INFRASTRUCTURE MAINTENANCE

PARKS AND RESERVES

Document:

IRRIGATION ASSETS SPECIFICATION MANUAL

Reference #: **COD-PR-IA-01**

Application:

IRRIGATION STANDARDS FOR THE DEVELOPMENT OF PUBLIC OPEN SPACE PROJECTS TO BE MANAGED & MAINTAINED BY CITY OF DARWIN

Scope:

SPECIFICATION FOR PLANNING, DESIGN, SUPPLY, INSTALLATION, COMMISSIONING, AUDITS, UPGRADE &/OR MAINTENANCE OF IRRIGATION WORKS

Principal Irrigation Consultant:

HYDROPLAN

Rev: 0

PREFACE

INFRASTUCTURE MAINENANCE - PARKS AND RESERVES

IRRIGATION VALUES

CITY OF DARWIN IRRIGATION VALUES ARE TO

TO ENCOURAGE COMMUNITY SPORTS & RECREATION WITH;

SAFETY, ENVIRONMENT, CONSERVATION, SUSTAINABLILITY, PERFORMANCE, EFFICIENCY & STANDARDS

Contents

SPECIFICATIONS BY:

Principal Consultant: Scott Johnstone

E: sj@hydroplan.com.au P: 0427 327 790 W: www.hydroplan.com.au

A. Document Management

1. Document number

    1.1 This is a controlled document, # COD-PR-IA-01

2. Revision Log

    2.1 This is a document may not be changed without authorisation of the City of Darwin, Co-Ordinator Parks and Reserves &/or principal irrigation consultant (HydroPlan).

    2.2 Formal revisions and updates shall be distributed to relevant City of Darwin department managers, coordinators and team leaders for internal team distribution;

- Co-Ordinator Parks and Reserves
- Team Leader Irrigation and Turf
- Manager Infrastructure Maintenance
- Manager Capital Works
- Senior Capital Works Co-Ordinator
- Manager City Planning
- Town Planner

    2.3 Requests or recommendations on changes to this document shall be received in writing and considered by City of Darwin Co-Ordinator Parks and Reserves before consultation with stakeholders and if in agreement, changes will be made & manual updated.

    2.4 This document shall be listed in City of Darwin Planning Development Resources, referenced with Subdivision and Development Guidelines, plus City Planning, Capital Works & Infrastructure Maintenance department standards.

    2.5 City of Darwin technical support contact details for the Irrigation Assets Specification Manual are;

- Council: City of Darwin
- Contact: Team Leader Irrigation & Turf
- Dept/Sect: Infrastructure Maintenance, Parks & Reserves
- Postal: GPO Box 84, Darwin. NT. 0801
- Phone: (08) 8930 0300 or (08) 8980 3616
- Email: darwin@darwin.nt.gov.au

    2.6 Revision log below;

REVISION LOG - DOCUMENT #: COD-PR-IA-01

Rev	Details	Issue Date	Issue By	Dist Date	Issue To
Draft	Original draft issue – for internal review only, not for distribution	16/03/18	SJ	NA	RS/IS
0	Issue for implementation and distribution	24/04/18	SJ	26/04/18	ND/RS/IS
A					

3. Document control

    3.1 The continuance and distribution of this document is the responsibility of the City of Darwin, Co-Ordinator Parks and Reserves, and may not be altered without express permission.

4. Intellectual property

    4.1 This document is copyright and intellectual remains the property of the originating author. This document may not be distributed, sold, replicated or modified for commercial purposes in any way without written permission.

5. Principal Irrigation Consultant

    5.1 The City of Darwin principal irrigation consultant for Irrigations Assets Specification Manual is HydroPlan.

    5.2 Consultants contact details;

    - Contact: HydroPlan
    - Consultant: Scott Johnstone
    - Address: 15 Bittern Ave, Burleigh Waters. QLD. 4220
    - Mobile: 0427 327 790
    - Email: sj@hydroplan.com.au

B. Introduction

6. Introduction

6.1 This specification establishes a standard for all irrigation assets or works carried out within the City of Darwin local government region for works carried out on public property that is, or shall eventually be, managed and maintained by the City of Darwin.

6.2 The City of Darwin provides for sustaining public areas that benefit the community and environment by using efficient irrigation systems and implement responsible water management practices.

6.3 The requirement of areas to be irrigated may be site specific, refer 'Extent of Irrigated Areas' section below

7. Extent of Irrigated Areas

7.1 Applies to any irrigation asset or works that is or shall be managed by City of Darwin, including:

- All public sports turf surfaces.
- Public parks, recreation facilities, council building surrounds and memorial facilities.
- Road reserves and streetscapes particularly feature gardens and high traffic turf areas.
- Renovations, maintenance and upgrades for above.

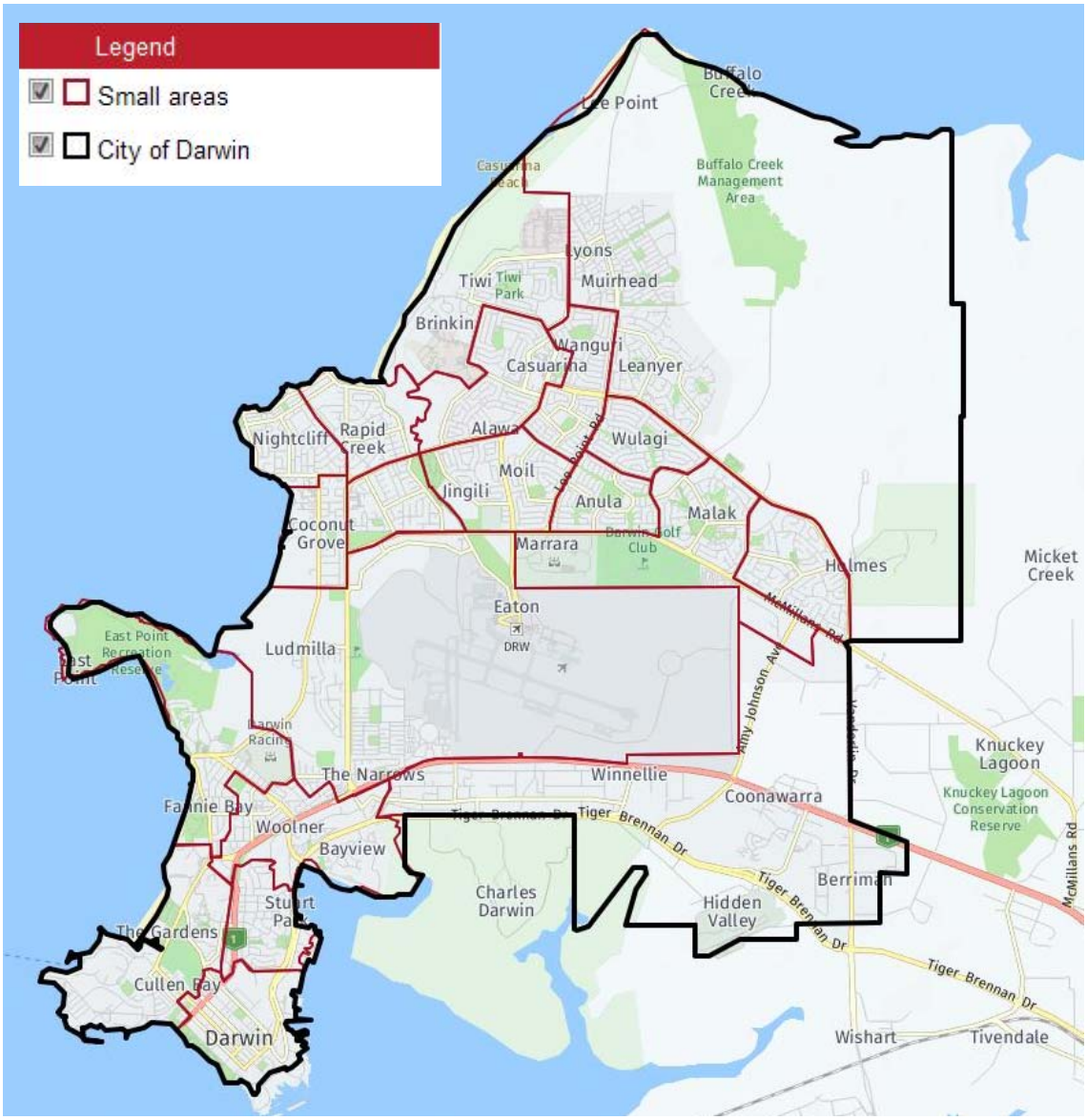
7.2 As directed by City of Darwin subdivision and development guidelines, approvals and/or permits.

7.3 As directed by City of Darwin department managers, coordinators or team leaders, as follows;

- Co-Ordinator Parks and Reserves
- Team Leader Irrigation and Turf
- Manager Infrastructure Maintenance
- Manager Capital Works
- Senior Capital Works Co-Ordinator
- Manager City Planning
- Town Planner

8. City of Darwin boundary map

8.1 Refer map below



City of Darwin,
Local Government Boundary Map
8.1

C. Preliminaries

9. Scope of Irrigation Specification

9.1 The scope of this irrigation specification applies to the design, supply, installation, commissioning and maintenance of irrigation systems for parks, sports fields, building surrounds and public open spaces that are now, or shall be managed by City of Darwin, Infrastructure Maintenance department, Parks and Reserves section. The scope includes works to be constructed by City of Darwin Capital Works department, private developers and commercial contractors.

9.2 Substitution of proprietary products will not be accepted without prior written approval from City of Darwin, Team Leader Irrigation & Turf. Some proprietary products provide for multiple brands or models. Non-proprietary products shall normally include wording, 'or equal' and proposed 'equal's' require approval. Products not specified must be of high quality, fit for purpose and where applicable meet relevant Australian or ISO manufacturing standards.

9.3 For items not included or provided for in this specification, installation details &/or product specifications shall be required to be submitted for approval by the City of Darwin, Team Leader Irrigation & Turf, prior to construction.

10. Irrigation values

10.1 Protect community investment by maintaining City of Darwin parks, sports fields, recreational grounds and gardens in good condition

10.2 Utilize irrigation assets and parks resources to have a positive environmental impact

10.3 Demonstrate water conservation by excellence in irrigation design and operational practices

10.4 Enhance public open spaces for the benefit of residents and community

10.5 Provide quality safe sports turf surfaces for the sporting community

10.6 Encourage recreation activities by providing functional open spaces

10.7 Support regional tourism efforts by providing attractive parks and facilities

10.8 Facilitate education of council staff and progress communication with community facility users in the responsible use of water for irrigation purposes.

11. Irrigation projects

11.1 City of Darwin Community Parks, Sports fields, Playgrounds, Memorials, Recreational spaces, Public buildings, Environment

Sport facilities and Recreation venues: The Gardens and Kahlin Ovals
11.1-1

Feature parks; Bicentennial Park, The Esplanade
11.1-2

12. Irrigation priorities

12.1 Set effective standards in irrigation system quality, performance & efficiency

12.2 Implement effective irrigation water management programs and irrigation system integration via PC based central control with remote site communications.

12.3 Utilize environmental sensor devices to facilitate accurate determination of irrigation requirements.

12.4 Consistency of irrigation control systems and key components to facilitate management and ease of maintenance.

12.5 Upgrades or renovations of existing irrigation assets, particularly larger parks and sporting facilities with high water usage requirements.

12.6 Monitor City of Darwin parks irrigation flows and water use budgets.

12.7 Provide effective ongoing system maintenance

13. Irrigation processes and flow charts

13.1 Refer Appendix A for process flow charts

13.2 Refer Appendix C for standard forms & checklists

14. Definitions or Abbreviations

14.1 Australian Standard issued by Standards Australia: AS

14.2 City of Darwin: COD or council

14.3 COD Parks and Reserves section: PR

14.4 COD Co-Ordinator Parks and Reserves: CPR

14.5 COD PR Team Leader Irrigation and Turf: TLIT

- TLIT may delegate specific tasks to assistant team leader Irrigation (ATLI) or authorised COD representative

14.6 COD PR Assistant Team Leader Irrigation: ATLI

14.7 COD Infrastructure Maintenance department: IM

14.8 COD Manager Infrastructure Maintenance: MIM

14.9 COD Capital Works: CW

14.10 COD Manager Capital Works: MCW

14.11 COD Senior Co-Ordinator Capital Works: SCW

14.12 COD Project Officer Capital Works: POCW

- SCW or POCW may be substituted and referenced in same context for project management purposes, as CPR and TLIT (above) where the project is being managed by Capital Works department
- POCW may delegate specific tasks to project supervisor or authorised COD representative

14.13 COD City Planning department: CP

14.14 COD Manager City Planning: MCP

14.15 COD Town Planner City Planning: TPCP

14.16 COD Information Technology department: IT

14.17 COD Manager Information Technology, MIT

14.18 Power Water Corporation: PWC

14.19 Main contractor: developer, project manager or principal contractor (may be council) pending contractual arrangements that may be specific to a project: PC

14.20 Irrigation Contractor, sub-contractor or main contractor if irrigation works only contract: IC

14.21 Original equipment manufacturer: OEM

14.22 Registered Professional Engineer: RPE

14.23 Irrigation Australia: IAL

14.24 Irrigation Australia Certified Irrigation Designer: CID

14.25 Inspection & Test Plan: ITP

14.26 Standard Construction Detail drawings: SCD

14.27 Standard Field Layout drawings: SFL

14.28 Bill of Quantities: BOQ

15. Disclaimer

15.1 Use of this specification, products or equipment does not negate the designer, contractor or manufacturer's warranty and responsibilities.

D. Technical Design, Standards & Drawings

16. Technical Contacts

16.1 All irrigation specification enquires may be directed to;

- Team Leader Irrigation & Turf, City of Darwin
- Phone: (08) 8930 0300 or (08) 8980 3616
- Email: darwin@darwin.nt.gov.au

17. Irrigation design

17.1 For City of Darwin projects, an irrigation design may be provided by COD Capital Works (CW) or Parks and Reserves (PR). The irrigation design by Certified Irrigation Designer (CID) shall be submitted to the COD PR Team Leader Irrigation & Turf (TLIT) for approval prior to tender or construction.

17.2 For irrigation design projects, the approved consultant shall allow to include;

- Scope Clarification meeting with COD PR TLIT &/or Project Officer Capital Works (POCW), plus invited stakeholders to confirm brief and requirements
- Draft concept drawings & cost estimate
- Meeting with COD PR TLIT &/or POCW for draft review & approval
- Detailed design drawings, BOQ & estimate of costs
- Confirm COD PR TLIT approval & required input for further tender or construction documentation as nominated

17.3 For irrigation design & construct type contracts, all irrigation design work must be carried out by a Certified Irrigation Designer (CID), endorsed by Irrigation Australia Limited, with appropriate experience and qualifications for the scale of project.

17.4 The irrigation design intent shall comply with council irrigation assets specification and standards contained herein and be consistent with industry best practices to provide efficient use of water, power, labour & maintenance inputs.

17.5 The irrigation design shall incorporate the use of proprietary products and equipment contained in this specification. Alternative products, or approved equivalents, recommended by the designer for specific applications may be submitted to the council TLIT with supporting specification data and justification.

17.6 Turf areas shall be irrigated using stainless steel popup (min 100mm) spray or rotor sprinklers of appropriate size for the scale of area and

minimizing potential for overspray. Exception may apply for temporary turf irrigation areas, refer below 18.

17.7 Gardens and planted areas shall be irrigated using popup (300mm) spray or rotary sprinklers of appropriate size for the scale of area and minimizing potential for overspray. Exception may apply for temporary planted or revegetation irrigation areas, refer below 18. Drip irrigation may only be used by written instruction from council TLIT.

17.8 Target Scheduling Co-efficient is ≤ 1.2 and shall not exceed 1.4

17.9 The sprinkler spacing shall be no greater than radius (head to head) in planted areas and low traffic turf areas.

17.10 The sprinkler spacing in sports turf shall be no greater than 90% radius.

17.11 For large radius turf rotors spaced greater than 15m it is undesirable to mix full circle and part circle sprinklers, and generally shall not be allowable on sports turf surfaces if part circle sprinkler radius or scheduling co-efficient does not meet requirement.

17.12 Sprinklers on a common valve or station shall have matched precipitation rates. Sprinklers or emitters with dissimilar precipitation rates must not be mixed together on common valve or station.

17.13 The sprinkler pattern may be square or triangular. Single row pattern may be allowable for long narrow areas less than 1.5m wide, provided precipitation rates are consistent and satisfactory coverage is achieved. Single row sprinklers must be on separate station.

17.14 Design irrigation requirements, based on peak season:

- Landscape & low traffic park turf areas 37 mm/week
- Sports turf surfaces & high traffic areas 42 mm/week
- Specific projects may have special establishment requirements, refer council TLIT or POCW.

17.15 Available irrigation time window:

- Total window available (potable WS): 10pm to 6am, 7 days/week
- Total time available (potable WS): 56 hours/week
- Total window available (recycled WS): 10pm to 4am, 7 days/week
- Total time available (recycled WS): 42 hours/week
- Specific areas or projects may have custom times or special allowances during establishment, refer council TLIT or POCW.

17.16 The irrigation hydraulic design shall ensure uniform and adequate pressure to all emitter outlets for optimum performance. Target total friction losses <10% across main pipework and +/-10% of

sprinkler design pressure along lateral pipework, with average pressure being design pressure. Pipe flow rates shall not exceed guidelines for maximum pipe velocities & flows– refer Appendix B.

