VFD when required
- Phase failure
- Run mode
- Low water level (submersible pump only).

4.9.29 Reset Button - Reset button shall be black 22mm to reset on high and low pressure, low level only.

4.9.30 Motor Isolator - Motor isolator shall be DIN rail mounted type complete with lock "OFF" facility.

4.9.31 Neutral Link - Neutral link shall be of a minimum 13 hole or larger. Neutral link shall be mounted at the rear of the cubicle adjacent to the earth bar.

4.9.32 Control Relays and Timers - Control relays and timers shall be suitable for din rail mounting or of a plug-in type. The timer shall be OMRON H3CR or equivalent.

4.9.33 Pressure Switches / Pressure transducers – If pressure switches are used, they are to be MOELLER type MCS-11 or equivalent and to be mounted within the front low voltage access panel. Pressure switches shall be mounted so that high-pressure switch is to the left side and low-pressure switch is to the right side of the panel. If pressure transducers are used Telemecanique (Schneider) XMLK010B2D71 10 bar, Telemecanique (Schneider) XMLK010B2D21 10 bar or equivalent and are to be mounted as per pressure switch information.

4.9.34 Mainline Pressure Gauge - The mainline pressure gauge shall be stainless steel 63mm, rear entry, flush mounted complete with any mounting flanges required. Provide additional protection to pressure pipe to base entry level to

prevent possible leakage of water from joints accidentally damaging electrical components.

4.9.35 Ammeter - Ammeter shall be 72mm and be flush mounted on the control panel. Ammeters shall be rated at full load current, 3 times over scale.

4.9.36 Phase Failure Relay - Phase failure relay shall be din rail mounted at rear of cubicle, connected to the pump starter, protected by a suitable rated circuit breaker on starter tray.

4.9.37 Thermal Overloads - Thermal magnetic circuit breaker type overloads shall be provided. Ensure that the selected overloads are on the pump manufacturer's approved list.

4.9.38 Meter Panel - Provide an approved meter panel. Blank the unused portion of cabinet with panel board for future installation of equipment. Ensure that irrigation equipment or controls are not installed on or behind this panel. Provide open slot ducting, generally 60 mm x 40 mm to conceal electrical cabling where possible. All other cables not installed in cable ducts shall be stranded and all stranded cables shall be secured by cable ties or spiral wrap.

4.9.39 Ventilating Fans - Ventilating fan-isolating switch shall be installed to the front right-hand underside of top to the irrigation control cabinet. Two 240v AC 120 mm ventilation fans shall be installed in top section of cabinet to provide circulation from base of irrigation control cabinet expelled through to canopy. VFD fans where applicable must be a minimum 171mm or a size to suit manufacturer's air flow requirements if a larger fan is recommended.

4.9.40 Fans to be controlled by one thermostat located at the rear of the irrigation control cabinet. The thermostat for the ventilation fans shall be set to operate at 18-20 degrees C. The thermostat control is to be adjusted and mounted on the rear of the cubicle. Fans are to be set to operate at all times a pump is in operation.

4.9.41 Western Power Kilowatt Hour Meter - Supply and install a Western Power approved Kilowatt hour meter for the monitoring of the power consumption. Meters may be obtained from a Western Power outlet.

4.9.42 Pump Connection - Allow for cable and underground conduit for pump up to 10 meters away from cabinet. Connect all cabling with approved connectors as required.

4.9.43 Water Meter Connection – Allow for cable and underground conduit for water meter up to 10 meters away from cabinet. Connect all cabling with approved connectors as required.

4.9.44 Future expansion for auxiliary functions – Cabinet is to allow room for the installation of three (3) data points, relays, or nodes with access to the irrigation controller.

4.9.45 Labelling

All equipment, including ACBs, kilowatt-hour meters, switches, reset buttons and contactors shall be identified with appropriately engraved TRAFFOLYTE labels or equivalent, fixed to panels using screws.

Labelling shall be a minimum of 3mm high black lettering on white background using laminated TRAFFOLYTE with bevelled edges. The labels shall be fixed to the sheet metal panels using screws. Adhesive labels are not acceptable.

The wording of all labels must be shown. This shall include, but is not limited to, the following:

- Pressure switches and fault lights
- Main switch and neutral link
- Fault lights - refer drawing and
- Each circuit breaker switch or any ancillary equipment within the cubicle

4.9.46 Power Point

Provide din rail mounted single General-Purpose Outlet (GPO) within the irrigation control cabinet. General Purpose Outlet (GPO) shall be CLIPSAL 4SO10 and is to be protected by residual current device (RCD) circuit to provide protection against earth leakage current when portable or handheld equipment is in use.

RCD protection shall comply with the requirements of Regulation Division 6 — Residual current devices Work Health and Safety (General) Regulations 2022 and with AS/NZS 3000 - 2018.

4.9.47 Consumer Mains

Consumer mains shall be sized to accommodate the proposed bore pump with an additional 35 amps per phase (minimum) allowance for future development. Minimum size 16 mm 4 core.

4.9.48 Underground pillar

The Contractor shall allow for connection to an existing Western Power pillar no more than 10 metres from the cabinet.

4.9.49 PLC Use

Where PLCs are used in place of timers and relays the following applies:

- Upon handover to the City of Wanneroo the PLC is to be unlocked, having no outstanding intellectual property attached
- To be of a ladder program type
- Copy of program is to be supplied to the City of Wanneroo
- To be 24V DC

Recommended PLC types include:

- IMO iSmart range
- Schneider Zelio range
- Moeller Easy range

4.9.49.1 Contractor shall confirm operation and function of all controls and pump operation to The Principal representative before handover. At hand over all PLC, VFD, and other software programs that are required must be supplied.