17.17 The irrigation electrical control cable shall ensure adequate voltage to all automatic control valves. Voltage drop shall not exceed AS3000 or guidelines for maximum ULV cable runs – refer Appendix B.

17.18 Automatic control valve flow rates shall not exceed guidelines for maximum solenoid valve flows– refer Appendix B.

17.19 Automatic control valves shall have pressure regulation*. Control valves zones shall have similar topographic levels within the valve zone, where topography levels are in excess of +/-2m, or 10% of the sprinkler design pressure, individual pressure regulation of the sprinkler is required either at the nozzle or fitted to sprinkler base. (*) Exception for sports fields where pressure regulation is not required if; main inlet pressure is constant, rotor pressure is consistent & field topography has less than 3m variation.

17.20 Popup irrigation is preferred for all turf areas. Drip tube irrigation may be used for landscaped garden areas only where overspray, design constraints or other issues such as vandalism may present a risk. The irrigation designer should include brief statement with approval application outlining recommendation for drip irrigation. In specific cases the COD Parks and Reserves TLIT may require drip tube irrigation.

17.21 The irrigation design may need to allow spare capacity to cater for future stages or link adjoining to adjoining parks, where applicable.

17.22 For design & construct type contracts, the irrigation design layout (minimum concept design drawing with proposed; control locations, water supply location/capacity, main line routes, hatched irrigation zones-separate turf/gardens, grid/sprinkler type and performance notes) must be submitted for preliminary approval by the council TLIT. Detailed working drawings for construction issue shall be provided for approval by the council TLIT at least 15 working days prior commencement of irrigation installation. Council TLIT to provide conditions and/or design approval within 10 days of receipt of detailed design drawings. Acceptable format for approvals are A3 pdf. The pre-start meeting may be scheduled prior to final design upon request where site details require clarification.

18. Temporary irrigation

18.1 Exceptions may be allowable for temporary irrigation to establish grassed and revegetation areas on a case by case where approved by POCW or TLIT. Temporary irrigation should maintain efficiency and

schedules managed to meet plant requirements. Temporary irrigation shall maintain safety standards and be removed on satisfactory completion of establishment.

19. Drawing Standards

19.1 Base drawings with survey information, services and surface treatments shall normally be provided in AutoCAD format by the developer, principal contractor or project manager, unless otherwise specified in the contract. If drawing file uses external base drawing, survey or aerial photo, external reference files (X-REF's) must be included with drawing files.

19.2 The irrigation design drawings must be generated in AutoCAD or compatible format. The software version shall be recent edition & no older than 5 years, and compatible with council operating system.

19.3 The paper space scaling must allow for reasonable clarity and drawing interpretation. As a guide allow up to 1:250 for small or complex projects, and up to 1:500 for large or open spaces on full scale sheet. Where multiple sheets are required a master sheet shall be provided with a drawing schedule keying sheet numbers with adjoining sheets.

19.4 The drawing size may be A3 or A1 pending on the scale of project. Other sizes may be allowable upon request or approval by council TLIT.

19.5 Drawing shall use council standard title blocks, refer Appendix F, where applicable. In absence of Appendix F, the designer may use a title block to council TLIT approval.

19.6 The drawing title block and format must include, as a minimum; title block, legend, sheet size, scale bar, north pointer, council name, project name, drawing title, drawing number, issue dates, revision number, CID number, designer and contractor contact details.

19.7 The drawing legend shall list all irrigation pipes and key components shown on drawing scaled to clearly identify with sufficient product details.

19.8 The drawing shall notate irrigation window available, estimated irrigated area, peak irrigation duty required - pressure and flow as a minimum. Key performance criteria to also be noted, station flow rates and emitter application rates.

19.9 For clarity cable routes are optional where in common trench with mainline providing controllers and valves are cleared coded, with supporting drawing notes or table of cable type, sizes and number of cores. Spare wire valve box locations must be noted on drawings.

19.10 All key components shall be created in separate CAD layers with logic coded layer names, including but not limited to:

- Text
- Dimensions
- External references
- Controllers
- Pumps
- Cables, separate layer for each size & route
- Pipe, separate layer for each size & type
- Valves
- Irrigation emitters
- Hard surfaces
- Structures

19.11 For special components or custom arrangements not provided for in this specification, such as tanks or pump station, a construction detail drawing shall be required for approval by council TLIT.

19.12 All drawings shall include a plot file plus relevant external references. Preferred plot file reference 'COD IRR A1-A3.ctb'

19.13 When plotting to paper or pdf format do not 'scale to fit', all drawings must be either full scale or 50% reduction. Paper size must be clearly noted in title block of all drawing.

19.14 Drawings to be legible when plotted in black and white. Design drawings may be presented in color for ease of interpretation. Color may be used provided there is clarity when printed or copied by using most definite colors, and avoid using light colors such as yellow.

19.15 The preferred black pen sizes for lines or hatching are as follows;

• 0.2mm	Cyan	#4
• 0.25mm	White	#7
• 0.3mm	Green	#3
• 0.35mm	Yellow	#2
• 0.4mm	Magenta	#6
• 0.5mm	Red	#1
• 0.7mm	Blue	#5

- For hatching, avoid using solid hatch

19.16 Line types & line scales shall allow reasonable clarity of pipe, cable and key components plus be consistent with legend scaling when plotted.

19.17 The preferred black pen sizes for text are as follows;

• 2mm	Cyan	#4
• 2.5mm	White	#7
• 3mm	Green	#3
• 3.5mm	Yellow	#2
• 4mm	Magenta	#6
• 5mm	Red	#1
• 7mm	Blue	#5

20. Standards

20.1 All materials and work to be carried out where applicable in accordance with Australian Standards including:

- AS 4303 General Conditions of subcontract for design and construct
- AS 4300 General Conditions of Contract for Design and Construct
- AS 4130 Polyethylene (PE) pipe
- AS 4129 Fittings for polyethylene (PE) pipes for pressure applications
- AS 3500.1 Plumbing & Drainage, Water services
- AS 3000 Wiring rules
- AS2845 Water supply - Backflow prevention devices
- AS 2698.2 Plastic pipes & fittings for irrigation & rural applications – Polyethylene rural pipe
- AS 2698.3 Plastic pipes & fittings for irrigation & rural applications – Mechanical joint fittings for use with polyethylene micro-irrigation pipe
- AS 2566.2 Buried flexible pipelines, Installation
- AS 2142 General Conditions of Contract (for construction only type contracts)
- AS 2053 PVC wire conduits
- AS 2033 Installation of PE pipe systems
- AS 2032 Installation of PVC pipe systems
- AS 1477 PVC pipe & fittings
- AS 1432 Copper tubes for plumbing, gas fitting & drainage applications
- All relevant Australian Standards associated with these works

20.2 All materials and work to be carried out in accordance with state & local authority standards or requirements, including;

- NT local power authority requirements, Power & Water Corporation, and electrical codes
- NT local water supply authority requirements, Power & Water Corporation, and plumbing codes
- City of Darwin subdivision and development guidelines
- City of Darwin irrigation assets specification manual

20.3 All materials and work to be carried out in accordance Manufacturers specifications, installation & operating instructions.

20.4 Any conflicts identified are to be presented to City of Darwin TLIT for clarification and approval, which may be referred to council principal irrigation consultant.

21. Reference information

- Climate data http://www.bom.gov.au/
- Irrigation Australia http://www.irrigation.org.au/

E. Irrigation Audits & Planning Reports

22. Audit or Planning Scope

22.1 Where specified for existing facilities, irrigation audits shall measure irrigation system performance, evaluate key criteria and system management to help determine potential efficiency gains and improve surface quality. The objectives are to assist operations & maintenance staff to identify areas of improvement in the irrigation system, including;

- adopt best practice in irrigation agronomy & water conservation
- ensure sports fields are managed to be healthy, safe & durable surfaces
- recommend service requirements, improvements, renovations or upgrades
- impact on primary inputs & costs; water & power
- consider derivative costs; labour, fertilizer, chemicals and other inputs
- reduce environmental risks & foster sustainability

22.2 Where new development site a planning report may be required to access infrastructure and master plan irrigation requirements, via a planning report

23. Audit specifications or Planning report

23.1 Irrigation audit shall only be carried out by consultants approved by council TLIT that are either a certified irrigation auditor &/or designer with appropriate experience in similar scale projects

23.2 The specifications for an audit or planning report may vary depending on extent of existing services. For new development site some of the specification criteria (below) will be recommendations instead of evaluation.

23.3 The irrigation audit at each test site examines key performance criteria, including but not limited to;

- Capacity – identify water supply infrastructure & confirm capacity requirements
- Controls – confirm operation of all stations & sensors
- Equipment – rotor types & nozzle sizes, check matched precipitation rates & proportional program schedules for full circle & part circle operation
- Layout – grid spacing, pattern, radius & arcs

- Uniformity – catch can test in a representative grid, min 1 grid per sports field
- Precipitation rates – calculated in catch can test
- Rotor pressure – pitot tube tests, rotors as used in catch can test (low, ave, high)
- Flow rates – meter readings
- Scheduling – current program scheduling and water use
- Seasonal irrigation requirements – based on BOM data, and forecast water usage budget
- Plant observations – turf type & root depth
- Soil observations – type (additional testing optional)
- Budget estimates for recommended works

23.4 Optional audit or planning items, or where specified by council TLIT or POCW

- Specific infrastructure or external supply services research & testing
- Develop preliminary master plan, concept or detailed design – refer section D for technical design requirements
- Develop detailed cost estimates for renovations, upgrades or new works, where required
- Generate as constructed information – drawings &/or manuals, where unavailable
- Training: eg, develop site irrigation water management plan & implement programming
- Laboratory: water quality, soil & plant tests c/w evaluation report & recommendations

24. Site audits, tests, planning & reports

- In accordance with above scope & specifications
- Refer Appendix C for audit ITPs & report forms

F. Contractual Matters

25. Tenders & Contractual matters

25.1 Refer to City of Darwin contracts for all contractual matters, including but not limited to;

- Tenders
- Tender evaluation criteria
- Price schedules – BOQ & rates
- GST
- Contracts & commercial terms
- Insurances
- Payments
- Warranty & Defects
- Indemnity
- Discrepancies
- Disputes
- Workplace Health & Safety
- Traffic Management Plan
- Environmental Protection & Management Plan
- Prequalification of Irrigation consultants - designers
- Prequalification of Irrigation consultants - auditors
- Prequalification of Irrigation & pump suppliers
- Prequalification of Irrigation contractors

25.2 In the event that either a council contract is not in place, does not apply, or some tender and contractual matters are not covered under the works order or contract the following items may be used to address above contractual matter points.

26. Tenders

26.1 Where issued by council, tenders shall be weighted in accordance with project needs to take into account, including but not necessarily limited to the following criteria for irrigation contractors, consultants & auditors:

- Capability, similar type & size of projects completed
- Personnel, experience & qualifications
- Conformance, design and specification

- Submission, scope & detail
- Quality, safety & environmental plans
- Capacity, staff & equipment
- Availability, meet project delivery timeframes
- Value assessment, quantity survey & price
- Risk assessment, including insurance cover
- Locality, proximity to council or site, and local staff numbers
- References, recent similar projects
- Contractor performance, for past council projects
- Above criteria shall each be allocated weighting, to total 100%. Criteria may be grouped into relevant categories.

27. Price Schedules

27.1 Contractors to provide completed;

- Bill of Materials, for all key items, components or assemblies
- Schedule of Rates for staff, machinery, sandbed & sandfill
- Schedule of Rates for selected materials supply only, where applicable upon request

28. Goods & Services Tax (GST)

28.1 For GST inclusion, refer main or principal contract.

28.2 Where not instructed, show all amounts;

- Net pricing exclusive of GST.
- Separate GST amount.
- Total price inclusive of GST.

29. Contracts & Commercial Terms

29.1 The contract or commercial terms are not in the scope of this specification, refer council contract or works order.

29.2 Commercial terms are covered separately by the applicable contract or sub-contract with either: City of Darwin or nominated principal contractor. Where a contract has not been nominated either AS2124 (construction) or AS4300 (design & construction) shall apply, as applicable.

30. Insurances

30.1 Refer main or principal contract.

30.2 As a minimum or where not specified;

- Public Liability (supply &/or construction contracts), $20,000,000
- Professional Indemnity (for design & construct contracts), $10,000,000
- Workers Compensation, NT WorkSafe compliant
- Specific project insurances may be required, refer main contract terms and conditions

31. Payment & Retentions

31.1 Refer council contract or works order for all payment terms and conditions, including:

- Invoice dates
- Payment terms
- Guarantees, bonds or retentions

31.2 Where not clearly defined, payment terms and conditions must be nominated on quotation, for approval by council CPR or SCCW prior to commencement.

32. Warranty & Defects

32.1 Materials

- minimum 1 year against faulty materials or product defects
- extended product warranty where greater than 1 year in accordance with manufacturers specifications, terms & conditions

32.2 Workmanship, 1 year against faulty workmanship and defects unless stated otherwise in contract.

32.3 Provide a Warranty Schedule for all key components & items listing manufacturer, model & manufacturer's warranty term.

32.4 Time to complete defects &/or warranty work;

- Priority 1 – urgent leakage: within 24 hours
- Priority 2 – routine operation: within 5 days
- Defects not completed within acceptable timeframes may be rectified by COD and back charged to the contractor at discretion of council TLIT.

33. Indemnity

33.1 The intent of this specification is to provide a minimum standard for council irrigation assets and does not relinquish the contractor or

supplier from responsibilities not covered under this specification or normally associated with the scope of works.

33.2 The contractor or supplier shall familiarize themselves with the specification and raise any concerns prior to accepting or commencing works.

34. Discrepancies

34.1 In the event of a discrepancy, the matter shall be communicated immediately with the council TLIT or POCW.

34.2 Where there is a contradiction between this specification and project drawings, the specification shall take precedence however confirmation shall be sought if a discrepancy is found.

35. Disputes

35.1 In the event of a dispute, the matter shall be communicated immediately with the council TLIT or POCW.

35.2 If a satisfactory dispute resolution cannot be negotiated, the matter may be referred to the council administration for consideration. Minor unresolved matters may be referred to an independent arbitrator via the Institute of Arbitrators & Mediators Australia unless otherwise specified in the contract.

36. Irrigation consultants – Design

36.1 The irrigation consultant must have appropriate design experience in completing similar type and scale of project.

36.2 Irrigation consultant undertaking design work shall be a Certified Irrigation Designer in Landscape & Sports Turf (CID-LTG), issued by Irrigation Australia Limited, along with appropriate qualifications for the type & scale of project.

36.3 The council TLIT or POCW may request references of similar type and size design projects and certificates to pre-qualify irrigation design consultants &/or sub-consultants. For consultants having completed prior COD council projects, Contractor/Consultant performance report may be required & reviewed.

36.4 The irrigation consultant shall keep detailed records to prove all key design elements, including; meetings, irrigation agronomy, hydraulic, electrical, scope layout, performance, efficiency, scheduling, water budgets & cost budgets. Design records to be made available to council TLIT or POCW upon request.

37. Irrigation consultants – Auditors

37.1 The irrigation consultant must have appropriate audit experience in completing similar type and scale of project.

37.2 Irrigation consultant undertaking audit work shall be a Certified Irrigation Auditor issued by approved training provider, &/or appropriate qualifications for the type & scale of project.

37.3 The council TLIT or POCW may request references of similar type and size audit projects and certificates to pre-qualify irrigation audit consultants &/or sub-consultants. For consultants having completed prior council projects, Contractor/Consultant performance report may be required & reviewed.

37.4 The irrigation consultant shall keep detailed records to prove all key audit elements, including; meetings, testing & reports. Audit records to be made available to council TLIT or POCW upon request.

38. Irrigation & Pump suppliers

38.1 Irrigation & pump suppliers to council or nominated irrigation contractors shall have OEM authorized service agents for products offered with the capacity to deliver reliable technical and warranty support through OEM distribution network in council region.

38.2 The council TLIT or POCW may request references of similar type and size supply irrigation or pump projects, and provide OEM authorized service agent certificates to pre-qualify irrigation or pump suppliers.

39. Irrigation contractors

39.1 The irrigation contractor must have appropriate experience in completing similar type and scale of project.

39.2 All irrigation installation work must be supervised on site by an irrigation supervisor &/or foreman holding a Certificate III in Irrigation, issued by Irrigation Australia Limited or approved RTO, along with appropriate experience for the scale of project.

39.3 The council TLIT or POCW may request references of similar type and size projects and certificates to pre-qualify irrigation contractor, project supervisor, foreman installation, staff&/or sub-contractors. For contractors having completed prior council projects, Contractor performance report may be required & reviewed.

39.4 The irrigation contractor shall ensure a full set of current irrigation layout drawings, construction details and specifications are available on site, including amendments.

39.5 All irrigation installers, machinery operators and subcontractors on site must have appropriate training, competencies and supervision for their assigned tasks, along with current WHS Construction (white) card, permits &/or licenses.

G. Project Management

40. Pre-Start meeting

40.1 Conduct pre-start meeting at least 2 weeks prior to commencement. Attendance to include:

- Principal or Main contractor's project manager
- City of Darwin Team Leader Irrigation & Turf
- Irrigation contractor's project supervisor & site foreman

40.2 Review setout and installation of equipment

40.3 The irrigation contractor shall identify and flag all services along trench routes, prior to commencement of works.

40.4 Instruct all parties on program and co-ordinate timing, contractor to provide detailed schedule with milestone and hold points.

40.5 Refer Appendix C for ITP's & forms.

41. Final grade

41.1 It is the main contractor's responsibility to handover the site to irrigation contractor with bulk earthworks & soil final grade for all surface treatments is established or, in the event of any pre-works required pegged with finished levels notated.

41.2 Where there is staging of project, layers or levels, this shall be identified in project specifications or offer methodology, and responsibilities and timing clarified at prestart. For example;

- Where there maybe complex irrigation & drainage pipe placement zones within a perched water table construction profile, along with limiting potential contamination between subgrade, drainage & top soil layers within the soil profile.
- Where the surface must be laser graded after pipework installation, prior to fitting rotors, requiring relocation of rotor risers.

42. Interruption to Facility Use

42.1 The contractor shall co-ordinate all works with council TLIT or POCW to minimize disruption to facility use and consider priorities in relation to special events, etc. All work in progress shall be suitably backfilled &/or flagged by the contractor, and/or sub-contractors, where applicable

43. Site parking & access

43.1 Reasonable parking and site access shall be provided, or in accordance with main or principal contract.

44. Site Storage

44.1 Materials & equipment may be stored inside a suitable compound at a point to be decided by council TLIT or POCW. Responsibility of compound and facilities shall be in accordance with main or principal contract.

45. Site Tidiness

45.1 Site is to be kept tidy at all times by contractor. Project manager or main contractor to provide rubbish bins and removal, unless otherwise specified.

46. Work Health & Safety (WHS)

46.1 Refer to council project &/or panel contracts for all Work Health & Safety matters.

46.2 The irrigation contractor is responsible to maintain site safety standards at all times from site establishment to completion, handover & maintenance.

46.3 All works to be carried out in compliance of national & state work health & safety requirements. Safety manual and Safe Work Method Statements to be provided as required under main contract.

46.4 All workers on site must have a NT WorkSafe general construction induction (safety) card, have competency assessments (relevant tools, equipment or assigned tasks), plus undergo council/site safety induction prior to commencement of work.

46.5 Safety manual to be provided by irrigation contractor prior to prestart, including as a minimum;

- Site Safety officer & contact details
- Emergency contacts
- Safety signs, flagging & barriers
- Evacuation plan
- Risk assessments
- Safety Data Sheets (SDS)
- Safe Work Method Statements (SWMS)
- Personal Protective Equipment (PPE)
- Inductions
- Competency assessments
- Tools & equipment – inspections, tags & operator competencies
- Toolbox talks

- Site safety observations & audit
- Incident & Near miss reports
- Maintain accurate records & registers

46.6 All incidents &/or accidents must be reported & recorded to the council project manager (either TLIT or POCW), & authorized site safety representative immediately.

47. Site Induction

47.1 Refer main or principal contract.

47.2 All workers on site to be inducted in accordance with principal contractor or project managers requirements.

47.3 Undergo council site safety induction and compliance prior to commencement of work, where required.

48. Traffic Management Plan

48.1 Refer to council project &/or panel contracts for all Traffic Management matters.

48.2 Where works impacts on road network or pedestrian traffic a traffic management plan must be submitted, approved & implemented prior to commencement of work in impacted areas.

49. Environmental protection and management plan

49.1 Refer to council project &/or panel contracts for all Environmental Protection & Management matters.

49.2 All works to be carried out in compliance with state Environmental Protection Authority statutory requirements. Environmental management plan to be provided under main contract, where applicable.

49.3 Removal of overburden, spoil & rubbish in accordance with council Environmental Policy to approved facility.

50. Installation Program & Timing

50.1 Refer to council project &/or panel contracts for specific program timeframes and requirements, where applicable.

50.2 A detailed construction schedule in the form of a Gantt chart shall be required to be provided by the irrigation contractor and coordinated with the council TLIT or POCW for program approval prior to commencement of works on site, including;

- Design
- Pre-start

- Installation program (milestones & stages for large projects, including hold or inspection points as nominated by council TLIT or POCW, refer 51.2)
- Practical completion
- Commissioning
- Training
- On maintenance handover
- Maintenance program
- Off maintenance handover

51. Inspections and hold points

51.1 At the prestart meeting the council TLIT or POCW shall nominate a requirement for inspection, witness or hold points.

51.2 The requirement for inspection or hold points may depend on the scale and nature of the project. As an example, typical milestones during installation are;

- Setout power & water supply infrastructure.
- Power & water supply infrastructure installation & test.
- Setout main.
- Mainline installation – inspect trench, pipe, valves & cables – keep photo records of a representative sample of main trenches with pipes/cables installed, prior to backfill, at each section or stage.
- Mainline flushing & then pressure test.
- Setout sprinklers.
- Lateral & rotor installation.
- Lateral flushing – till clear of sediment & debris.
- Sprinkler/rotor nozzle fitout & adjust sprinkler/rotor arc & radius.
- Electrical earths & ULV control cable test.
- System Testing, including automatic operation, sensors & check flow rates.
- Full system commissioning, including IWMP, program & database entry.
- Handover inspection, OM manuals, as-constructed drawings & training.

51.3 Refer Appendix C for list of ITP's & forms

52. Commissioning & Testing

52.1 All relevant ITP's & test certifications shall be completed, signed by operator & witnessed by council TLIT or POCW, and submitted to council TLIT or POCW by practical completion.

52.2 Refer Appendix C for list of ITP's.

52.3 Backflow, RPZD;

- Test certificate and appropriate documentation to be provided to council TLIT or POCW by the contractor from a licensed plumber for any new backflow devices supplied by irrigation contractor – refer operations and maintenance manual.
- Check strainer is clean.
- Test performance, log pressure across a range of flows at least 2 points from minimum flow up to maximum design duty. Confirm consistent with design operating pressure requirements.

52.4 Water Supply Tank

- Confirm net capacity & inflow rate
- Confirm size & quantity inlets, outlets, overflow & drain points
- Confirm access ladders, hatches & locks
- Confirm level indication devices
- Confirm level sensors & operation or alarms
- Isolate refill, record water level, visual check & record water level after 24 hours. Confirm zero leaks or level variance within 24 hours.

52.5 Pump Station

- Check suction conditions
- Check pressure tank when isolated & vent to atmosphere, charged to 10% below cut in pressure setpoint
- Check discharge performance (Qmin to Qmax) at operating head
- Check voltage & current draw at maximum design duty
- Check stable operation, no hunting or short cycling
- Confirm operation & alarms for all sensor inputs &/or outputs
- Refer Appendix C for Pump station ITP

52.6 Control system;

- Test power & earth (resistance <5 ohms at controller, or meet OEM specification).
- Run diagnostics.
- Fill in station detail data sheet/s inside enclosure & insert copy with operation and maintenance manual.

- Setup irrigation programs in accordance with current maintenance requirements.
- Run test cycles, confirm operation.

52.7 Pipework;

- Flush all pipework, mainline first then laterals, prior to final sprinkler fit out & operation.
- Pressure test mainlines to 1000kPa for 30 minutes in accordance with AS2566:2. Identify and fix, if any leaks. Repeat test until within tolerance within allowable make up water, isolate areas where required. Provide ITP with make-up water calculations & results, to be witnessed by council TLIT or POCW. Send ITP's to council TLIT or POCW & include copies with O&M manual.

52.8 Control cables.

- Check earth, circuit/coil resistance and voltage drop within AS3000 & manufacturer's specification. Identify and fix, if any outside tolerance. Repeat test until within tolerance. Provide ITP with relevant calculations & results, to be witnessed by council TLIT or POCW. Send ITP's to council TLIT or POCW & include copies with O&M manual.
- For decoder systems, ground resistance <50 ohms for all wire paths or meet OEM specifications

52.9 Valves

- Check all manual valves and set manual valves to correct position for normal operation.
- Set flow control on all solenoid valves for smooth open/close operation.
- Set pressure regulating modules on solenoid valves to correct design operation pressures, refer drawings and sprinkler specification and selection charts.
- Check automatic operation of all solenoid valves.
- Check valve box lid &/or SS tag ID's.
- Remove flagging, if no longer required.

52.10 Sprinklers & Rotors

- Ensure final height set to correct grade.
- Ensure no blockages or debris in sprinkler or nozzle.
- Check suitable nozzle pressure.
- Adjust arc & diffuser where required to minimize overspray.
- Remove flagging, if no longer required.

52.11 Drip zones

- Open flush valves until clear of debris.
- Clean filters.
- Test all drip zones during commissioning at end of line flush valves for acceptable pressure range, minimum 175 kPa to maximum 250kPa, by connecting pressure gauge to flush valve hose.

53. As constructed drawings

53.1 Refer 'Drawings standards' section.

53.2 Refer Appendix F for standard title block.

53.3 Maintain accurate updates on drawings throughout construction activity.

53.4 Show locations of all spare wires, mark 'SP' on drawings.

53.5 Scaled pdf's to be submitted with operation & maintenance manual.

53.6 Update autocad files on completion to be submitted to council TLIT or POCW, prior to handover.

54. Operation & maintenance manual

54.1 Two hard copies in binders, with index & sectional dividers with soft copy on USB flash drive (folders to mirror index) inserted in each binder, including;

- List assessment of sites potential WHS risks.
- List assessment of sites potential environmental risks.
- Contact list – contractor/s, service agents, and key personnel.
- List main supplier/s for each key component.
- As constructed drawings, scaled A3 (min sheet size).
- Include a spreadsheet with all stations details included valves sizes, sprinkler type, spacing, nozzle selection, total flows & precipitation rates.
- Controller program charts with peak monthly run times for all stations based on historical weather data from nearest Bureau of Meteorology weather station. Use forms in this manual, refer Appendix B.
- Water management plan with water budget % for each month, based on historical weather data from nearest Bureau of Meteorology weather station, completed with total irrigated site area and estimated monthly water usage. May reference tables in this manual, refer Appendix B.

- Technical specification data for all key components.
- Test certificate from a licensed plumber for any new backflow device/s supplied by the irrigation contractor, where applicable.
- Manufacturer's manual for operation & maintenance of all key components.
- Include system trouble shooting chart/s detailing common faults, diagnostics & remedies.

55. Training

55.1 Training is on the basis of when required or requested.

55.2 When required, allow for training of relevant council staff plus key stakeholders of facility at the start of maintenance period, by invitation to council TLIT, and council POCW if relevant.

- Expect 2 to 6 attendees.
- Allow 2 to 4 hours, about 50% in class room format (site clubhouse with projector, agenda handouts & OM manuals) & 50% in field ('hands on' with equipment).

55.3 Training agenda to be submitted min 5 working days prior to training date, to include:

- Introduction to 'Operation & maintenance manual', detailed in section above. Overview of contents of in each chapter & examination of as-constructed drawing set.
- Detail specific current and/or future irrigation requirements including irrigation application rates & frequency. Examination of Irrigation Water Management Plan (IWMP).
- Water supply; overview of flow capacity and pressure requirements.
- Pump station; settings, programming, operation, inputs & alarms.
- Control system; settings, programming, operation, inputs & alarms.
- Valves & filters; settings, operation and maintenance.
- Sprinklers; nozzles, settings, operation and maintenance.
- Drip tube zones; operation, flushing and maintenance.
- Basic troubleshooting, include any special tools & available spare parts.
- System startup & shutdown.
- Routine service & seasonal maintenance requirements. Refer Operations Manual & Maintenance Manual, plus Maintenance Program requirements below.
- Keep log for recording service & maintenance.

56. Practical Completion

56.1 Refer to council project &/or panel contracts for specific Practical Completion matters.

56.2 Refer Appendix C for ITP's & forms.

56.3 Where not specified, assume at completion of supply & installation phase with basic system operation functionality. Installation may be completed in stages – this should be reflected in construction program where required.

57. On Maintenance Handover

57.1 Refer to council project &/or panel contracts for specific maintenance matters.

57.2 Upon completion the contractor shall arrange the On Maintenance Handover site inspection with council TLIT or POCW. The contractor shall target zero defects prior to handover inspection. If for logistical reasons portions of the works cannot be completed at completion milestone, partial or staged inspection process may be requested. Allow at least 5 working days notice for all inspections.

57.3 Satisfactorily complete COD Irrigation Handover Checklist – refer Appendix C - and council TLIT or POCW will sign or issue On Maintenance notification providing there are no major defects after satisfactory site inspection. Any outstanding works or defects will be listed on Handover checklist.

57.4 Minor defects may be allowable during maintenance period providing they are rectified within 1 week of On Maintenance notification. Completion of defects may be as instructed pending nature and urgency of the defect/s, providing all defects are completed before off maintenance inspection.

57.5 The council TLIT or POCW shall inspect defects at any time after Practical Completion Handover and again at end of Defects Liability Period Handover. If required, additional formal COD irrigation inspections due to defects shall be at the cost of the contractor, at the discretion of council TLIT or POCW.

57.6 Council may undertake outstanding defects not rectified within the nominated timeframe. The rectification costs may be passed onto the irrigation contractor if the outstanding defects are deemed to be the responsibility of irrigation contractor.

58. Maintenance Period

58.1 Refer to council project &/or panel contracts for specific maintenance matters, where applicable.

59. Vandalism

59.1 Refer to council project &/or panel contracts for vandalism matters, where applicable.

59.2 Where not specified, generally the irrigation contractor's responsibility up until on-maintenance inspection is completed, after which time the responsibility transfers to the main contractor or project manager until the end of maintenance period. At completion of the maintenance period council IM will assume responsibility for all maintenance requirements directly due to vandalism.

60. Maintenance Program

60.1 Refer to council project &/or panel contracts for specific maintenance matters, where applicable.

60.2 Monthly inspections to include:

- Function test each station & check correct operation.
- Check for pump & controller alarms.
- Check for leakage & overspray observations.
- Check for blockages, non-rotation & stuck up sprinklers.
- Make plant health, weather and soil moisture observations.
- Adjust controller program to suit current seasonal requirement, monthly water budget %.
- Log flow meter readings and calculate actual monthly water use, check budgeted monthly water use. Confirm no leakage when system static.
- Record monthly inspection on COD Irrigation Maintenance Report form – refer Appendix C, attach photo's if any unusual incidents or vandalism.
- Note any faults and report issues to council TLIT or POCW as applicable.

60.3 NOTE: The irrigation intervals should be extended to normal seasonal requirements within 1 to 2 months from establishment of each stage & with program times adjusted to suit - the main contractors maintenance staff needs to be informed of this during 'Training' section, above.

61. Defects Liability Period

61.1 At completion of Defects Liability Period the contractor shall arrange the Defects Liability Period Handover site inspection with council TLIT or POCW. The contractor shall target zero defects prior to handover inspection. Allow at least 5 working days notice for all inspections.

61.2 Review of completed COD Irrigation Handover Checklist – refer Appendix C -and council TLIT or POCW will sign or issue notification of completion of Defects Liability Period providing there are no defects after satisfactory site inspection. Any outstanding works or defects will be listed on Handover checklist.

61.3 Minor defects may be allowable providing they are rectified within 1 week of Off Maintenance notification, or as instructed pending nature or urgency of the defect/s.

61.4 The council TLIT or POCW shall inspect defects at any time within 1 month of Off Maintenance Handover to confirm rectification. If required, additional formal COD irrigation inspections due to outstanding defects not rectified shall be at the cost of the contractor, at the discretion of council TLIT or POCW.

61.5 Council may undertake defects not rectified within the nominated timeframes by the contractor. Emergency repairs within 24hours, routine repairs within 5 working days. The rectification costs may be passed onto the contractor if the outstanding defects are deemed to be the responsibility of contractor, as determined by council TLIT.

62. Subcontractors

62.1 All sub-contractors must have statutory licenses, appropriate experience and competency assessed for assigned tasks or works to be carried out, including; plumbing, electrical and machinery operators.

63. Machinery & Equipment

63.1 All machinery and equipment shall be fit for purpose and be operated by appropriately trained &/or licensed personnel as required with competency assessments.

63.2 Machinery or equipment requiring registration or safety tags shall have current sticker or inspection tags.

H. Supply of Services

64. Water supply

64.1 Incoming water supply shall normally be provided by the developer, principal contractor (which may be council) or project manager, unless otherwise specified in the contract.

64.2 The irrigation contractor is required to specify duty requirements to meet irrigation design criteria, including dynamic pressure at required peak flow.

64.3 The main or principal contractor is responsible to provide confirmation &/or testing or water supply capacity where required. For potable & non-potable water supply, the modeling data can be requested from COD or PWC water supply engineer where required, in particular where infrastructure may not yet be available during design or preliminary construction stages.

64.4 Potable water: Incoming water supply infrastructure c/w isolation valve, PWC meter & stub of adequate capacity within irrigation area precinct to be provided by the principal contractor where specified at the proposed backflow prevention device location. The irrigation contractor shall normally provide the backflow prevention device and downstream irrigation system, unless otherwise specified. Should potable supply capacity be inadequate then the option of break tank with booster pump station shall be considered as an alternative. Detailed layout and design data is to be provided for any proposed break tank or boosted system by principal contractors irrigation consultant (CID) when required or requested by council TLIT or POCW.