4.9.50 Irrigation control wiring

All irrigation control cabling is to be 24V DC and a minimum 1mm single core flexible cable – 32/0.20 V90HT.

4.10 Circuit diagrams

4.10.1 The Contractor is to design a working circuit to incorporate all protection devices, indicating lamps, control equipment and motor starters listed above.

4.10.2 Verify current data logging connection requirements and terminal allocation to ensure compatibility with irrigation controller. Data connections to the irrigation controller to include inputs from - low level switch, low pressure switch, high pressure switch, flow meter, overloads, door switches, pump kWh meter and phase failure relay.

4.10.3 The Contractor shall provide 'As Installed' circuit diagrams showing wire numbers, rating and operation settings for all electrical circuits. Diagrams shall be provided as an electronic file. The drawings shall provide all information necessary for the operation, maintenance and replacement of equipment.

4.10.4 Copyright of the circuitry drawings becomes the property of the City of Wanneroo.

4.11 Pump protection

4.11.1 The pump protection equipment and settings installed by the Contractor shall ensure failsafe operation of the pumping equipment when operating in each of manual or automatic mode.

4.11.2 High /Low Pressure

The Contractor shall include for the supply and installation of high- and low-pressure switches complete with time delays and fault lights. The setting of each pressure switch and time delay shall be carried out on site by the Contractor, to ensure satisfactory system operation.

High- & low-pressure settings shall be within the operating range of the pump installed.

4.11.3 Bore Low Level Probe

The Contractor shall supply and install a two-wire low level bore probe within the 25mm probe conduit. A probe relay, fault light and lock out relay shall be installed by the Contractor.

4.11.4 Maximum Starts

When switch selector in "Auto" position the maximum allowed pump starts shall be limited no more than 4 per hour.

4.11.5 Motor Overload Protection

The VFD has electronic overload protection that will operate should a pump overload occur. The "PUMP START FAULT" lamp will illuminate, and the pump starter will be shutdown.

5 IRRIGATION SYSTEM

5.1 Standards and codes, materials and workmanship

5.1.1 The relevant and current Australian or ISO standards will apply to all work conducted in accordance with this specification.

5.1.2 The Contractor shall warrant that all materials shall be of a high quality and free from defects. All equipment supplied and installed shall be in accordance with standard industry practice and equipment / material manufacturer's recommendations and specifications.

5.1.3 Accordingly, the Contractor shall warrant that all equipment and materials are guaranteed by the manufacturer of the materials for a minimum period of 12 months from the date of Practical Completion of the works.

5.1.4 All materials, equipment and works must conform to the City's Standard Irrigation Specifications

5.1.5 The Contractor shall warrant their workmanship for a minimum period of 12 months from the date of Practical Completion and shall agree to rectify any non-compliant works due to poor workmanship during the guarantee period. The removal, repair and/or replacement of any such materials and equipment shall be undertaken by the Contractor, at no cost to the City.

5.2 Site access – city engaged contractors

5.2.1 Before bringing any plant, equipment or materials to site and before commencing any construction operations the Contractor shall liaise with the City for authority to access the site. All site access to parks and reserves is to be limited to current chain gate locations unless alternate arrangements have been approved by the City.

5.2.2 All contractors completing works for the City must complete the City's online Contractor induction course prior to any works commencing.

5.2.3 The Contractor shall be allowed access to the site during normal working hours. Working hours shall be advised by the City for each project site.

5.2.4 During installation Contractors shall occupy only such portions of the site as are necessary to carry out the works. Care must be taken to avoid damage to the grounds, turf, buildings, paths, kerbing, roadways, fences or any other property, landscaping trees or plants. Turf protection mats must be used to limit damage to surrounding turf areas. Any damages caused by the Contractor shall be corrected at the Contractor's expense to the City's approval.

5.2.5 The Contractor shall document any damaged infrastructure prior to beginning works. Any damage that has not been documented prior to works beginning will be assumed to have been damaged by the Contractor.

5.3 Existing services

5.3.1 It is the Contractor's responsibility to contact Dial before you dig to ensure there are no utilities in the area which have not been shown on the plan. The Contractor shall allow for engaging a licenced sub-surface service locating company to determine the exact location of all existing site services, which may not be indicated on the drawings, and they shall conduct their work so as to prevent interruption or damage to existing services. Damages to existing services shall be repaired at the Contractor's own expense.

5.4 Setting out

5.4.1 The Contractor shall do all setting out in accordance with the Contract specifications and irrigation design drawings. Any site anomalies should be reported to the City prior to commencing work.

5.4.2 The Contractor shall peg out the location of each run of pipes and sprinkler heads prior to trenching. Before installation commences in any given area, the City shall check all setting out locations and grant approval.

5.4.3 Where irrigation is to be installed in active playing fields the contractor shall allow to engage a licenced surveyor to mark sprinkler and valve locations for approval by the City.

5.5 PVC irrigation pipes

5.5.1 All piping installed shall be manufactured in AS/NZS 1477:2017. Connections and piping installations shall be in accordance with the manufacturer's recommendations and must comply with the relevant Australian Standard Codes of Recommended Practice.

5.5.2 All piping shall be installed within 18 months from the date of manufacture.

5.5.3 Mainline Pipes - All mainline piping shall be MDPE PN12.5 pipe and shall be joined by electrofusion welding.

No pipe joins or fittings shall be accepted in sleeves or under road crossings. Mainline through sleeves or under roads shall be a continuous length of MDPE PN12.5 pipe of approved diameter. The pipework must extend a minimum of 1m beyond the extent of the sleeve and have butt welded flanges on either end to allow for connecting further pipework.