64.5 Alternative water sources: Alternative water sources may be used; such as; non-potable, recycled water, stormwater harvesting, bore or river providing the water is of sufficient capacity, suitable quality, appropriate risk assessments are met. Detailed layout and design data is to be provided for any proposed alternative water source, along with appropriate water management plan, applicable permits or licenses.

65. Water Use

65.1 Water use shall normally be provided by the developer, principal contractor or project manager, unless otherwise specified in the contract.

65.2 The irrigation contractor is responsible for monitoring water use from commencement through to completion, and throughout maintenance period where applicable.

65.3 Costs associated with excessive water use may be attributed to the irrigation contractor if deemed to be negligent in demonstrating reasonable duty of care. Greater than 25% of estimated seasonal water use shall be deemed excessive. Estimated seasonal usage shall be adjusted accordingly in the case of unseasonal weather conditions, such as extreme heat or significantly below average rainfall. The council TLIT or POCW is responsible for reporting any known excessive water usage if detected prior to completion (off maintenance), or as soon as identified in the case or major defect, to the irrigation contractor.

65.4 The council TLIT and ATLI are responsible for managing water usage once the system has passed practical completion handover, is connected to the council central control system and being managed by council PR.

66. Non-potable water

66.1 Some council parks & sporting facilities may use non-potable water such as; storm water, bore, river or recycled water.

66.2 Where alternative non-potable water sources are to be used such as; raw water or recycled effluent water;

- Lilac identification is required for recycled water on all: pipes, valve boxes and sprinklers
- Erect signage on site at two or more visible appropriate locations, such as park & field entry points, eg; for raw water 'Non potable Water used for Irrigation purposes at this facility – Do not drink' for recycled water 'Recycled Water used for Irrigation purposes at this facility – Do not drink & avoid contact'.
- All signage; location, materials, size & art to be approved by council TLIT or POCW to meet COD signage requirements.

66.3 Contractor to comply with Australian Guidelines for Water Recycling. Including implementation of;

- Risk Assessment and WHS
- Recycled water management plan (RWMP)
- Environmental protection and management plan

67. Power supply

67.1 Incoming power supply shall normally be provided to a nominated distribution point by the developer, principal contractor or project manager, unless otherwise specified in the contract.

67.2 The irrigation contractor is required to specify power requirements. The main or principal contractor is generally responsible to provide

confirmation &/or testing of available power supply capacity where required.

67.3 Incoming power supply connections required to irrigation controllers, pumps and associated equipment where applicable at nominated points within irrigation precinct at nominated locations. Surge protection be included in all power outlets. Scope of electrical work for irrigation contractor to be confirmed with project design and detailed on drawings by CID.

68. Access conduits & penetrations

68.1 Access conduits under roads, paths and hard surfaces shall normally be provided by the developer, principal contractor or project manager, unless otherwise specified in the contract. Minimum under road or path conduit size, 100mm PVC PN9. Larger or multiple conduits may be required to suit size & quantity of irrigation pipes & cables – refer irrigation design drawings. Install bronze kerb makers stamped 'IC' where conduits installed under roads with kerbs.

68.2 Seal all access conduits with expanding foam.

68.3 Do not allow moisture ingress to conduits providing access into electrical panels, eg; seal & vent conduit &/or elevate panel.

68.4 Penetrations through walls and buildings shall normally be provided by the developer, principal contractor or project manager, unless other specified in contract. All pipe or conduit penetrations to be sealed neatly and lagged through to protect against concrete or sharp edges where appropriate.

68.5 The irrigation consultant (for design contracts) or contractor (for design & construct contracts) shall be required to provide an access conduits plan to the principal or main contractor where applicable at the early planning stage of project.

I. Water Supply Tanks, Pumps & Treatment

69. Water Tanks

69.1 Generally water tanks are not required unless specified, typically for;

- Where an alternative or additional water source to potable is planned.
- Where the irrigation design duty exceeds the potable water supply capacity and requires a break tank and pump station.

69.2 Tank capacity shall allow for reliable irrigation water supply during peak season based on climatic data and based on balancing inflows and outflows.

69.3 Site specific specification and construction detail shall be required for approval by council TLIT or POCW. The following water tank product and installation information is provided as a guide only.

69.4 Products

- Tank size & capacity to be determined by irrigation designer (CID).
- Above ground < 45kl, light green poly. Bushmans or approved equal
- Above ground > 45kl, light green colorbond steel with liner. Altanks or approved equal
- Above ground & Underground, reinforced concrete. Approved contractor with appropriate qualifications & sound experience.
- All tanks, ladders & accessories must comply with relevant Australian Standards.

69.5 Installation

- Refer Appendix D for standard construction details.
- On completion, fill tank and perform minimum 24 hour leak test. Submit witnessed ITP for tank confirming: test and water levels for inlets, outlets, overflow & all sensors. Refer Appendix C for ITPs (part of pump station ITP)
- Level compacted base with sand or crusher dust capping
- Fittings to include; inlet, float valve*, overflow to waste, lockable inspection cover, outlet, discharge valve & drain valve to waste. (*) for float valve – refer ‘Hydraulic Control Valve’ section.
- MultiTrode level sensor (tank height) with MTIC in wall mount enclosure, connect input to pump control panel & pause pump at low level (400mm above suction outlet). Other inputs may be required for; start, stop, interrupt & alarm signals.
- External visual mechanical float level indicator fitted to tank.

- Security enclosure fence with access gates for tank compound, is only required on specific sites where requested by TLIT. Refer COD lock type & master key requirements - below. The foundations, hardstand and edge surround are minimum requirements for maintenance.
- Inspection access hatch cover to be fixed or lockable, refer COD lock type & master key requirements - below.
- For all tank access hatches or fences, use COD approved lock fixing type specific for hatch or gate type. Confirm lock fixing type requirements with council TLIT or POCW. A temporary lock provided by contractor shall be required for security until handover to council. Council shall supply an approved COD master keyed lock to be fitted at handover.
- Extended service entry hard surface treatment may be required for tank compound to provide access from nearest available driveway or road.
- Installation of all tanks, ladders & accessories must comply with relevant Australian Standards.
- Must comply with council Health & Building regulations.
- If any RTU or SCADA system network integration requirements – request information from council &/or PWC.

70. Pumps

70.1 Generally pumps are not required unless specified, typically for;

- Where an alternative water source to potable is planned.
- Where the irrigation design duty exceeds the potable water supply capacity and requires a break tank and pump station, or inline booster pump station.

70.2 Pump duty must meet peak season irrigation requirements, plus any specified future or standby duty.

70.3 Site specific specification and construction detail shall be required for approval by council TLIT or POCW. The following pump product and installation information is provided as a guide.

70.4 Products

- Surface mounted pumps, vertical multistage. Franklin VR, Grundfos CRI, Lowara eSV (* min 304SS – refer note below), or approved equal.
- Submersible pumps, multistage borehole. Franklin 4400/SR, Grundfos SP, Lowara GS/Z6 (* min 304SS – refer note below), or approved equal.

- VFD and Multi-pump applications: Franklin DrivE VR/BU, Grundfos Solo-E/MPC or Lowara Hydrovar, or approved equal.
- Special applications: Franklin, Grundfos, Lowara or approved equal.
- Pump & motor construction materials selection to suit water quality.
- (*) Minimum 304 grade Stainless Steel for pump wet end component and manifold pipework construction in low corrosion risk & potable water applications.
- (*) Minimum 316 grade Stainless Steel for pump wet end components and manifold pipework construction in moderate corrosion risk & recycled water applications.

70.5 Installation

- Refer Appendix D for standard construction details.
- Test and complete witnessed pump station ITP prior to handover, refer Appendix C
- Packaged pump stations are required unless otherwise stated. Packaged pump stations shall be manufactured by the pump OEM or pump OEM's authorized distributor
- Single pump control panel minimum requirements to include; mains isolation switch, on-off-auto selector, pressure control, low pressure protection with delay timer, low level pause protection, alarm output, starter, switchgear and all sensors. In addition, multi-pump control panels shall have a control unit with display and keypad with user friendly menus for system status, operator setting adjustments, data and alarm logs. Panel components to be clearly labeled, cables tagged and circuit diagram provided with instruction manual.
- Pump selection shall ensure seamless operation within the design pressure range from minimum to maximum flow range without cycling or hunting.
- Variable speed control shall be required for motors > 4kW, flows > 3 l/s, and where flows are significantly variable > 20%. All VFD motor cables must be shielded and grounded in accordance with manufacturers recommendations.
- Multiple pumps may be required for large flows >10 l/s, variable flows or duty/standby capability.
- Submersible pumps shall normally be fitted in a vertical orientation and ensure minimum water velocity across motor is achieved during operation. Submersible pumps may be mounted horizontally where required for tank, dam, river or inline applications providing the pump is fitted with a cooling tube, supports, fixings, cables & connections suitable for application approved by manufacturer

(OEM) or certified by registered professional engineer (RPE). A motor cooling shroud must be fitted to all submersible pumps in well or tank installations, and in any application where minimum water velocity over motor is below manufacturer's requirement.

- Pump station valves and associated equipment shall generally include, but not limited to; foot valve(w/a), isolation valves, pressure gauge, pressure tank with both isolation & vent valve, check valve/s (w/a multi-pump) and flow meter. A flexible connection or single rubber sphere coupling is required on pump discharge manifold take off connection. Valves and equipment material construction shall be graded in accordance with suitability for water quality.
- Pump station pipework shall be stainless steel, graded in accordance with suitability for water quality. Unless stated, generally 304 grade stainless steel for water with low corrosion risk (potable water), and 316 grade stainless steel with moderate to high corrosion risk (raw or recycled water). Passivate all pipe welds. Copperwork and polyethylene (PE100) may also be used for connection pipework.
- Support and anchor all suspended pipework, using stainless steel or HDG MS fabricated brackets, with stainless steel or galvanized fixings. Unistrut brackets & Ramset fixings, or equal.
- A stainless steel base plate or HDG MS base frame, with stainless steel or galvanized fixings, is required. Shim to level.
- Slab and secure enclosure or shed shall be required, if not available or provided by others.
- For externally mounted pump control panels, fit in IP66 weatherproof 316 stainless steel or marine grade alloy lockable enclosure. Eldon or equal. Ensure no sharp edges to enclosure cut outs & all fillings or swarf is removed from panel.
- For all pump enclosures, sheds or fences use COD approved lock fixing type specific for enclosure, door or gate type. Confirm lock fixing type requirements with council TLIT or POCW. A temporary lock provided by contractor shall be required for security until handover to council. Council shall supply an approved COD master keyed lock to be fitted at handover.
- For pump shed where specified, unless otherwise stated use industrial quality colorbond steel shed with; adequate clearances, cross flow ventilation, vermin proof, access door/s (lock master keyed to COD), general power outlets , internal lighting & external weatherproof sensor light. Comply with local building code &/or permits, taking into account; location, wind rating and soil type – for structural engineering and slab construction elements. Ranbuild or

equal, builder must be approved by council TLIT or POCW. External finishes colour, Wilderness green unless otherwise specified.

- Seal pipe penetrations neatly using rubber flange gussets to all enclosure entry and exit points. Apply lagging where required to protect pipe.
- If any RTU or SCADA system network integration requirements are specified – refer council or PWC.
- Install quick acting pressure relief valve downstream of pump unit & upstream of main isolation or master valve. Set below pipe PN rating and at nominal 50-100kPa below pump shut off head. Bermad IR43Q or 430.

71. Water Treatment

71.1 Water treatment is generally not required unless specified in main contract and does not form part of this specification, other than basic sediment filtration.

71.2 The contractor to recommend advice be sought where there are concerns over water quality, such as recycled or storm water, and the proposed application. In this case analysis of water, soil and/or plant samples will be referred to a recognized industry consultant for site specific recommendations to be considered, for example;

- Ultra Violet for disinfection.
- Synthetic acid dosing to pH buffer, for water pH >7.5
- Calcium dosing to buffer Sodium toxicity &/or improve nutrient uptake.
- Surfactant dosing to improve water penetration in hydrophobic soils.
- Liquid fertilizer injection for foliar uptake & plant nutrition utilisation.

71.3 For site specific water treatment, where recommended or required, refer council TLIT or POCW for approval.

72. Primary Filter

72.1 Generally mainline or primary filters are not required with potable water supplies connected directly to RPZD or DCV assembly which has a strainer unless specified, typically for;

- Where an alternative water source is used or water quality (sediment load) concerns.
- Where a break tank and pump station is required and water quality (sediment load) concerns.

72.2 Filter capacity must meet or exceed peak flow requirements and factor in water quality for minimal maintenance. Water sampling and analysis may be required. Routine manual filter cleaning or maintenance requirements shall be kept to the minimum.

72.3 Site specific specification and construction detail will normally be required for approval by council TLIT or POCW. The following filter product and installation information is provided as a guide only.

72.4 Products

- Semi-automatic filters, screen with brush kit & flush valve. Flows < 4 l/s & relatively low sediment load clean water quality. Triangle Filtration & Irrigation 500 series c/w vacuum suction nozzle minimum PN10 rated. Size capacity within manufacturers recommendations based on sediment load. Screen size 200 micron for rotor/sprinklers or 120 micron for drip tube.
- Automatic filters, electric interval timer & hydraulic differential. Flows > 4 l/s &/or moderate-high sediment load water quality. Filterworx Stainless Steel body automatic self-cleaning, minimum PN10 rated. Size capacity within manufacturers recommendations based on sediment load. Screen size 200 micron for rotor/sprinklers or 120 micron for drip tube.

72.5 Installation

- Refer Appendix D for standard construction details.
- Fitting to include; upstream isolation valve, upstream pressure gauge, vent valve, flush valve, flush pipe to waste, downstream isolation valve, downstream pressure gauge. Where suitable waste drain is unavailable, route flush outlet to nearest swale drain a concrete headwall with apron, extend flush pipe through headwall and install with frog flap to outlet.
- Automatic filter configuration also requires by-pass pipework manifold including 2x addition isolation (butterfly) valves sized to main manifold.
- Clean & test all filters prior to handover

J. Irrigation Control Systems, Sensors & Components

73. Central Control System

73.1 City of Darwin has an existing PC based central irrigation control system using Aquamonix Rainman Master Central software.

73.2 Product: HP workstation or equal

73.3 Computer hardware & accessory, min requirements (*)

- Min 1TB Hard drive
- Min 3 Ghz Intel Processor, i7 or later
- Min 12 GB RAM
- Min 4 GB dedicated graphics card
- Modem
- Plain phone line port
- 4x USP ports
- HDMI port/s
- Network port
- Audio out & microphone ports
- DVD-RW
- Multi- media card readers
- Sound card & speaker/s
- 3 year on-site warranty
- 22” Full HD monitor
- Keyboard & wireless mouse
- Multi function printer, A4 color copy, scan & fax
- External modem, dial up
- Min 1 TB External backup hard drive
- Uninterrupted Power Supply (UPS) c/w surge protection filter and min 4 hours backup power supply to computer

73.4 Computer software min requirements(*);

- Operating System, Windows 10 Pro or most recent compatible with both Rainman Master Central & City of Darwin requirements
- Irrigation central control, Aquamonix Rainman Master Central, most recent version
- Administration, Microsoft Office Professional, most recent version

- PDF reader, Adobe
- Remote management, refer council MIT where allowable
- Anti virus protection, most recent version, refer council IT requirements
- (*) Hardware & software requirements are subject to confirmation at time of upgrades. Equipment & software version #.#'s should be the most recent unless otherwise specified or compatibility issues. Software & equipment must be compatible.

73.5 All new field controllers and system upgrades shall be Rainman (^) and must be compatible with Rainman Master Central software, c/w current Netcom communications module

73.6 (^) Alternative control options may be allowed at the request & discretion of council TLIT for specific sites an alternative control options may be allowable for trials, future upgrades, minor or isolated standalone sites.

- The consultant or contractor must seek pre-approval for design, specifications & construction details where applicable for any alternative control systems from council TLIT, with written instruction, prior to construction.

73.7 Installation

- Refer Appendices A & B for IWMP program guide.
- Refer Appendix D for standard construction details.
- Connect all computer hardware including backup drive, external modem, UPS & printer c/w cables
- Earth all interfaces in accordance with manufacturers recommendations, with grounding grid < 5 ohms resistance.
- Load all software and configure all equipment
- Load database for all field controllers & setup initial programs
- Confirm remote communications
- Create backup database & backup schedule

74. Communications

74.1 NetComm Wireless cellular network communications module, to suit Rainman field controllers, fitted to approved enclosure.

74.2 Field satellite controllers currently use, NetComm NTS-3000 series communications module. Note: as future network upgrades occur the communication module shall be upgraded to meet current COD requirement as compatible modules become available. Council to supply Telstra data SIM card, refer below 74.3.

74.3 Council TLIT or ATLI shall provide a Telstra SIM card for field controllers, with data number enabled and PIN disabled, upon application request from irrigation contractor. Refer council TLIT for application form with site details and Telstra code #.

74.4 Irrigation Contractor to confirm current cellular network signal strength from control location at pre-start prior to construction or installation of any wiring and field controllers. Record, date and witness signal strength with locations and heights tested. If signal strength is weak or unreliable, either use extension cable with post and external antenna, or consider alternative controller location to gain reliable signal strength with approval from council TLIT or POCW. A variation may be submitted for consideration where additional costs are incurred for extension cable/post or alternative controller location, provide breakdown with justification.