Mainlines are not to be installed under any fixtures such as footpaths, rock pitching, trees, play equipment etc. and shall not be installed in any drainage swale at a distance of greater than 1m from the swale top edge.

Mainline and valves will not be installed on a slope with a fall greater than 1:6.

5.5.4 PVC Laterals

All PVC lateral piping shall be a minimum of Class 9. Laterals of 80mm or less in diameter shall utilize the Solvent Weld method of jointing (SWJ); laterals greater than 80mm in diameter shall be Rubber Ring Jointed (RRJ).

5.5.5 PVC Fittings

All fittings used in the installation must be new, compatible with the pipes used and manufactured to AS/NZS 1477:2017 and shall be compatible with PVC pipe produced in accordance with the standard. PVC fittings shall be manufactured to Class '18'. The City's preference is for Vinidex or Iplex fittings to be utilised.

Changes in direction of pipe work shall be with standard fittings. The crossing of fittings shall under no circumstances be allowed. All outlet branches of tees shall be installed in the horizontal plane.

5.5.6 Primers, Solvents, Rubber Rings and Lubricants

Primers and solvents used for the piping connections shall be of approved manufacture and shall be used in accordance with the manufacturer's recommendations. All solvent weld connections must be clean and have no excess solvents outside the joint. Cleaners, primers and solvents must be coloured.

All primers and solvents are to be applied as per the manufacturer's recommendations.

Rubber rings supplied for pipes and fittings shall comply with current Australian Standards. The supply of pipe and fittings shall include a ring lubricant as recommended by the manufacturer of the pipe or fittings.

5.6 Bending of pipes

5.6.1 The bending of pipes will not be accepted unless written permission has been given by the City.

5.6.2 Where approval has been granted pipe bends shall not exceed the manufacturer's recommendations for the material, class and diameter of pipe being bent.

5.7 Thrust blocks

5.7.1 Thrust blocks shall be constructed in accordance with the pipe manufacturer's installation instructions and shall be constructed symmetrically about the centre line of the fitting. The pipe or fittings shall be covered with a protective membrane of PVC when adjacent to concrete.

5.7.2 Concrete shall be thoroughly mixed on the surface prior to installation. Dry concrete mix and water shall not be mixed in the trench. Locations shall be determined on site and suit the ground conditions, but it can be assumed that thrust blocks shall have minimum dimensions of approximately 500 x 500 x 500mm.

5.7.3 All thrust blocks must be installed in relation to pipe sizes and not be deemed excessive, any excess concrete must be removed from site. The irrigation contractor shall provide all materials and concrete for the thrust blocks.

5.7.4 Thrust blocks shall be installed on all RRJ mainline fittings, including elbows, bends, reducers, tees and isolation valves, but excluding 'self-straining' take-offs such as tapping bands for air valves and tees to solvent welded branches for sub-mains.

5.7.5 Thrust blocks shall be so placed that the pipe joint will be accessible for inspection and repair. Concrete for thrust blocks shall be placed against undisturbed soil faces. All sides of thrust blocks not in contact with undisturbed soil shall be formed.

5.8 Excavation and trenching

5.8.1 Piping shall be laid in parallel straight lines. The trench bottom shall be flat, firm, smooth and free from rocks. Care shall be taken so that no rocks, rubble or sharp objects are laid in contact with the pipe. It shall be at the City of Wanneroo's discretion whether excavated spoil is suitable for backfill.

5.8.2 Upon request the contractor must submit photographic evidence of all works being compliant with the specification relating to but not limited to trenching works, sleeves, pipe depth and separation.

5.8.3 Trench Depth

Minimum cover over all pipe work shall be 350mm and maximum depth not greater than 450mm (Exception will be when mainline exceeds 150mm, then minimum cover depth of 450mm / max of 750mm applies).

The trench bottom shall be continuous, firm, relatively smooth and free of rocks, rubble or sharp objects. The pipe should be uniformly and continuously supported over its entire length.

5.8.4 Trench Width

The trench width shall be sufficient to provide adequate room for joining the pipe in the trench, (if this is necessary) and to allow for the installation of different pipes and conduits within the same trench. The width shall be sufficient to provide a minimum of 100mm space between each pipe and conduit. No pipe or conduit shall be installed directly above or below another pipe or conduit.

5.8.5 Trenching Parallel with Roads

Under no circumstances will trenching, which runs parallel with the road, be allowed closer than 600mm from the kerb. In the case of lateral lines, sprinklers will need to be offset even though this may not be indicated on the drawing.

5.8.6 Road Crossings

Where ducts do not exist, all road crossings must be installed by means of horizontal under-road boring.

5.8.7 Pipe Embedment

The Contractor shall allow for the placement of sand to provide an embedment of 100mm thick (minimum) between the pipe and any unsuitable material. Sand needed for embedding pipes shall be supplied by the Contractor at the installation rates submitted. The Contractor shall provide all necessary labour and plant for the transporting of the material to the trench site and its placement. This requirement will be dependent on whether the existing soil is deemed suitable for use along with the nature of the unsuitable material and is based on approval from City of Wanneroo.

5.8.8 Back Filling

5.8.8.1 Excavated spoil may be used as backfill material if free of rocks, organic material such as turf or tree roots and is deemed suitable by the City. Rejected spoil shall be removed from the site and replaced with clean sand. The Contractor shall provide all necessary equipment for the backfilling, compacting, and levelling of trenches. The City of Wanneroo may request that minor debris will be removed from backfill material allowing the material to be reused. This process will be at the contractor's cost and includes disposal of debris.

5.8.8.2 Backfilling material in trenches must be compacted using a vertical rammer style compactor to ensure correct consolidation is achieved. The use of plate compactors may only be utilised with prior approval from the City if the machines overall plate width is less than that of the trench being compacted.

5.8.8.3 Tyre tracking is not an acceptable method of compacting trenches. It is the Contractor's responsibility to maintain the integrity of trench walls and to prevent edges of turf from collapsing.

5.8.8.4 All trenches must be compacted in layers not exceeding 150mm thick with finished level and density to be equal to the surrounding surface. All spoil remaining on the turf surface adjacent to trenches must be removed immediately following backfilling and area hand raked to ensure the turf surface is clearly visible.

5.8.8.5 All lateral spurs and valve box and sprinkler voids must be well compacted utilising a non-mechanical, hand operated, plate style compactor to ensure sprinkler and valve box setting and heights are maintained and there is no subsidence following installation.

5.8.8.6 The Contractor shall warrant all trenches against subsidence for a period of twelve months from date of Practical Completion (PC). Any subsidence during the Defects Liability Period (DLP) shall be the responsibility of the Contractor to rectify at their own expense.

5.8.8.7 The Contractor shall remove all surplus spoil and sand piles from site immediately following installation works. Any damage or turf loss caused from spoil remaining on the surface must be replaced with new turf at the contractor's expense. All spoil and backfill material must be removed, and area hand raked to ensure that 80% of the turf leaf is clearly visible. Back blading with machinery is not an acceptable method of removing spoil or site cleaning.

5.8.9 Sleeves

Sleeves or Ducts shall be installed under roads or other hardstand surfaces to enable installation of mainline or lateral pipework. The sleeves installed shall be a minimum of PE100, PN10, SDR17, and MDPE and be Straight lengths up to 6m. Sleeves exceeding 6m in length may be installed using rolled lengths depending on the required diameter.

Sleeves shall:

- Be sized to minimum 2 x combined required diameter of services to run through the sleeve.

- Extend to a minimum of 1m beyond the kerb or hardscape.
- Be sealed properly at both ends utilising expanding foam to prevent ingress of foreign material.
- Have a minimum of 600mm soil cover.
- Separate sleeves shall be installed for all electrical conduit
- Any variation from this requirement shall only be at the specific approval of the City of Wanneroo.

5.9 Poly plough

5.9.1 The poly plough method shall be used for installing MDPE pipe in Active sporting fields and any other open turf areas that suit this method of installation. The poly plough method shall be carried out by qualified and experienced poly fitters and must be used when indicated on the irrigation plan approved by the City of Wanneroo.

5.9.2 The plough machine is to be a four wheeled tractor type machine, with a vibratory plough attachment fitted with cutting tines of various lengths and bullet widths depending on the lateral pipe size.

5.9.3 All wiring laid with the mainline shall be fed into the plough tine and shall not be dragged in with the pipe.

5.9.4 All lateral piping installed via the poly plough method must be at a minimum depth of 350mm measured from the top of the pipe.

5.9.5 Installation of sprinklers on the poly lateral lines shall be connected via Philmac, Plasson or City approved equivalent metric tapping bands. The excavation of holes for sprinkler installations is to be by a neat square cut sod of turf using a spade and measuring no more than 300mm x 300mm. Excavation of holes for sprinkler installations by machinery or excavators is not acceptable.

5.9.6 Following sprinkler installation the hole is to be filled with appropriate material, compacted and the sod of turf reinstalled around the sprinkler. Special care shall be taken to ensure the replacement turf is compacted and level with the existing turf.

5.9.7 The end of poly lateral lines shall be capped with a metric poly plug to match the diameter of the pipe. The excavation of holes for poly plug installations is to be by a neat square cut sod of turf using a spade and measuring no more than 300mm x 300mm. Excavation of holes for sprinkler installations by machinery or excavators is not acceptable.

5.9.8 After installation of the poly lateral lines and sprinklers is complete, a ride on roller of a sufficient weight shall be used to compact the cut line and rise caused by the plough. The contractor must roll the cut line as many times as is required to eliminate any evidence of mounding caused by the plough.

5.10 Sprinklers

5.10.1 Installations

All sprinklers shall be installed as per manufacturer's specifications.

5.10.2 Road Verge Sprinklers

Any sprinklers installed within turf areas on road verges are to be installed with square concrete surrounds.

5.10.3 Sprinkler Heights

All sprinklers shall be installed as per the manufacturer's instructions and City of Wanneroo standard drawings.

The Irrigation Contractor shall be responsible for ensuring all sprinkler heads fully retract when not in operation and non-drain valves operate correctly to prevent line damage. Any changes to the height of the sprinklers caused by subsidence of trenches shall be rectified by the irrigation Contractor.

The Irrigation Contractor shall allow for returning to the site after establishment of turf grass and adjust sprinkler heights where necessary.

5.10.4 Spray Sprinklers

Where circumstances dictate the use of domestic type sprinklers, the City's preference is for Toro brand 570Z series.

Sprinklers installed in lawn areas shall be of the spring retractable, pop-up type with a minimum pop-up height of 100mm. MP Rotor or other multistream style nozzles are not the City's preferred method of irrigation. Any use must be approved in writing by the City prior to installation.

The use of alternative brand spray sprinklers shall require written approval from the City.

5.10.5 Bubbler Types

In the case of bubblers, they shall be of the pressure compensating, fixed flow type. Sprinklers and bubblers shall be installed on Toro brand 570Z series pop-up bodies and screwed polyethylene articulated risers.

5.10.6 Drip and Subsurface Systems

The installation of subsurface is NOT the preferred irrigation method and, permission to install a drip system must be obtained from the City in writing prior to irrigation design. Subsurface is NOT to be installed under turf areas.