74.5 Communication sharing between field controllers is allowed where practical for sites that have multiple controllers, within Rainman system architecture capacity and constraints. Communications hardwire cables and connections to meet OEM (Aquamonix/Rainman) specifications.

74.6 Alternative communications may be allowed at request & discretion of council TLIT, generally only where cellular communications is unavailable or shared.

75. Remote handheld

75.1 Laptop, tablet or similar, nominal 13”, to council IT specification with data SIM & preloaded with approved council remote management software, refer COD IT requirements. Council to prove data only SIM, refer 74.3

- Aquamonix Mobile Control, app for Smart Phone remote management

76. Irrigation field controllers

76.1 Site irrigation field controllers are to provide accurate programming to meet plant requirements, operate automatic control valves on site and accept flow and environmental sensor inputs with remote communications to base with full central integration for monitoring and programming.

76.2 Product: Rainman MPS/MPG, TWIN & RIC field controllers

- MPS or MPG Standard wiring, up to 46 stations for wire runs up to 250m
- TWiN Decoder, up to 96 stations may be used for wire runs > 250m or shall normally be required for cable runs > 400m, based on irrigation designer’s recommendation &/or council TLIT

requirement.

- RiC solar powered for DC systems up to 8 stations may be used where mains power is unavailable, at the discretion and approval of council TLIT. Note DC latching coils required for solenoid valves plus check calculations for specific cable runs and sizing.
- Galcon, some existing Galcon DC or solar systems remain – to be phased out and replaced with Rainman controllers with central control interface & compatibility when appropriate.
- Netcomm NTS-3000 communications module fitted.

76.3 Installation

- Refer Appendix A, B & C for IWMP tables, ITP's & programming forms. Submit completed program sheet/s with OM manual.
- Refer Appendix D for standard construction details.
- Wall mount, indoor & outdoor – Rainman wall mount enclosure fitted in min 600x600x210mm (unless otherwise required/specified) security enclosure sized to allow required space for all control equipment & acceptable clearances, IP66 weatherproof, 316 stainless steel, Rainman.
- All irrigation controller enclosures shall be fitted with swing handle hasps to accommodate COD standard locks. For all enclosures, use COD approved lock fixing type specific for enclosure type. Confirm lock fixing type requirements with council TLIT. A temporary lock provided by contractor shall be required for security until handover to council. Council shall supply an approved COD master keyed lock to be fitted at handover.
- Outdoor free standing post mount enclosures may be used where a council building or wall is not available in close proximity to a suitable controller location, low level drainage issues or weather stations mount is required. Rainman SS pedestal option c/w concrete plinth may also be used if drainage is not an issue & vandal risk is low.
- Incoming power surge protection on supply, Rainman
- Line surge protection on field wiring at controllers, plus end of line terminating unit for all decoder wire routes, Rainman
- Grounding kit in accordance with OEM recommendations. Provide separate conduit with earth wire to separate ground rods & or earth plates. Connect with bare copper wire connected with Cadweld or approved earth clamps, locate copper ground rods or plates in 250mm round valve box. Grounding to be tested and ohms recorded in handover checklist. Ground resistance shall be <5 ohms or in accordance with OEM requirements.

- Support exposed conduits with corrosion resistant brackets and fixings. Protective galvanized MS duct cover to all exposed PVC conduits.
- Vermin proof all conduits with expanding caulk. Spray base with long acting ant repellant surface spray, taking care not to directly spray any electronic components.
- Ensure no sharp edges to enclosure cut outs & all fillings or swarf is removed from panel.
- Incoming power supply at enclosure location with surge protection and isolation switch – by others, unless connection point otherwise specified.

77. Environmental Sensors - weather

77.1 To monitor to local weather conditions and interface with Rainman Master Central Control, via Rainman field controllers.

77.2 Environmental weather sensors to be connected or linked to all sites, unless otherwise specified by council TLIT or the contract:

- Sites > 2500m² irrigated area: add or link to nearest Lufft WS700-UMB smart weather station.
- Where a weather station is not available within acceptable proximity to site, say < 2.5km, the TLIT may direct a smart weather station be installed.
- Minimum requirement for all sites without smart weather station in close proximity (< 2.5km): Aquamonix Rainman iC Rain Sensor.
- COD is evaluating a strategic plan to enable all sites to have access link to a relevant smart weather station in close proximity to implement seasonal adjust (Et) capability and advanced water management plan.
- Upon approval a COD smart weather station master plan will developed with smart weather station locations and relevant coverage area boundaries highlighted to link controller sites.

77.3 Installation:

- refer Appendix D for standard construction details
- Connect to the field controllers, hardwire cables and connections to meet OEM (Lufft & Aquamonix) specifications.
- Mount in exposed location on roof/gutter bracket or galvanized post with stainless steel brackets & concrete post footing, with irrigated turf environ surrounds underneath sensors.
- Site location and height shall take into consideration to minimize potential vandalism.

78. Environmental Sensors - Soil

78.1 Soil sensors are only required at the instruction of council TLIT for specific sites. The type of soil sensor device may vary depending on controller type (standard or decoder) & function (moisture/temp/Ec/Ph/etc).

78.2 For detailed product & installation specifications of soil sensors, console HMI, remote communications and central control interface - refer council TLIT for approval.

79. Power cables (LV)

79.1 Low voltage power supply to irrigation controllers, pumps or other powered devices normally provided by main contractor or project manager, unless otherwise specified.

79.2 All electrical work to be approved by a council electrical representative.

79.3 240V & 415V is accordance with AS3000, PWC electrical authority code, council electrical standards and manufacturers installation specifications.

79.4 Installation:

- All high voltage work to be carried out by licensed electrician.
- All VFD motor cables must be shielded and grounded in accordance with manufacturers recommendations.
- Maintain minimum 200mm separation between Low Voltage and Extra Low Voltage control or communications cables when run in parallel in common trench.

80. Control cables (ELV)

80.1 Extra Low Voltage (ELV) Cables to supply 24V power to automatic control valves and sensors for standard Rainman irrigation field controllers.

80.2 Product:

- Tycab Tyflo
- Multistrand plain oxygen free copper wire
- UV stablised polypropylene insulation
- Common, minimum 2.5 mm^2 (7/050), single core.
- Actives, minimum 1.5 mm^2 (7/050), multicore (3, 5, 7, 9 & 13 core)
- Wire connections, waterproof suit direct burial splice kit, Snaploc BVS2 (yellow) or 3M DBR/Y-6.

80.3 Installation:

- Refer Appendix B for Tables for maximum cable runs lengths,
- Refer Appendix D for standard construction details.
- All ELV control cables shall be installed in MD Electrical conduit sized to allow adequate space for cables. Recommend 40mm minimum for irrigation (multi-core) control cables 40mm, and 32mm minimum for communications (2 core) cables. Seal underground entry & exits ends. Support above ground conduits with galvanized conduit brackets anchored with corrosion resistant fasteners and gland at controller entry.
- Any path or road crossings must be in access conduit, normally provided by others unless specifically noted
- Avoid in field cable joints to extend ULV cables. All in field cable joints must be located in 910 valve box & shown on AC plans. Valve box lid ID = 'CJ'.
- Snake cable in trenches & tape to one side of mainline at 6m intervals.
- Allow expansion loops at all bends junctions.
- Allow 1m spare cable loop at each solenoid valve.
- Allow minimum 2 spare active cores at the end of each route.

81. Control cables (decoder ULV)

81.1 Cable to supply 34V power and communication to decoders for Rainman TWiN Decoder irrigation controllers, where applicable.

81.2 Product:

- Decoder cable, up to 2km. Minimum 2 core x 2.5mm². Rainman, TWiNtrax Cable.
- Decoder cable, up to 3.5km. 2 core x 4.0mm². TWiNtrax Cable.
- Connections, waterproof suit direct burial, Snaploc BVS2 (yellow) or 3M DBR/Y-6.

81.3 Installation:

- Strictly in accordance manufacturer's design & installation requirements, including line surge protection with grounding kit at controller and line termination units with grounding kit at end of all decoder cable routes.
- Refer Appendix for standard construction details where applicable.
- Up to four cable individual cable paths, do not link or loop any cable paths.

- All ELV control cables shall be installed in MD Electrical conduit sized to allow adequate space for cables. Recommend 40mm minimum for irrigation (multi-core) control cables 40mm, and 32mm minimum for communications (2 core) cables. Seal underground entry & exits ends. Support above ground conduits with galvanized conduit brackets anchored with corrosion resistant fasteners and gland at controller entry.
- Any path or road crossings must be in access conduit, normally provided by others unless specifically noted
- Avoid in field cable joints to extend ULV cables. All in field cable joints must be located in 910 valve box & shown on AC plans. Valve box lid ID = 'CJ'.
- Snake cable in trenches & tape to one side of mainline at 6m intervals.
- Allow expansion loops at all bends junctions.
- Allow minimum of 1m spare cable loop at each solenoid valve.
- Ground decoder system in accordance with manufacturers specifications with surge protection at controller and end of line.
- Test resistance on all cable routes. Maximum in field ground resistance 50 ohms or in accordance with manufacturers specification.
- Refer 'Irrigation controllers, field' & 'Decoders' section for additional information.

82. Special sensor, signal or communications cables

82.1 Special cables for sensors or modems where applicable, shall be in accordance with manufacturer's recommendations and may require shielding, grounding, conduits and separation.

83. Flow Meter

83.1 Fit flow meter with sensor to all irrigation field controllers

83.2 Flow sensor to display flow rate

83.3 Flow sensor to monitor flow including underflow and overflow detection to raise alarms &/or shutdown

83.4 Flow Sensor data log usage volumes, report by areas & timeframes

83.5 Product:

- For direct supply from backflow device; Arad, EV with pulse output, sized to accurately handle min & max flow range
- For boosted supply from pump station; Krone Waterflux 3000C magflow with IFC 050 transmitter, sized to accurately handle min &

max flow range

83.6 Installation:

- Refer Appendix D for standard construction details.
- Locate in HR or Rain Bird 1419-12 standard rectangular valve box
- Mount directly downstream of RPZD, or pump, prior to any mainline take-off points.
- Ensure laminar flow of straight pipe, minimum 10 diameters upstream and 5 diameters downstream, clear of bends or junctions.
- Connect to the field controller with approved communications cable and direct burial cable connectors, Snaploc BVS2 (yellow) or 3M DBR/Y-6.

84. Master valve

84.1 The master solenoid valve shall limit system leakage and unauthorized use outside of controller programmed irrigation window.

84.2 A master solenoid valve is required for all pressurized and potable water supplied automatic irrigation systems, except pumped systems. Requirement for master valve on pumped system is at the discretion on council TLIT or recommendation of irrigation designer.

84.3 Product:

- Main line size 25mm, BSP; Toro Irritrol 2400 or 205 series solenoid valve for Sizes: 25mm. PN10 rated.
- Main line size 40-50mm, BSP; Toro Irritrol 200B series solenoid valve for Sizes: 40 & 50mm. PN10 rated.
- Main line size 80mm, BSP; Rain Bird 300-BPE-S (Scrubber) solenoid valve for Sizes: 80mm. PN14 rated.
- Main line size ≥ 100mm, flanged; Bermad IR-410-X, epoxy coated cast iron globe with bronze controls. PN16 rated.
- 24VAC 50Hz coils. Inrush current 0.4 A, Holding current 0.2A (nominal, varies)
- Manual bleed & flow control.

84.4 Installation:

- Refer Appendix B for maximum valve flows, cable sizes
- Refer Appendix D for standard construction details
- Use cable connectors, suitable for direct burial, Snaploc BVS2 (yellow) or 3M DBR/Y-6.

- Locate in HR or Rain Bird 1419-12 rectangular valve box, minimum. Valve ID tag = 'MV' & Stencil VB lid same with white weatherproof paint (nom. 50mm font).

85. Automatic Control Valves

85.1 Solenoid valves for automatic operation of all irrigation zones, from irrigation field controller.

85.2 Product:

- Sizes, 25mm BSP; Toro, Irritrol 2400 or 205 series solenoid valves
- Sizes, 40 to 50mm BSP; Toro, Irritrol 200B series solenoid valves
- Sizes, 80mm BSP; Rain Bird 300-BPE solenoid valves
- Min Pressure rating: PN10 (25-50mm), PN14 (80mm)
- 24VAC 50Hz coils. Inrush current 0.4 A, Holding current 0.2A (nom)
- Internal manual bleed and adjustable flow control
- For pressure regulation where required, add OmniReg module
- For dirty water applications, use Scrubber versions
- For recycled water applications, use lilac valve box lid

85.3 Installation:

- Refer Appendix B for maximum valve flows & cable sizes.
- Refer Appendix D for standard construction details.
- Fit O-ring swing joint between main line take-off elbow & secondary isolation valve upstream of auto valve, Lasco Sched 80 sports field swing joints PN21 M.BSP SBE, sized to auto valve size, eg: 40mm SV = 40mm SJR, 50mm SV = 50mm SJR, 80mm SV = 80mm SJR.
- Fit isolation ball valve downstream of SJR & upstream of auto valve, Philmac or Hansen PN16 full flow.
- Pressure regulation module fitted & set to required irrigation pressure. Pressure regulation modules may not be required where inlet pressure is within 100kPa of design pressure, the system is supplied by VFD pump station & the high-low topography range on site is within 3m, eg; sports fields.
- Fit compression expansion joint within 300mm downstream of auto valve for ease of disconnection & service.
- Use cable connectors, suitable for direct burial, Snaploc BVS2 (yellow) or 3M DBR/Y-6.
- Locate in HR or Rain Bird 1419-12 rectangular valve box, minimum. Valve ID tag = 'SV #-##' (code, controller # - station ##) & Stencil VB lid same code, refer below.

- All valve boxes lids will be stamped with valve ID. Stencil VB lid with white weatherproof paint (nom. 50mm font).
- All automatic control valves shall be tagged with Allflex large (06) 76x56mm yellow cattle ear tag, loosely cable tied to valve solenoid coil cable, with alpha/numeric control vale code neatly hand written on tag with Allflex black weatherproof marker pen, eg; A – 12 (controller ID #/solenoid valve ID #).

86. Decoders

86.1 Decoders are to operate automatic solenoid valves and receive sensor inputs.

86.2 Required in conjunction with Rainman TWiN Decoder control system, where recommended by irrigation designer or required by council TLIT.

86.3 Product:

- Decoders c/w internal lightning protection, Aquamonix Tonick; 1 to 4 address.
- Decoder power draw, 3mA standby.
- Sensor decoder, Aquamonix Tonick; digital, frequency or analogue inputs.

86.4 Installation:

- Strictly in accordance manufacturer's design & installation requirements, including surge protection and grounding.
- Use no more than 1 solenoid per address.
- Run a 1.5mm² ULV control cable common & active for each address to each solenoid valve, do not run common in series loop for multiple address decoders.
- Locate decoder within 30m of solenoid valve, maximum ELV control cable route.
- Sensor decoders will only accept the unpowered digital output function of sensor device, not provide power supply. Sensors device that require external power supply must be from a 24V power supply nearest to the sensor device, unless battery or solar power is specified.
- Where pump start or master valve is required, use single address decoder (with pump start relay for pump stop/start control where applicable). Not required for pressure on demand systems, which are generally preferred.
- Line surge protection and grounding kit required at controller location.

- Line termination unit and grounding kit required at the ends of all decoder cable routes.
- Locate all grounding hardware within irrigated area under sprinklers where practical. Where no irrigation in close proximity, create a small station for grounding. All grounding copper wire connections using Cadweld or approved connections.
- Use approved cable connectors, suitable for direct burial Snaploc BVS2 (yellow) or 3M DBR/Y-6.
- Locate in HR 1419-12 rectangular valve box, minimum, with automatic valve/s.
- Refer 'Control cables, decoder (ELV)' & 'Irrigation controllers, field' for further information.

87. Lock fixings & hardware

87.1 All key entrance points or enclosures with public access require lockable security hardware, including but not limited to; tank compounds, pump sheds & controller enclosures. Use council approved lock fixing type specific for type of door, gate, hatch or enclosure.

- Confirm lock fixing type hardware requirements with council TLIT or POCW for specific entrance or enclosure type.
- A temporary lock, provided by the contractor, shall be required for security until handover to council.
- Council shall supply an approved COD master keyed lock to be fitted at practical completion or handover.

K. Distribution System & Manual Valves

88. Backflow Prevention Devices

88.1 Backflow prevention devices are required for any potable water supply cross connections to all irrigation supply mains in accordance with Australian Standards, PWC and local plumbing code.

88.2 Product:

- ValvCheq DCV-CO or RP03-CO based on risk assessment, complete assembly including isolation valves & strainer, or approved equivalent
- Up to 50mm BSP with ball valves
- Greater than 50mm Flanged with butterfly valves
- Size according to system peak duty requirements, target maximum losses across the backflow assembly not to exceed 90kPa for RPZ, or 70kPa for DCV

88.3 Installation:

- Refer Appendix D and PWC drawing W1-1-27 for standard construction details.
- Installation to be carried out by qualified persons and tested by a licensed plumber in accordance with plumbing code. A test certificate shall be required in operation and maintenance manual.
- Riser and exposed pipework, Copper or DICL
- Install assembly on concrete pad with 4x CCA treated timber traffic bollards 100-125mm diameter with dome top 900mm above ground level to pad corners. Bollards may be inset to form slab boxing.

89. Footvalves

89.1 Footvalves are required for any pump system where there is a suction lift.

89.2 Product:

- Alderdice brass footvalve side outlet c/w double ball floats, for up to DN50
- Rodney Industries poly housing with stainless steel backing flange & stainless steel wafer check valve for DN80, or approved equal
- Footvalves >DN50 to include quick release
- Footvalves to include large strainer
- Size according to system peak duty, target maximum losses across the footvalve and suction pipework, max velocity 1 m/s

89.3 Installation:

- Ensure suction lift & pipework losses allow pump/s to operate within NPSH requirements, without cavitation. Generally limit vertical suction lift to 3m. Do not exceed manufacturers recommended suction overall pipe length, generally limit to <12m. Ensure suction pipe is constantly rising to or from pump suction, without dips or low points that may become air pockets.
- Individual footvalves & suction pipes may be required for multiple pump stations where single footvalve cannot satisfactorily service minimum & maximum flow range.
- In open water environment (dam or lake), support footvalve/s with floating PE pontoons of suitable size, ensuring footvalve arrangement is relatively simple to disconnect & service. River suctions require engineering drawings.
- In wet well environment, support footvalve/s with anchor points, ensuring footvalve arrangement is relatively simple to disconnect & service. Wet wells require engineering drawings.
- Attach quick release to anchor point using 4mm SS wire rope & D shackles.
- Suction pipework shall be have a prime port at highest point, with either by-pass or connection to water supply where suction lift for simple priming of pumps. Suction arrangements require drawings for approval by TLIT or council principal irrigation consultant.

90. Non return valves

90.1 Non return valves may be required to;

- At tank outlets on suction to supply to pump stations
- In multi-pump stations to prevent reverse rotation
- Limit water hammer in large mainlines &/or where topographic variation is significant.
- Non return valves may be required to prevent reverse flows, eg; treatment systems or by-pass arrangements

90.2 Product:

- Up to DN50, Zetco DZR watermarked brass PN16 F.BSP, or approved equal
- For >DN50, Danfoss Socla PN16 flanged, or approved equal
- The model or type shall depend on application, fast acting or controlled close, & space available. Selection of specific check valve model shall be based on consultants recommendation & sized for minimal losses, generally V < 1.1 m/s for main lines where practical.

90.3 Installation:

- Generally mount in horizontal position where practical.
- For vertical mount, use suitable valve that is recommended for vertical installation.
- Where installed underground locate in valve box, engrave lid 'CV', paint letters white, refer valve box section.

91. Underground Pipework

91.1 Pipework for all underground irrigation mainline and laterals, shall be either PVC (S1) or Polyethylene (PE100), council may specify required pipe type on specific projects.

91.2 Product:

- Polyethylene (PE) pressure pipes are acceptable, with minimum PN12 pressure rating. Higher pressure applications >1200kPa require higher PN rating.
- HDPE (PE100) PN12.5 pipe in accordance with AS 4130. Compression joints for 75mm or less are acceptable, and electofusion(EF) or butt weld(BW) joints are required for 90mm or greater. EF joints may also be used on 75mm or less sizes. Tapping saddles may be used for take offs up to DN50. Any joint type exceptions must be approved council TLIT prior to commencement.
- For non-potable & recycled water applications, use lilac stripe or lilac colour.
- PE pipe fittings shall be minimum PN16 to AS 4129. Philmac, Plasson or George Fischer.
- Tapping saddles shall be min PN16, up to 50mm. The tapping outlet shall be at least 2 DN pipe sizes smaller than the take-off pipe. Type, HDPE 4x stainless steel bolts. Note; Mild steel or zinc plated bolts are NOT acceptable.
- Flanges, Table E or PN16 with rubber gasket where required. PE flanges to include SS backing ring. Nuts, bolts & washers to be Stainless steel.
- Threaded fittings, BSP. Philmac, Plasson or George Fischer for PE connections. Copper, Brass or Stainless Steel to Australian Standard for metal connections.

91.3 Installation:

- Refer Appendix B for max velocities.
- Refer Appendix C for ITPs .
- Refer Appendix D for standard construction details.

- Install 100mm wide detectable warning tape for 'water main (green)' with SS trace wire in trench, 200mm above all mainline pipework. For recycled water main, use lilac.
- Installation, per approved manufacturer installation manual and in accordance with AS4129, AS2032 & AS2566.
- Large bore PE (90mm or greater); Butt weld or electro-fusion with flanged connections, to mainline take off points or valves > 80mm.
- Small bore PE (less than 90mm); compression fittings with threaded or flanged connections to valves or key components.
- Tapping saddles, where used, must have stainless steel nut/bolts. Holes must full size available for tapping diameter and be deburred of swarf.
- Concrete thrust blocks are generally not required for underground PE pipeline connections. Where specified or required, for example end caps or puddle flanges or above ground anchors, install concrete thrust blocks in accordance with manufacturers installation manual and Australian Standards. The pipe must be lagged with a protective membrane, Denso WP pipe wrap or approved equal. Stainless steel anchor straps & fixings are required on some connections, such as; main isolation valves, end caps, vertical or above ground bends - brackets or anchor straps/chains to be firm fit, do not over tighten or damage pipe.. Power or control cables must not be directly in contact with concrete, where cables must run through concrete the cables must be laid in conduit/s. The concrete shall be 32mPa with volume (depth x length x width) & shape shall be in accordance with manufacturer's installation manual based on site soil type/s. Do not pressurize until concrete has time to cure sufficiently, normally 7 days in average weather conditions.
- Teflon tape (or paste) to all threaded joints (where allowable in accordance with manufacturers recommendation).
- Cap or bag & tape all exposed pipework at end of each day to limit potential contamination such as; debris in event of rainfall inundation, or wildlife intrusion.
- Also refer related item headings, including; trench works, sandbed & excavation in landfill sites.

92. Above Ground Pipework

92.1 For above ground pipework, pending size and application, there may be a specific requirement.

92.2 Products,

- Copper, in accordance with plumbing code, normally required for mounting backflow devices ≤ DN80. Crane Group or equal.
- Ductile Iron, fusion coated, normally required for mounting backflow devices > DN80. Iplex, AVK or Vinidex.
- HDPE (PE100), PN12.5, generally preferred for pump suction and discharge connections.
- Stainless steel (SS), schedule 10, normally required for pump station manifolds. SS grade 304 is acceptable for low to moderate water corrosive elements & temperature. SS grade 316 required for mod to high water corrosive elements & temperature. Refer COD irrigation consultant for aggressive water quality conditions. SS pipework must be pickled & passivated after fabrication & welding. Sandvik or equal.
- For non-potable & recycled water applications, use lilac ID stickers or paint lilac with suitable industrial coating for pipe type.
- Flanges, Table D or PN16 with rubber gasket where required. PE flanges to include SS backing ring. Nuts, bolts & washers to be Stainless steel.
- Threaded fittings; BSP Philmac, Plasson or George Fischer for PE connections. Copper, Brass or Stainless Steel to Australian Standard for metal connections.

92.3 Installation:

- Refer Appendix B for max velocities.
- Refer Appendix C for ITPs .
- Refer Appendix D for standard construction details.
- Installation, per approved manufacturer installation manual in accordance with Australian & industry standards.
- Support with hot dipped galvanized steel or Stainless steel support posts and brackets. Size and spacing appropriate to minimize vibration and withstand water hammer. Brackets or anchor straps to be firm fit, do not over tighten or damage pipe. Fix with industrial quality corrosion resistant fasteners to concrete base slab or thrust block.
- For above ground wall penetrations, lag pipework & use Dektite rubber boot flashings neatly fixed with stainless steel fasteners on all pipe or conduit entry & exit points.
- Concrete thrust blocks for above ground pipework may be required in accordance with pipe size and manufacturers guidelines. The pipe must be lagged with a protective membrane. Anchor straps & fixings are required on some connections, such as; main isolation valves, end caps, vertical or above ground bends. Power or control cables

must not be directly in contact with concrete, where cables must run through concrete the cables must be laid in conduit/s. The concrete volume (depth x length x width) & shape shall be in accordance with manufacturer's installation manual. Do not pressurize until concrete has sufficient time to set, normally 7 days.

- Teflon tape (or paste) to all threaded joints (where allowable in accordance with manufacturers recommendation).

93. Dissimilar Metals

93.1 Do not use dissimilar metals that create galvanic corrosion issues with pipework, valves pumps, supports, fixings. Fully insulate with appropriate finishes or plating where compatibility issues are unavoidable.

94. Trench Works

94.1 Excavate trench depth to maintain min cover of 450mm for mainlines & 300mm^ for laterals unless exceptional circumstances or existing services limit excavation depth. Note(^) minimum cover for laterals in large area turf & sports turf rotors is 400mm & allow adequate angle for swing joint riser to function correctly.

94.2 Excavate trench width to allow 50mm minimum clearance between pipe OD and trench wall. Where multiple pipes in common trench allow 50mm minimum clearance between pipes.

94.3 Sand bed all mainlines, minimum 50mm of approved bedding sand surround on top, bottom and all sides.

94.4 Provide level trench base and backfill with clean site fill where suitable. If site fill is found to be unsuitable for back filling, such as rubble or sharp edges, advise council TLIT or POCW for a site instruction to sand bed or fill based on day rates. Sand fill (above 50mm surround bedding sand surround) is normally a variance where required, unless specified.

94.5 Fill & compact trench in layers using wheeled &/or mechanical compaction as necessary. Minimum density to be 85% to 95% modified compaction. Subsidence within 12 months shall be the contractor's responsibility to remediate. Final grade consistent with surrounding level and finished grade, slight mounding made be acceptable. The ground surface level must be clean sand/loam layer free from rubble and sharp edges, top dress as required. Grass seed or re-turf where specified or required option.

94.6 Backfill all excavation works in same day, where practical. Barricade exposed trenches or excavation with Hi-Viz barrier mesh or netting that is not backfilled, prior to departing site for the day.

94.7 Flag all new work such as valve pits and sprinklers, through establishment.

94.8 Optional unless otherwise specified in main contract, turf cutting and/or relaying turf and other surface treatments, such as grass seeding or sand fill.

94.9 Refer Excavation in Landfill sites below, where applicable.

95. Erosion and Sediment Control

95.1 Ensure erosion and sediment control plans or measures are in place for all excavation works. Also refer environmental management plan.

96. Additional Sand Fill Trenches

96.1 Provide schedule of rates for all projects to sand fill both mains & laterals with tender prior to construction.

96.2 Main pipe work shall require additional sand filling (above standard sand bedding) where site trench spoil material contains sharp edges or is deemed unsuitable for backfilling &/or topdressing.

96.3 Lateral pipe work shall require sand bedding &/or sand filling where site trench spoil material contains sharp edges or is deemed unsuitable for direct contact with pipe and is unacceptable for backfilling & topdressing.

96.4 Sand bed shall be required on landfill sites &/or sand fill may also be required depending topsoil type & cap depth for various pipe types, eg; mains & laterals. Contractor to pothole & test samples at various depths along pipe routes at several locations across site prior to construction where unsure and submit report with recommendations.

- Sand bed &/or sand fill may be specified by irrigation consultant or council TLIT as deemed appropriate on a project by project basis.
- Where sand bedding (laterals) or sand filling (mains or laterals) is not specified however is deemed required upon detailed site investigation, the contractor shall raise recommendation with RFI to council TLIT or POCW to perform the sand bedding works on agreed day rates or rate per lineal metre, in accordance with the schedule of rates.

96.5 Product:

- Coarse bedding sand, graded, unless otherwise specified.
- For premium sport fields, for example with perched water table, the bedding sand maybe required to be same specification as the field sand profile. Submit sample or analysis report for bedding sand upon request from council TLIT or POCW.

96.6 Installation:

- Level trench base, with minimum 50mm sand base under pipe/s. Where multiple pipes in a common trench, maintain minimum 50mm separation with sand fill between pipes.
- Sandbed, cover and surround from edge of all pipe work, minimum 50mm sand surround.
- Sandfill, fill trench to top ground level with compacted sand. For sport turf surfaces, top dress final 100mm of same top soil specification as field surface.
- Removal of overburden, spoil & rubbish in accordance with council Environmental Policy to approved facility.

97. Excavation in Landfill Sites

97.1 For excavation in landfill (tip) sites ensure universal precautions are used, including;

- Comply with council & Northern Territory Government legislation and codes of practice in relation to landfill sites.
- Spark arrester on chain diggers.
- Fire extinguisher within 2m of excavation machinery.
- Butt weld all main pipes with landfill zones.
- Removal of overburden, spoil & rubbish in accordance with council Environmental Policy to approved facility.
- Where asbestos present, comply with council & Northern Territory Government legislation & codes of practice. Include asbestos management plans in environmental management plan and work health & safety plans.
- Sand bed all trenches and 100mm sand pipe surround as a minimum requirement in landfill contamination zones, or sand fill where trenches are deeper than cap. Provide schedule of rates for all projects to sand bed & sand fill both mains & laterals. Reinstatement of cap to acceptable standard by approval of council TLIT or PMCP.

98. Excavation in Close Proximity to Trees or Significant Plants

98.1 For excavation in close proximity to trees or significant plants the contractor is to liaise with TLIT to provide a survey of existing vegetation and determine an acceptable route for excavation. A register is available for tree preservation and historic tree register with COD PR.

98.2 Where excavation may be in close proximity to significant vegetation or within drip canopy area, document plant condition and photograph site vegetation prior to commencement to benchmark monitor any degeneration.

98.3 Avoid excavation within dripline canopy area where possible. Approved works to carried out within the dripline canopy area should be kept to an absolute minimum, using suction/vacuum truck excavation techniques where required to minimize damage and preserve the health of the plants root system.

98.4 All work requiring root pruning of vegetation shall be performed by a qualified arborist approved by COPR for roots greater than 75mm diameter. Roots to be pruned shall be cut no less than 0.6m from pipework. Backfilling shall be comparable material with excavation and consolidated with watering. Obstructions in backfill material such as root offcuts, stumps and rocks shall be removed from site. Special treatment and ongoing maintenance may be required for a period where recommended by arborist.

99. Under Road or Path Crossings for Irrigation Pipe and Cables

99.1 Road or path crossings are generally the responsibility of the developer, council or principal contractor, unless otherwise specified.

99.2 Where specified, the contractor shall make application and gain approval from COD and NT Government, Department of Transport, prior to undertaking any road crossings for irrigation pipes and/or cables, including traffic management plan.

99.3 All under road crossings shall be carried out in accordance with permit by a qualified contractor, sleeved encased in a heavy duty conduit extended beyond the road verge required distance. The crossing/bore shall be tightly packed and grouted around conduit to NT Department of Transport specification. Any damages or remediation works to be made good by contractor.

99.4 Conduited pipework through road or pathways to be 1 single pipe, no joins within conduit, PVC if under 5m conduited length, over 5m use one piece HDPE

99.5 All under path crossings shall be carried out by a qualified contractor, sleeved encased in a heavy duty conduit extended beyond the path edge required distance. The crossing/bore shall be tightly packed and grouted around conduit to COD specification and approval. Any damages or remediation works to be made good by contractor.

99.6 When trenching across bitumen hard pavements, if not backfilled with bitumen immediately then alternative EZ asphalt or equivalent is to be used to leave work site safe until works complete and bitumen reinstated.

100. Excavation in Archeologically Sensitive or Hazardous Sites

100.1 For excavation in Archeologically sensitive sites ensure universal precautions are used in accordance with City of Darwin and Northern Territory environment and heritage policy, including, for example;

- Heritage sites
- Sacred sites
- War sites
- Hazardous sites

100.2 Seek approval from COPR prior to excavation in Archeologically sensitive sites.

100.3 Report any archeological findings resulting from excavation or construction works immediately to COPR. Halt works until approval from COPR instruction to proceed or re-route. Do not disturb, or remove any items that may be considered archeologically sensitive, of heritage value or hazardous.

101. Surface Treatments, Mulch, Seed or Turf Trenches

101.1 Trenches or excavated areas may require sand topdressing, mulch, grass seeding &/or re-turfing where there are recovery time limits or quality constraints.

101.2 Product:

- Topdress material shall be a suitable clean, weed free, Turf sand or sandy loam Sports Turf blend, as supplied by Southern Pacific Sands or approved equal. Submit sample or analysis report for topdressing material upon request from council TLIT or POCW.
- For trenches in garden beds, mulch shall meet COD PR standards or approval, by consistent with surrounding mulch and 100mm cover.
- Turf shall be a suitable A grade, weed free, sports turf species consistent with field surface or proposed surface. As supplied by a registered turf supplier. Confirm grass or turf species with council TLIT or POCW prior to construction.

101.3 Installation (grass/turf):

- Cut existing turf prior to excavation for neat edges.
- After excavation, backfill & compaction, prepare ground surface & remove spoil.
- Spread & level topdressing to adjusted finished grade, with minimum 10mm turf sand or sandy loam turf blend.
- Incorporate fertilizer, Scotts Lawn Builder at 18g/m² or approved equal.

- Spread grass seed at required rate, or lay turf as required.
- Roll turf.
- Final topdress & level, as required.
- Ensure no subsidence or excessive mounding.
- Maintain, irrigate & mow through to acceptable establishment, plant health & root depth.