If approved by the City of Wanneroo the dripline system is to be installed as per manufacturer's recommendations and is to include all necessary filters and valves and fittings.

5.11 Mainline connections

5.11.1 Solenoid valves up to and including 50mm in size shall be installed on the mainline by means of MILNE gunmetal tapping bands, RMC tapping bands or Vinidex tapping bands with stainless steel bolts & nuts or City approved equivalent.

The tapping outlet size MUST be the same size as the solenoid valve. Solenoid valves 80mm and larger shall be installed on NORTITE, BSP tapped, rubber ring joint tees.

5.11.2 In the event of non-availability of the specified take-off fittings, the City must be contacted for advice and/or approval of acceptable alternatives. Where pop up sprinklers or drippers are used, pressure to these must be controlled either with the use of pressure regulating solenoid valves or separate pressure regulators.

5.11.3 Where threaded (BSP) pipe fittings are to be utilised to facilitate the connection from the mainline fitting/tapping to the solenoid valves they shall be manufactured from brass or copper. They shall be rated at a maximum working pressure of 1600 kPa (PN16) as tested by the manufacturer in accordance with AS/NZS 4129:2020.

5.11.4 All threaded joints of control valves and associated fittings shall have their threads sealed with Teflon sealing tape to prevent leakage. Where a fitting is connecting PVC with metal Teflon tape and liquid pipe seal will be required.

5.12 Solenoid control valves

5.12.1 Solenoid control valves shall be of Bermad manufacture or approved equivalent, normally closed, 24-volt A.C., 50-cycle solenoid coil operated diaphragm valves.

5.12.2 As a minimum the solenoid control valve shall comply with the following features:

- Female B.S.P. threads for valves up to 50 mm diameter.
- 65 mm diameter valves are not to be supplied.
- Bonnet of valve larger than DN 25 to be secured by nuts, not screws.
- Manual control stem for flow adjustment.
- "Bleed" water to discharge internally (during automatic operation).
- Manual open/close control.
- Corrosion resistant internal components.
- Low power requirements: inrush current not to exceed 0.42 amps.
- Pressure rating 10 bar. Operating Pressure Range: 0.5-10 bar.
- Reinforced plastic body construction.

5.12.3 Installation of solenoid valves shall comply with the following:

- Top of valve to be located a maximum depth of 350 mm below finished ground level.
- A clearance of 100 mm minimum between top of valve (flow control stem) and the underside of the valve box lid.
- A clearance of 100mm minimum between the base of the valve and the base of the valve pit.
- Housed in a reinforced lockable plastic Jumbo valve box of suitable size to allow for maintenance.
- Solenoid valves shall be positioned within valve boxes to provide best access for maintenance.

- Solenoid valve assemblies are to be installed in grassed or garden areas approved by the City of Wanneroo.
- Solenoid valve assemblies shall not be installed within 5m of active playing areas, this means whenever possible valves will be located to the sides of large turf areas.

5.12.4 Valves are not to be located outside property boundary lines, if applicable to the site and scope of work under contract. No valves are to be installed in active sport playing areas. If valves need to be installed near active turf areas approval must be sought from the City.

5.12.5 Valves are not to be located within drainage swales.

5.12.6 A Philmac ball valve, the same size as the solenoid valve, must be installed immediately upstream (prior) of the solenoid valve.

5.12.7 The control valves shall be located adjacent to the mainline but a minimum of 700mm of straight pipe is to be provided downstream (sprinkler side) of the valve assembly to allow for future servicing. No quick fixes, threaded couplings or Milnes e.g., shall be used on new installs within 6 meters of valves unless approved by the City's Irrigation Technical Officer.

5.13 Air release valves

5.13.1 Air release valves shall be installed at, and above, all mainline high points to manufacturer's recommendations.

5.13.2 Installation of Air release valves shall comply with the following:

- Valve construction to be brass
- A clearance of 100 mm minimum between top of valve and the underside of the valve box lid
- Housed in a reinforced lockable Rainbird VB Series valve box of suitable size to allow for maintenance
- Air release valves shall be positioned within valve boxes to provide best access for maintenance
- Air release valve assemblies are to be installed in areas approved by the City

5.14 Mainline isolation valves

5.14.1 Mainline isolation valves shall be clockwise closing sluice valves, of approved manufacture, sized as per the mainline i.e., 100mm valve for a 100mm mainline. They shall be installed into the mainline by means of flange-socket adaptors suitable for mainline pipe type and housed in a Rain Bird VBRND10 Round box with an appropriately sized internal sleeve to ensure there is unrestricted operation and access.

5.14.2 All under road crossings must have an isolation valve located reasonably between 1.5 and 10 meters off the kerb edge on the supply side of the crossing and shall be housed in a Rain Bird VBRND10 Round box with an appropriately sized internal sleeve to stop the ingress of sand and allow ease of access to the isolation valve

5.14.3 Isolation valves shall not be installed within concrete or pedestrian walkways.

5.14.4 The top of the mainline isolating valve (spindle) shall have a minimum clearance of 100mm to the valve box lid. For larger mainlines this may require extra depth for the mainline near valve location.

5.15 Mainline flushing valves

5.15.1 Mainline flushing valves shall be clockwise closing sluice valves, of approved manufacture, sized as per the mainline i.e., 100mm valve for a 100mm mainline. They shall be installed into the mainline by means of flange-socket adaptors suitable for mainline pipe type and housed in a Rain Bird VBRND10 Round box with an appropriately sized internal sleeve to ensure there is unrestricted operation and access.