102. Valve Boxes

102.1 All valves and underground devices requiring to be easily located or serviced shall be located in a valve box.

102.2 Limit of one valve assembly per valve box.

102.3 Valve boxes shall be sized to allow valve operation and reasonable maintenance clearances. Minimum valve box size shall be 910 (225mm diameter x 250mm deep) round type.

102.4 All valves boxes shall be located minimum offset of 4m buffer from sports field boundaries where practical. Valve boxes may only be allowed within 4m of sports field boundaries with written approval and at the discretion of council TLIT or POCW.

102.5 Where valve boxes are allowed to be located within sports field or 4m buffer boundaries, pending application & type, special treatment shall be required for valve box lids to be either:

- Covered with premium sports quality artificial turf, 40mm pile height, bonded with manufacturers approved weatherproof adhesive. Trim edges neatly & allow access to locking bolt.
- Buried subgrade, nominal 125-150mm with SS plate fixed to top of lid. Locate position with GPS & triangulate co-ordinates from 2 fixed positions for each valve box on as constructed drawings.

102.6 Product

- Round: air valves, QCV, isolation valves. HR or Rain Bird 910 c/w SS lock nut & bolt kit.
- Rectangular: master valve, solenoid valves, flow meters, any valves that do not provide reasonable service clearance in a 910 round valve box. HR or Rain Bird 1419-12 c/w SS lock nut & bolt kit.
- Special: large valves, filters or underground devices that require service access. HR or Rain Bird Jumbo or valve box extensions may be used c/w SS lock nut & bolt kit.
- For non-potable & recycled water applications, use lilac lid c/w SS lock nut & bolt kit.

102.7 Installation

- Refer Appendix D for standard construction details.
- Compact and backfill under valve pit with free draining coarse sand.
- Support valve box with paver on compacted base to limit subsidence. Ensure pipe and cable is not hard up against sharp edge of pavers or valve box.
- Skirt valve box with Geo Bidim (A29 or equal) fixed with duct tape and seal pipe entry/exit points to limit soil ingress into pit.
- All valve boxes lids will be stamped with valve ID. Stencil VB lid with white weatherproof paint (nom. 50mm font)
- All automatic control valves shall be tagged with stamped SS dog tag cable tied to valve (nom 25x75mm with 10mm font).

103. Mainline Isolation Valves

103.1 Mainline isolation valves are to be strategically located at main junctions and generally along mainline at regular intervals no greater than 200m to facilitate system servicing without complete system shutdown where practical, or excessive drain times.

103.2 Product:

- Linesize, up to 80mm BSP; bronze AS tested gate valve to AS1628, AIP or approved equivalent.
- Linesize, >80mm FLG; ductile Iron sluice valve, resilient seat, fusion epoxy bonded, PN16 Flanged, suit underground application to AS2638.2. AVK or approved equivalent.
- Include valve handle, with extension, where applicable

103.3 Installation:

- Refer Appendix D for standard construction details.
- Use DN200-250 PVC access sleeve to top of valve
- Lag valve/pipe, thrust block, anchor with support straps for valves >80mm where recommended and support above ground valves
- Locate in HR or Rain Bird 910(min) round valve box, with c/w SS lock nut & bolt kit
- Valve ID = ‘IV’. Stencil VB lid with white weatherproof paint (nom. 50mm font)

104. Secondary Isolation Valves

104.1 Fit isolation ball or gate valve to allow service of all automatic and air valves without requiring mainline shutdown.

104.2 Product:

- Ball valve, Polyethylene up to DN50. Philmac or Hansen, full flow bore, PN16 & watermarked to AS. For non-potable & recycled water applications, use lilac handle.
- Ball valve, Brass with stainless steel handle, up to DN50. AIP PN25 DRZ watermarked to AS.
- Gate valve, Brass, DN80 to DN100. AIP tested DR, PN20 watermarked to AS.

104.3 Installation

- Refer Appendix D for standard construction details.
- Connect directly onto associated valve with PE nipple using Pink plumbers tape or Teflon paste.
- Locate in associated valve box to allow valve handle operation.

105. Quick Coupling Valves (QCV)

105.1 QCV's are to be installed where required to facilitate manual watering of surrounds and flushing system.

105.2 Locate a QCV at end of all mainline routes as a scour valve.

105.3 Locate a QCV directly next to all drip irrigation automatic control valves, where applicable.

105.4 Where manual watering of surrounds or temporary irrigation is required, locate at maximum 50m intervals along main or 50m grid where area width exceeds 50m.

105.5 Product:

- 25mm PE QCV fitted c/w anti-rotation collar or stake, Plasson 25mm BSP # 303900300A.
- For recycled water applications, use lilac top.

105.6 Installation:

- Refer Appendix D for standard construction detail.
- Install on Lasco 25x300mm(min) Sched 80 double O-ring swing joint riser.
- Fit anti-rotation collar or Galv picket with SS clamps.
- Locate in HR or Rain Bird 910 round valve box with SS Loc-kit.
- Valve ID = 'QC'. Stencil VB lid with white weatherproof paint (nom. 50mm font).
- Supply 1x QCV valve key with swivel elbow & 30m white washdown hose c/w 25mm adjustable spray nozzle. Fix hose tails with stainless steel hose clamps.

106. Automatic Air Valves

106.1 Air valve (AV) are to expel air from mainline to reduce potential water hammer on mainline filling, and allow air intake during mainline voiding to prevent vacuum.

106.2 Locate air valves strategically at high points along the mainline. Maximum intervals to be determined by CID pending on size of main, size of air valves and topography.

106.3 Locate air valves upstream on mainline isolation zones or main isolation branches.

106.4 Locate air valves end of all mainline routes.

106.5 Pump suction require air release valves at high point of suction pipe where suction lift condition, locate above ground nearest pump inlet.

106.6 Product:

- For mainlines 63mm or less, use 25mm ARI D-040 auto air valve
- For mainlines greater than 63mm up to 200mm, use 50mm ARI D-040 auto air valves.
- For pump suctions, use Bermad CSA Fox 3F-RFP-EO air discharge only, sized to suit.

106.7 Installation:

- Refer Appendix D for standard construction detail.
- Install on minimum length 300mm double O-ring swing joint riser, same nominal bore as air valve.
- Include Secondary isolation valve at base of all air valves, same nominal bore as air valve.
- Locate in HR or Rain Bird 910-10 (min) round valve box with c/w SS lock nut & bolt kit.
- Valve ID = ‘AV’. Stencil VB lid with white weatherproof paint (nom. 50mm font).

107. Hydraulic Pressure Control Valves

107.1 Quick acting pressure relief valves (QRV) are required at all pump stations and any application with significant topography or risk of water hammer. QRV may be required at supply tank or reservoir inlets upstream of float valve.

107.2 Hydraulic control valves may be required for a range of applications, including;

- Pressure reducing & regulating (PRV) – for constant downstream pressure within topographic zone to optimize emitter performance &/or limit risk of equipment failure.
- Pressure sustaining (PSV) – for constant upstream pressure to limit risk of equipment failure due to potential line filling surges & pump cavitation.

107.3 Product:

- For quick acting pressure relief valves, use Bermad 400 series PN16 IR43Q or IR-430.
- For pressure control valves, use Bermad 400 series PN16 IR-420-XZ (PRV) & IR-430-XZ (PSV).
- Combination pilots & remote options may be used, where required.
- Size to suit flow requirements within acceptable pipe velocity limits.

107.4 Installation:

- Locate QRV above ground downstream of pump unit & upstream of first main isolation valve external of pump unit.
- Locate PSV/PRV's above ground or underground, normally horizontal position.
- Set & test pilots at correct pressures. QRV set below equipment PN rating and nominal 50-100kPa below pump shut off head. Confirm operation, ensure no valve vibration or slamming.
- Securely support valve arrangements with corrosion resistant brackets fixings.
- Install vent pipe to quick acting pressure relief valves, return to supply or approved waste pit.
- Where underground, locate in HR or Rain Bird 1419-12 (min) rectangular valve box with c/w SS lock nut & bolt kit, providing sufficient space for service access. Jumbo valve box maybe required for larger valves.
- Valve ID = 'HV'. Stencil VB lid with white weatherproof paint (nom. 50mm font).

108. Level & Flow Control Valves

108.1 Hydraulic control valves may be required for a range of applications, including;

- Level & flow control (>DN50) – filling tank or water supply reservoir at known capacity without impacting upstream supply pressure.
- Level control (up to DN50) - filling tank or water supply reservoir.

108.2 Product:

- For level & flow control valves > DN50, use Bermad 400 series PN16 IR-457-66-U level & flow control with bi-level float.
- For level control up to DN50, use Philmac DZR brass high pressure PN14 float valve with copper float.
- Combination pilots & remote options may be used.
- Size to suit flow requirements within acceptable pipe velocity limits.

108.3 Installation:

- Normally locate above ground. Bermad 400 series (>DN50) normally located outside tank in close proximity to inlet pipe, in serviceable position. Philmac Brass HP (up to DN50) normally located inside tank directly on inlet in close proximity to access hatch, in serviceable position.
- Set & test pilots at correct levels & flow. Confirm operation, ensure no valve vibration or slamming. Set bi-level float to reasonable range to minimize potential incoming supply pump or valve rapid cycling. Set float high level to between about 200mm below tank overflow. Set high level alarm sensor at midpoint above high level & below overflow level.
- Securely support valve arrangements & float brackets with SS corrosion resistant fixings. Neatly fix, gland & conduit any hydraulic tubes & control cables in/out reservoir.
- Where underground, locate in HR 1419-12 (min) rectangular valve box with c/w SS lock nut & bolt kit, providing sufficient space for service access. Jumbo valve box maybe required for larger valves.
- Valve ID = ‘HV’. Stencil VB lid with white weatherproof paint (nom. 50mm font).

L. Sprinklers & Rotors Irrigation Emitters

109. Pop-up Sprinklers for Garden Beds

109.1 Pop-up sprinkler irrigation of all specified garden beds and planted areas, unless drip tube irrigation is required by council TLIT.

109.2 All pop-up sprinklers shall have 300mm high pop up riser, where located along edges and all exposed areas.

109.3 Pop-up bodies shall have; SS retraction spring & wiper seal. Nozzles shall have pre-filter. Check valve (optional) refer below.

109.4 Where topographic elevation exceeds 1m within a station/zone, fit popup bodies or shrub adaptors with built in check valve and use bottom entry.

109.5 Extension poly risers and shrub adaptors may only be allowed in centre of garden beds, or along back of gardens where located along fence or wall providing risk of vandalism is minimal. Where poly risers are used in centre areas, the riser shall extend 300 to 400mm above finished grade mulch level.

109.6 All valves or station zones shall have sprinklers with matched precipitation rates.

109.7 Products:

- 1.8 to 3.2m grid spacing, spray head. Hunter Pro-Spray(-CV) 300mm spray body with Hunter MPSR rotator nozzle. Nom pressure 250kPa.
- 3.3m to 4.2m grid spacing, spray head. Hunter Pro-Spray(-CV) 300mm spray body with Hunter MP1000 rotary nozzle. Nom pressure 300kPa.
- 4.3m to 5.4 m grid spacing, spray head. Hunter Pro-Spray(-CV) 300mm spray body with Hunter MP2000 rotary nozzle. Nom pressure 300kPa.
- For narrow spaces, Hunter Pro-Spray(-CV) 300mm spray body with MP Side strip & End strip Rotary nozzles. Nom pressure 300kPa.
- MP rotator Pro Spray bodies or riser adaptors to be fitted with built in check valves (CV) where station topographic elevation varies more than 1m.
- For non-potable & recycled water applications, use lilac top.

109.8 Installation:

- Refer Appendix B for data tables.
- Refer Appendix D for standard construction details.
- Fit to faucet tee or tapping saddles, saddles must have stainless steel nut/bolts.

- Install on minimum length 300mm articulated riser same nominal bore as sprinkler inlet c/w 3x MF elbows.
- Set to correct grade, level and at finished height of mulch.
- Use appropriate nozzle arc & adjust radius to minimize undesirable overspray onto hard surfaces.

110. Pop-up Sprinklers for Turf

110.1 Pop-up sprinkler irrigation of all specified turf areas and sports fields.

110.2 All pop-up sprinklers or rotors shall have minimum 100mm pop-up riser with; SS retraction spring, wiper seal, and inlet or nozzle filter. Built in check valve (optional), refer below.

110.3 Where topographic elevation exceeds 1m within a station/zone, fit popup bodies with built in check valve and use bottom entry.

110.4 All large areas pop-up rotors (radius >14m) shall have stainless steel risers and rubber cover, built-in check valve, with adjustable arc & at least 8 nozzle sizes.

110.5 All valves or station zones shall have sprinklers or rotors with matched precipitation rates, or separate zone/nozzles to suit full & part circles.

110.6 Products:

- 1.8 to 3.2m grid spacing, spray head. Hunter Pro-Spray(-CV) 100mm spray body with Hunter MPSR rotary nozzle. Nom pressure 250kPa.
- 3.3m to 4.2m grid spacing, spray head. Hunter Pro-Spray(-CV) 100mm spray body with Hunter MP1000 rotary nozzle. Nom pressure 300kPa.
- 4.3m to 6.4 m grid spacing, spray head. Hunter Pro-Spray(-CV) 100mm spray body with Hunter MP2000 rotary nozzle. Nom pressure 300kPa.
- 6.5m to 8.7m grid spacing, rotary sprinkler. Hunter Pro-Spray(-CV) 100mm spray body with Hunter MP3000 Rotary nozzle. Nom pressure 300kPa.
- 8.8m to 9.9m grid spacing, rotary sprinkler. Hunter Pro-Spray(-CV) spray body with Hunter MP3000 Rotary nozzle. Nom pressure 300kPa.
- 10m to 13.5m spacing, 100mm popup rotor. Hunter PGP Ultra PGP-04(-CV). Nom pressure 350kPa to 450kPa.
- 13.6m to 18m spacing, 100mm popup rotor. Hunter I-25-04-SS. Nom pressure 450kPa to 500kPa.

- 16m to 21m spacing, 125mm popup rotor. Rain Bird 8005-SS. Nom pressure 450kPa to 500kPa.
- For spacings greater than 25m or special applications, such as synthetic turf surfaces, refer council principal irrigation consultant for requirements & approval.
- MP rotator Pro Spray bodies or PGP Ultra rotors to be fitted with built in check valves (CV) where station topographic elevation varies more than 1m.
- For non-potable & recycled water applications, use lilac cap for rotators (Pro-Spray-R) or rubber cover for rotors (PGP-04-CV-R/I-25-04-SS-B-R-## & /I-90-#RV-B).
- For extension or replacement of existing sprinklers, ensure correct spacing's, nozzles or zones are matched for precipitation and programmed accordingly.

110.7 Installation:

- Refer Appendix B for data tables.
- Refer Appendix D for standard construction details.
- Fit to faucet tee or tapping saddles, saddles must have stainless steel nut/bolts.
- Install on minimum length 300mm articulated riser same nominal bore as sprinkler inlet c/w 3x MF elbows.
- Set to correct grade, level and at finished height of topsoil and turf interface.
- Use appropriate nozzle arc & adjust radius to minimize undesirable overspray onto hard surfaces.

M. Micro Irrigation & Drip Emitters

111. Drip Tube and Emitters

111.1 Drip irrigation may only be used upon recommendation of the irrigation designer and approval of the council TLIT for select landscaped areas to negate any potential overspray, or risks, such as; traffic islands and roundabouts, or vandalism.

111.2 Drip irrigation shall not be used at all in turf areas unless specifically instructed by council TLIT. Where drip irrigation is used in turf areas, QCV's must be installed at each control valve and link zone to facilitate turf establishment.

111.3 All drip tube shall have built in pressure compensated emitters with built in check valve to limit potential for siphon and low head drainage.

111.4 All drip zones shall include; Pressure regulator, filter, header manifold, flush manifold, and drip indicator – all of which are detailed in following sections.

111.5 Where multiple isolated zones are 'linked' to control valve, a set of air/flush valves and indicators are required at the furthest zone on each link zone route.

111.6 Product:

- DN13 PN4 drip tube, 3.0 lph @ 0.3m spacing, Netafim Techline AS or approved equal. Size & spacing may vary with run length, layout & soil type, refer design drawings subject to irrigation consultant's (CID) recommendation & council TLIT approval. Nominal design operating pressure 200kPa.
- For recycled water applications, use lilac drip tube.

111.7 Installation:

- Refer Appendix B for data tables.
- Refer Appendix D for standard construction details.
- Offset drip tube 0.2m from all edges or drip zone boundaries. Drip lateral spacing 0.4m unless otherwise specified by designer.
- Drip tube lateral maximum run length 65m using DN13 tube with 3 lph emitters @ 0.3m spacing, unless otherwise specified by designer (CID).
- At start and end of all drip tube laterals, fit to header and flushing manifold with take-off adaptor and crimp with Cobra stainless steel clamps. At the extremities of irregular shaped zones up to 3 laterals may be to teed together prior to manifold, providing maximum lateral flow capacity is not exceeded on any lateral.

- Install drip tube in garden beds at soil mulch interface, staked with 200mm galvanized J-pegs at 1.5m intervals.
- Install drip tube in turf areas at 100mm (+/- 25mm) below finished top soil grade.
- Test all drip zones are within operating pressure range at end of line flush valves, min 100kPa, as per 'Commissioning' section.