5.15.2 Downstream of the Mainline flushing valves will be a 90-degree long radius bend sized as per the mainline i.e., 100mm valve for a 100mm mainline with a male quick release coupling connected housed in a Rainbird VB-JMB valve box so that a female quick release coupling may be attached.

5.16 Valve boxes

5.16.1 Valves must be always accessible for manual opening, closing and servicing, therefore size of valve determines size of valve box. Rainbird VB-STD is the minimum acceptable valve box containing a solenoid. Any solenoid valve greater than 25mm shall be installed in a Rainbird VB-JMB valve box. All valve boxes shall be Rainbird VB Series or equivalent as approved by the City's Irrigation Technical Officer and have the lid secured with locking bolts, which must be in place prior to practical completion.

5.16.2 All valve boxes installed in turf shall be installed with their tops flush with finished ground level, valve boxes installed in garden beds and mulched areas shall be installed with their tops 20-30mm above the finished ground level including mulch. The valves shall not be buried within the valve boxes and the soil level inside the valve box must be brought down 100mm below the body of the solenoid valve. The top valve box shall be installed on a single course of bricks. If a valve box is below finished ground level, then another identical valve box is to be used to in a telescoping fashion with all valve boxes installed on a brick support base.

5.16.3 All valve boxes shall have the valve identifier (valve number) permanently inscribed on the valve box lid.

5.16.4 All gaps in valve box installations must be sealed up to prevent the ingress of sand. Contractor must obtain confirmation of the finished ground levels, as changes to valve box height settings resulting from incorrect installation will be carried out at the Contractor's expense.

5.17 Irrigation control system

5.17.1 Controller

The City requires irrigation controllers to be SIGNAL SDS-Series Controller (SDS-50 / SDS 100) type controllers.

Permission to use site-specific control system other than specified must be obtained from the City in writing prior to irrigation design.

It is a requirement that each public open space has an individual controller unless other permissions are granted by the City.

5.17.2 Licensing

The controller shall include, if required, an unlimited license which as a minimum allows meeting the future expansion needs of the City.

5.17.3 Data Node

The City requires that all public open space control systems must set up a Data node (counter type) connecting the pump flow meter with the irrigation controller.

The Contractor shall provide all required equipment and connections. Data node (counter type) and all connections will be provided and installed by the contractor.

5.17.4 Two Wire System Communications

The SIGNAL SDS-Series (SDS-50 / SDS 100) irrigation controller shall communicate with all field decoders using SIGNAL two-wire twisted pair decoder communication cable. Multiple two-wire paths must be installed on large sites to assist in future fault finding. Each two-wire path shall use a different coloured wire sheath where appropriate.

Two wire solenoid control cable and size shall be as specified by the controller's manufacturer. *Equivalents are not acceptable.*

Controllers must be set up to be able to communicate with Signal Cloud based software and will include modem, antenna and associated equipment. Prior to handover to the City the modem must be set to match the current City telecommunications company.

5.17.5 Multi Wire System Communications

The SIGNAL SDS-Series (SDS-50 / SDS 100) irrigation controller shall communicate to system valves via manufacturer's SIGNAL Relay Cubes™.

Multi wire systems are not the preferred option of City of Wanneroo and this type of control set up shall only be used on existing systems where extensions/upgrades may require use of current inground wiring.

5.17.6 Control Wire Connection

All connections must be installed as per the manufacturer's specifications. All field connections must be in either a cable pit (change of direction or joining new cable) or in the solenoid valve box.

Transcoders or Decoders are to be housed with the solenoid valve.

A 3m loop of spare cable shall be included in the valve box to allow for future maintenance.

5.17.7 Control Conduit

All solenoid wires shall be installed in MD Grey conduit. The ends of the conduits shall be sealed to prevent the ingress of dirt and insects.

Where not specified all conduits for low voltage (24V) control cables shall be adequately sized to accommodate the number and size of cables to be installed and shall be a minimum of 40mm MD Grey conduit.

Where conduits are installed with mainlines, they shall be installed alongside, but no closer than 100mm to the mainline. Elsewhere, the wires shall be installed with a minimum cover of 350mm. Refer Wanneroo Standard Irrigation Drawing TS-40-19-0.

Conduit entry into valve boxes shall be installed as per City of Wanneroo Standard Irrigation Drawing TS-40-14-0.

5.17.8 Lightning Strike and Surge Protection

All lightning protection must be installed as per controller manufacturer's specifications as a minimum. The two-wire path and all field communication equipment shall be fitted with adequate filtering equipment and protection to safeguard the unit from power surges from both the power supply and field wiring input sides.

The surge protection provided shall be greater than the maximum level of protection recommended by the manufacturers of the two-wire system, the City will not accept lower protection levels than to cover the shorter distance of 8 decoders or 250m of cable run. Surge protection devices to be housed in adequately sized, lockable plastic valve boxes.

5.18 Water meters

5.18.1 Water meters shall be Arad Octave water meters sized to suit the bore discharge headworks. Meters shall be capable of monitoring and storing collected data as a minimum requirement. All flow meters shall have the ability to record and display the following information:

- Flow Rate in L/sec
- Re-settable cumulative flow volume in cubic meters
- Non-resettable cumulative flow volume in cubic meters and
- Connection to the Data Node (counter type) at the controller within the control cabinet.

5.18.2 Water meters are to be installed in the bore discharge headworks prior to the testing tee and in accordance with manufacturer's specifications and located as per City's approved location.

5.18.3 All flow meters shall be installed in a lockable galvanised box to protect from vandalism or tampering and must include signal transmitter using manufacturer's recommended cable run back to the controller for monitoring flow. The cable is not to be run next to higher voltage cables. The cable run from the meter to the ground must be completed in a manner that is tamper proof.

5.18.4 Pulse output utilisation will be based on pump flow and set up by qualified technician to accurately report information to the irrigation controller.

5.18.5 At the completion of a water meter installation the Contractor must submit a works completed email to the City of Wanneroo containing the following information:

- Date of install
- Photo of the headworks with installed meter
- Photo of meter showing serial number and reading on installation
- Copy of the Certificate of Calibration showing serial number, model
- Details of any modifications made
- Photo of removed meter clearly showing final meter reading (if replacing an older meter)
- Location of meter including park name, site address and GPS coordinates

6 DESIGN AND INSTALLATION OF SCHEME WATER IRRIGATION SYSTEMS

6.1 Scheme water

6.1.1 Scheme water supplied systems are not to the City's preferences and permission from the City shall only be granted in extreme circumstances.

6.1.2 Scheme water supplied systems shall comply with the criteria outlined in previous sections regarding minimum design guidelines and common components. In addition, the following constraints will need to be met. (6.2 – 6.5)

6.2 Water supply

6.2.1 Should a point of supply (stopcock, gate valve or meter) not exist, the Contractor shall make the necessary application to the Water Corporation on behalf of the City or the Principal and carry out all liaisons in relation to the provision of the service. The City will pay all costs and charges levied by the Water Corporation if the project is being quoted direct to the City.

6.2.2 In the case of new construction sites, the Contractor shall liaise with the builder for the provision of a take-off point from the main supply to the site. The cost of the take-off point to be included in the total price quoted for the irrigation system.

6.2.3 On existing sites, already serviced with a scheme water services, the Contractor shall arrange, at his cost, for a licensed plumber to install an approved connection device as a point of supply for the irrigation system.

6.3 Backflow prevention

6.3.1 In all instances a backflow prevention device, as approved by the Water Corporation, shall be installed immediately downstream of the scheme water take off point. Both the take-off fitting, and the backflow preventer shall be housed in an adequately sized, lockable valve box.

6.3.2 All pipe work installed between the take off point, backflow preventer, master valve, if applicable, and the start of the irrigation mainline shall be copper with fittings being copper or brass – all as approved by the Water Corporation.

6.4 Flow and pressure test

6.4.1 The Contractor shall carry out a flow and pressure test from the scheme water take off point and use these figures as a basis for design. The Contractor at his expense shall rectify sprinkler malfunction due to inadequate flow and pressure.

6.5 Master solenoid valve

6.5.1 This shall be a Water Authority approved, 24v AC, tested solenoid valve (or approved equivalent). The valve shall be installed immediately downstream of the backflow preventer and housed in accordance with the specification for the backflow preventer housing. As with backflow preventer, it shall be sized to minimise pressure loss.

7 TESTING, COMMISSIONING, AND MAINTENANCE

7.1 Warranty

7.1.1 The Contractor shall guarantee the system against faulty materials, workmanship, and performance for a period of 12 months from the Date of Practical Completion. Contractor shall submit to City of Wanneroo any material warranties given by the manufacturers that exceed 12 months.

7.2 Flushing and testing

7.2.1 The pipelines shall be flushed and cleared by the Contractor until they are clean to the satisfaction of the City. The Contractor at his expense will rectify valve or sprinkler malfunction due to inadequate flushing. Testing of the system will be carried out in the presence of the City representative immediately after flushing procedures are finished and the system is deemed to be operational.

7.3 System run

7.3.1 The system shall run for seven days on automatic program prior to hand over if during the summer irrigation season. All other times will require more thorough manual testing as directed by the City.

7.4 Cleaning up

7.4.1 Daily

The entire site must be left in a safe, clean, and tidy condition at the end of each day and any equipment, rubbish, spoil including any surplus material accumulated as a result of installation procedures, shall be removed or stored correctly by the Contractor at his own expense.

7.4.2 Final

An inspection of the condition of the site will be carried out prior to Practical Completion and, should the Contractor's efforts to clean up the site be unsatisfactory, monies will be withheld until the site is restored to an acceptable standard.

7.4.3 Practical Completion will not be certified until the site is cleaned to the City's satisfaction.

7.5 Practical completion

7.5.1 When required, the City shall be contacted to arrange a Practical Completion inspection. Practical Completion will not be deemed complete until the system is proven to have been installed in accordance with City specifications, be functioning normally, and all "as constructed" drawings and other required deliverables have been presented to the City of Wanneroo. Drawing and documentation is required prior to the practical completion inspection.

7.6 As constructed drawings

7.6.1 Prior to Practical Completion of the complete installation, the Contractor shall supply As Constructed drawings to the City for review. Each As Constructed drawing must be professionally surveyed by a licensed surveyor using a global positioning system pickup with survey data being prepared and supplied to the City in accordance with A-Spec format. O-Spec digital data specification outlines the requirements for the delivery of digital data relating to Public Open Space and Recreation assets.

7.6.2 Each As Constructed drawing supplied to the City of Wanneroo must:

- Be provided in an Irrigation only format and not be a layer or component of any other landscape or construction As Constructed plan.
- Be prepared in AutoCAD format and be supplied to the City as two electronic files (CAD and PDF). Electronic files are to be named using the following naming convention. Park name_ File type (CAD/PDF) _Plan type_ Revision number_ Date. Any electronic transfer of files to the City must ensure that all documentation is able to be utilised with all functions of AutoCAD. (all drawings to be legible)
- Have full survey information recorded on the nominated layers in a black light weight pen line or grey.
- As Constructed open space data to be provided in O-Spec. As-constructed data (O-Spec) shall be supplied in GIS ready format (MapInfo, TAB, SHP, MID/MIF) in accordance with the A-Spec digital data specification.

7.6.3 AutoCAD and PDF files must be submitted as described above to the City prior to any Practical Completion meetings with the City. All drawings must be legible.

7.6.4 Open space O-Spec data must be provided to the City as part of the As Constructed drawings and must be submitted prior to PC being awarded.

7.6.5 Where applicable the City may provide an electronic copy of the “As Designed” drawings to the Contractor for the purpose of updating to As Constructed drawings.

7.6.6 As Constructed drawings shall be prepared in accordance with the City of Wanneroo’s CAD standards. The City’s Irrigation Technical Officer may be contacted to obtain confirmation of drawing number, standard drawing template and a copy of current CAD standards.

7.6.7 Each As Constructed drawing shall include but not be limited to the location and details of the following

- Site plan in CAD format
- Irrigation cabinet and Dosing cabinet if installed
- Bore and headworks
- Irrigation pump
- Filters
- Mainline pipe including material, size and sections showing the flow values for each section, as entered in the flow manager data base
- All valves and Irrigation control valves, with valve number, flow (L/sec) and precipitation rate (mm/hour) for each valve and valve decoder number
- Lateral pipe material including size and class
- Sprinklers including make, model, nozzle size, output and radius at expected pressure
- Electrical components including wire paths, isolation switching, surge protection and cable pits
- Showing a GPS located position of:
 - Each decoder, which is not an irrigation valve decoder
 - All surge/lightning protection devices installed
 - All road crossings and
 - Every isolating valve, mainline and lateral T joint and pipe bend
- A legend showing details of all components of the installed irrigation system
- A Valve-Table showing details for each valve or other decoder activated component and including decoder address for each decoder
- A table showing each sensor decoder and condition monitored and any simultaneous station groupings (SSG)
- Existing services encountered during the installation and not identified by the service location company and
- All existing features to be in grey pen or black lighter line weight.

7.6.8 Additions or alterations to an existing irrigation system

Where the City can supply existing CAD drawings of a system the As Constructed drawings of all additions or alterations to an existing irrigation system must be prepared as per Clause 1.3 of these specifications and supplied as a revision of the original As Constructed plan of the entire system. Separate As Constructed plans of only the added or altered irrigation will not be accepted.

Where the City cannot supply CAD drawings of the system, any alterations or additions to the existing systems will be clearly marked on PDF versions of plans provided. These mark-ups will show all deletions of existing systems and additions to the systems and will include all items described in Clause 1.3 of these specifications.

7.6.9 At Practical Completion and handover, the system shall be put to test under normal automatic operation.

7.7 Final inspection and commissioning

7.7.1 On completion of all works the City of Wanneroo must be contacted to arrange a date for final inspection and commissioning. This process must not proceed without the City representative, being present.

7.7.2 Upon completion of all testing and functioning of the water supply system, the Contractor shall program the system to operate automatically at frequency to be advised by the City of Wanneroo.

7.8 Defects liability

7.8.1 The Defects Liability Period shall be a period of twelve (12) months from the date of Practical Completion for City commissioned projects or two (2) years for works undertaken as part of a development by others (or until the City takes possession of the irrigation component of the development). During this period the Contractor shall warrant their workmanship and will be liable for rectifications to any faults that arise because of the installation of the system and shall make good any faults that arise because of faulty materials manufacture.

7.8.2 The Contractor shall allow for returns to site as often as requested by the City during DLP to respond to defects related problems such as but not limited to:

- Sprinkler subsidence
- Sprinkler arc function and settings
- Valve box subsidence and sand ingress and
- Trench subsidence.
- Sprinkler malfunction
- Solenoid valve malfunction
- Controller malfunction
- Communication cabling malfunction
- Failed pipework or joints
- Pump issues (if part of installation)
- Electrical issues (if part of installation)

7.8.3 The Contractor shall include an allowance to attend any breakdown calls arising from his liabilities during the Defects Liability Period within 24 hours of notification by the City.

7.8.4 At the end of the defect's liability period, or when directed earlier, the Contractor shall raise sprinklers to the surface level of the turf and/or as specified above garden bed surfaces.

7.8.5 All repairs must be completed promptly. This relates to faulty materials and or workmanship and shall not affect any manufacturer's warranty.

7.9 Handover

7.9.1 The City of Wanneroo shall only take handover of irrigation infrastructure if, at the time of handover, all integrated irrigation works have been completed and are also due for handover. The whole irrigation system needs to be functional at the time of handover.

TO BE PROVIDED AT HANDOVER FROM DEVELOPERS

7.9.2 For the irrigation and bore/pumping systems, the Contractor shall supply one (1) set of any:

- Technical information, operating and maintenance manuals in digital form
- Irrigation As Constructed drawings showing any approved amendments that have been made to the City prior to Handover. These should be one (1) set in hard copy laminated in A3 situated in the irrigation cabinet onsite and one (1) set in electronic format including CAD and PDF files
- A Spec / O Spec information as per Clause 7.6.1
- Guarantees and warranties
- Any special tools, keys etc
- All software programs for any electrical components such as PLC and VFD's
- Electrical plans circuit diagrams and Certification
- Confirmation that the irrigation system meets the COW Standard Irrigation Specifications
- As Constructed Bore details including flow test data
- Irrigation pump details including service history
- Water test results
- A photograph printed in A4 of pump at the borehole prior to installation with a whiteboard showing the Date, Location, Contractor, along with the make, model and serial number of both the pump and motor

7.9.3 At this time the City may elect to carry out a pump motor earth leakage test and C.C.T.V. borehole inspection. This may result in the City requesting remedial works to the borehole or pump servicing prior to handover and at no cost to the City.