112. Secondary Filters for Drip

112.1 Filters are to protect all drip tube downstream of automatic control valve.

112.2 Product

- Disc filter, 120 mesh. Triangle Filtration TD ## or approved equal.
- 25mm, 40mm or 50mm sized in accordance with control valve, or greater.

112.3 Installation:

- Refer Appendix D for standard construction details.
- Locate immediately downstream of drip stations automatic control valve (with pressure regulation fitted) in separate HR 1419-12 (min) with SS locking nut & bolt kit, valve box to allow reasonable access for service and cleaning.
- Filter shall have or be fitted with flush-vent valve and downstream pressure test port available for 1/4'" BSP pressure gauge to facilitate servicing.
- For non-potable water sources, additional 25mm BSP port with Philmac or Hansen PN16 ball valve shall be required upstream of filter for routine seasonal chemical injection.

113. HDPE Zone Link Pipes for Drip

113.1 Link pipes are required where multiple isolated drip zones are connected to an automatic control valve, and under all hard surfaces such as paths or road crossings.

113.2 Product

- HDPE (PE100) PN12.5 in accordance with AS 4130.

113.3 Installation

- Refer Appendix B for data tables.
- Refer Appendix D for standard construction details.
- As per 'Pipework, underground' and 'Trench works' sections.

114. LPDE Manifolds for Drip

114.1 Drip manifold LDPE pipework is to provide:

- Header pipe at the start axis of all drip tube laterals in a drip area to maintain sufficient hydraulic capacity with an air valve fitted at high point along manifold.
- Flush pipe at the end axis of all drip tube laterals in each drip area with a flush valve at furthest end of each route.

114.2 Product:

- 25mm LDPE, PN3. Iplex or equal.

114.3 Installation:

- Refer Appendix B for data tables.
- Refer Appendix D for standard construction details.
- Install at 150mm depth.
- Use LDPE fittings with Cobra stainless steel clamps for all push on fittings.
- As per 'Trench works' section, where applicable.

115. Air Valves for Drip

115.1 Automatic air valves in all drip zones to both release air to reduce water hammer and introduce air under to prevent vacuum effect.

115.2 Product

- Automatic air release and vacuum valve. DN15 Bermad.

115.3 Installation

- Refer Appendix D for standard construction details.
- Locate at high point of LDPE manifolds within drip zones in Rain Bird 910 round valve box. No isolation valve required for drip air valves, downstream of automatic control valve.

116. Flush Valves for Drip

116.1 Flush valves in all drip zones at one end of all flush manifold to facilitate flushing on startup and during service or routine maintenance.

116.2 Product

- 25mm PE ball valve. Hansen or approved equal.

116.3 Installation

- Refer Appendix D for standard construction details.

- Locate at furthest end/s LDPE manifolds within drip zones in HR 910 round valve box c/w SS locking nut & bolt kit.
- Connect 1m of white wash-down hose to end of all flush valves, fixed with stainless steel clamp, coiled in valve box.

117. Visual Indicators for Drip

117.1 Install one pop up sprinkler per control valve with red sealed nozzle as drip indicator to visually confirm drip zone is operating.

117.2 Product:

- Pop up spray head. Pro-Spray 150mm spray body with End Strip nozzle.

117.3 Installation

- Refer Appendix D for standard construction details.
- Locate within drip zone/s near garden edge in a visible locate.
- Install on minimum length 200mm articulated riser c/w 3x MF elbows.
- Set to correct grade, level and at finished height of mulch.
- Seal nozzle with silicone to prevent wet spot.

N. Spare Parts & Tools

118. Spare Parts

118.1 Refer main contract

118.2 Not required unless otherwise specified in main contract

119. Special Tools & Accessories

119.1 2x sets of controller & enclosure master keys.

119.2 Any special service tools required for routine service of irrigation and associated equipment.

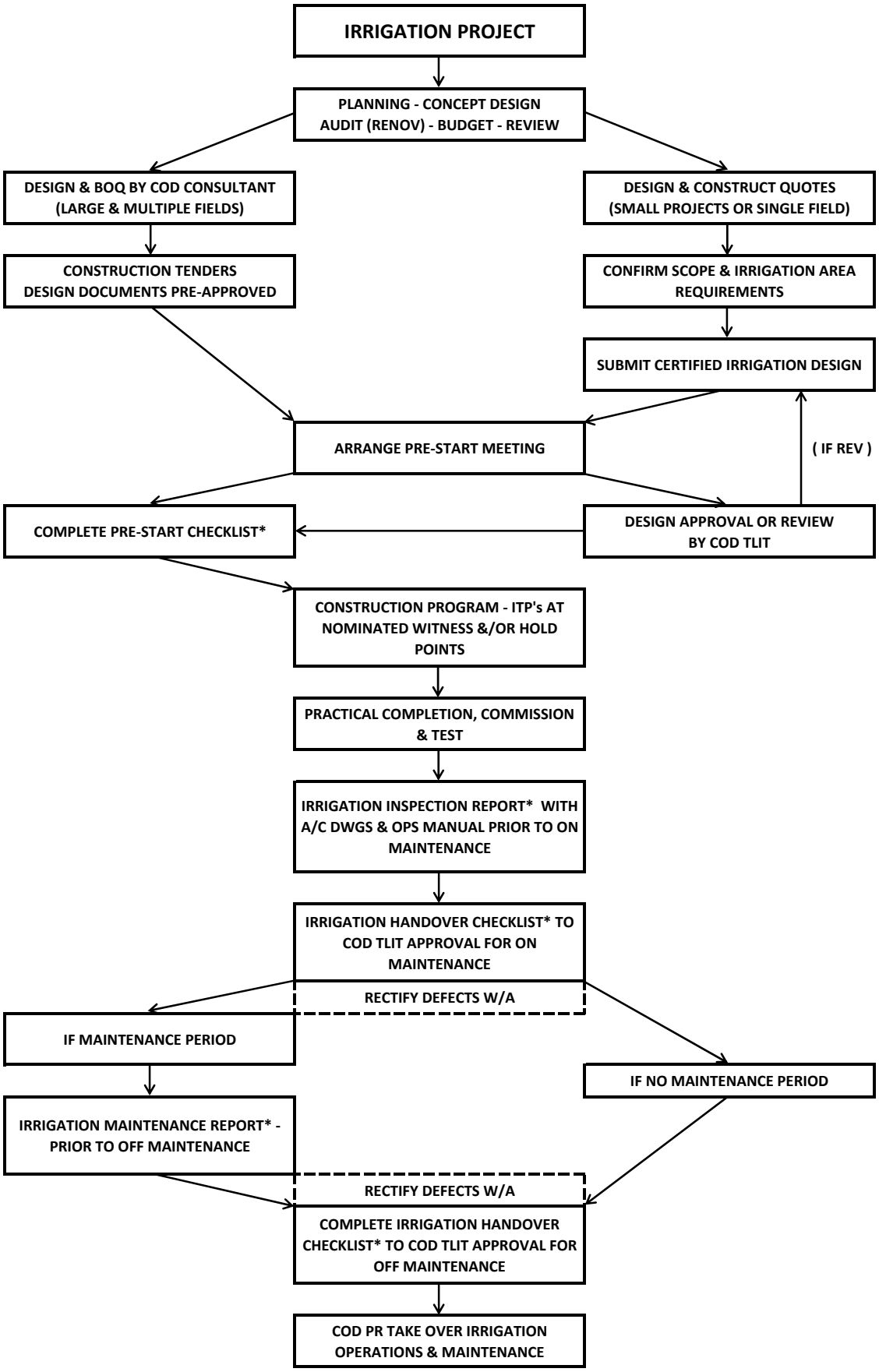
O. Appendices

120. Appendix A: Charts

120.1 Process flow chart, Irrigation Project

120.2 Programming irrigation controller flow chart

Flow Chart - Irrigation Project Process



Note: (*) refer Appendix C for ITP's, standard forms & checklists

Chart 1

Flow Chart - Irrigation Controller Programming Instructions

NOTE: * Used as a guide for site & establishment programming.

STEPS	Irrigation Water Management Plan (IWMP)	TIPS
		May not apply for ET based programs remotely controlled by central control
1	Gather information about your system & local climatic data. Where information is limited or unavailable do an audit.	As constructed drawings, manufacturers specification sheets & operating manuals, http://www.bom.gov.au/
2	Calculate local monthly water budget % table, for Jan to Dec	refer Appendix B Table 1 for your typical region, or develop one similar with your local climatic & plant factors
3	Calculate precipitation rates for for all emitter types, for each station	refer Appendix B Table 2 for generic emitter performance data. Check specific manufactuers product spec sheets. Important to know nozzle sizes, understand MPR, pressure and sprinkler spacings
4	Decide on run days based on current seasonal frequency requirements and calculate run times. Input program/s into contoller/s and set monthly water budget.	refer Appendix C Form 3 for sample guide to program sheet. Use product operator manual. Check sensors are set & functional w/a to maximise water savings.
5 (COD PR)	Implement an Irrigation Water Management Plan (IWMP). Calculate budget & forecast monthly water use. Measure and compare actual water use.	Implement most effective strategies for optimum water use & plant health. ********** Contact COD PR or COD principal irrigation consultant for site specific IWMP's and assistance.

Chart 2

121. Appendix B: Tables

Average regional weather data & Irrigation water budget estimates

Region: **Darwin, NT**

PLANT/TRAFFIC TYPE	Peak IR, mm/wk
Peak Month (100%), Landscape/Low	37.3
Peak Month (100%), Sports fields/High	42.2

Monthly Water Budget **(OCT)**

* Estimates based on Middle Point Rangers BOM site 014090 for average historical data

Month	Eo, mm/dy	Landscape (0.75*) & Low traffic turf Irrig Req, mm/wk	Sports (0.85*) High traffic turf Irrig Req, mm/wk	Water Budget, %
January ^	4.7	24.7	28.0	**66%**
February	4.5	23.6	26.8	**63%**
March	4.7	24.7	28.0	**66%**
April	5.2	27.3	30.9	**73%**
May	5.2	27.3	30.9	**73%**
June	5.2	27.3	30.9	**73%**
July	5.5	28.9	32.7	**77%**
August	6.1	32.0	36.3	**86%**
September	6.8	35.7	40.5	**96%**
October	**7.1**	**37.3**	**42.2**	**100%**
November	6.3	33.1	37.5	**89%**
December	5.2	27.3	30.9	**73%**

Notes:

1. *Irrigation requirements for soil profiles (sandy loam & sand) apply generic Eo/Et & plant factors, environmental factors (climatic & percolation) & performance factors (Scheduling Coefficent).
2. ^ Peak month = 100% water budget in controller monthly settings & design value.
3. For controllers without ET system, adjust controllers global water budget % monthly based on historical climatic data.
4. Sensors to adjust &/or shutdown for local rainfall events or environmental conditions.
5. For controllers linked with central control weather stations water budgets may be adjusted automatically based on current actual climatic conditions where program allows.
6. Adjust schedules (run times & frequency/week) seasonally, and after establishment;

ESTABLISHMENT	WET SEASON	DRY SEASON

Refer local or BOM weather station for current actual data or statistics.

Refer App B, table 2, for typical weekly run times.

Table 1

Sprinkler & Emitter performance data*

(guide only @ nominal pressure & spacings)

Based on Soil Profile: **Loam**

(recalculate Peak IR & IT for sandy profile)

**Based on square spacing noted using 360 ° arcs unless arc specifically noted & typical spacings - recalc for specific spacings & rotors with specific nozzle or varied arcs*

eg: for Sports 180 ° rotors, precition will be double that of 360 ° with same nozzle, therefore relative 180° run time will proportionally be half that of 360°.

Emitter type	Make/Model	Press, kPa	Nozzle #	Arc, °	Radius, m	Flow, l/m	Spacing*, ☐	Precip, mm/h	Peak IR mm/wk	Peak IT min/wk
Rotary spr, small/Lscape	HI PS-100/300	300	MP1000	360	4.3	2.9	4.0	11	37	**203**
Rotary spr, mid/Lscape	HI PS-100/300	300	MP2000	360	6.1	5.8	5.7	11	37	**209**
Rotary spr, large/Lscape	HI PS-100	300	MP3000	360	9.1	14.4	8.7	11	37	**196**
Rotor, mid/Parks turf	HI PGP Ultra	400	8	360	14.0	34.8	12.0	15	37	**154**
Rotor, mid/Sports turf	HI I-25-04-SS-B	450	18	360	18.3	62.3	16.0	15	42	**174**
Rotor, large/Sports turf	RB 8005-SS	450	18	360	20.1	70.4	18.0	13	40	**186**
Rotor, large/Sports turf	RB 8005-SS	480	22	360	22.2	95.0	20.0	14	42	**178**

Drip type	Make/Model	Press, kPa	Mx run, 13mm		Radius, m	Flow, l/h	Spacing*, ☐	Precip, mm/h	Peak IR mm/wk	Peak IT min/wk
13mm PC@30x40cm grid	Netafim TechAS 3l@0.3m	250	65		0.3	3.000	0.40	19	37	**119**

~ Use 0.3m drip emitter spacing x 0.4m drip tube lateral spacing most soil types and landscape applications except for free draining sandy soil, use 0.3m x 0.3m spacings.

NOTES:

Use matched precipitation rate nozzle selection for mixture arcs <360°, or use dedicated station for specific arcs (radius reqt's) & adjust precip rate (stations times) to suit

Peak IR (100% Water budget) = ave irrigation requirement (mm per week) during peak month (Jan - refer below), Peak IT = Irrigation time (min/week) to apply IR.

As a guide for frequency^ :

Establishment	Apply IT/7 daily cycles and taper off fortnightly until current seasonal maintenance regime can be achieved
Wet season	Apply IT/2 , two cycles per week wet-season (adjusting % water budget according to current month)
Dry season	Apply IT/3, three cycles per week mid-season (adjusting % water budget according to current month)

^ as a guide pending; as wet & dry season temperatures are fairly consistent, the frequency could also be consistent at say 2 or 3 cycles per week, pending soil type/capacity

^ as a guide pending; current season, soil type, plant type, & root depths. Refer App B, Table 1, for monthly water budgets & irrigation requirements

Table 2

Pipe Capacity Chart

(design guide *)

Polyethelene (PE100)		FLOW, l/s	Friction Loss
Mains, HDPE	**PN**	**Qmax @ 1.1 m/s**	**Hf% @ 1.1m/s**
225	12.5	**31.0**	0.5
160	12.5	**16.0**	0.8
125	12.5	**9.8**	1.0
110	12.5	**7.5**	1.2
90	12.5	**5.0**	1.5
75	12.5	**3.5**	1.9
63	12.5	**2.4**	2.3
50 (min)	12.5	**1.5**	3.0

Note: * based on individual one way routes, double for ring mains.

PVC (S1)		FLOW, l/s	Friction Loss
Mains, PVC	**PN**	**Qmax @ 1.1 m/s**	**Hf% @ 1.1m/s**
200	12	**35.0**	0.5
150	12	**17.6**	0.7
125	12	**13.4**	0.8
100	12	**9.0**	1.1
80	12	**5.5**	1.5
50	12	**2.5**	2.4
40 (min)	12	**1.6**	2.2

Note: * based on individual one way routes, double Q for ring mains.

Laterals, HDPE	PN	Qmax @ 1.6 m/s	Hf% @ 1.6m/s
75	12.5	**5.0**	3.7
63	12.5	**3.5**	4.5
50	12.5	**2.2**	5.9
40	12.5	**1.4**	7.7
32 (min)	12.5	**0.9**	10.3

Laterals, PVC	PN	Qmax @ 1.6 m/s	Hf% @ 1.6m/s
80	12	**8.0**	3.0
50	12	**3.5**	3.4
40	12	**2.3**	4.6
32	12	**1.8**	7.1
25 (min)	12	**1.1**	9.5

Drip manifolds, LDPE	PN	Qmax @ 1.5 m/s	Hf% @ 1.6m/s
25 (min)	3	**0.75**	11.0
32	3	**1.25**	8.0

Refer App B, table 2 for drip tube max run length

% = m/100m

Notes: Target total losses < 10% Hf losses across main pipework

Target < +/- 10% pressure variance across lateral, ave pressure = design pressure

Target < +/- 5% flow variance across lateral, ave flow = design flow

* Values are nominal may be exceeded (<2m/s) over short lengths (<10m)

Table 3

ULV Cable Run Lengths Chart

(design guide max*)

* Based on individual cable per solenoid valves routes.

May use multicore cables. Use 1x active core per per solenoid valve.

		Tycab	
Std - actives	**Type**	**Resist Ohm/km**	**Max run (m)**
1.5mm² (min)	Tyflo 7/0.50	**13.6**	200
2.5mm²	Tyflo 7/0.67	**7.4**	400

For decoder secondary path to solenoid, use 2 core (common+active) x1.5mm² for each solenoid valve.

Eg; dedicated active & common per decoder address, per solenoid.

For multi-address decoders, use 5 core for 2x addresses in one route (1x spare).

Std - common	**Type**	**Resist Ohm/km**	**Max run (m)**
2.5mm² (min)	Tyflo 7/0.67 (black)	**7.4**	400.0

Use seperate dedicated common/s, single core & black in colour.

Run common in star routes (not ring), use multiple common routes where practical

Decoder - cable	**Type**	**Resist Ohm/km**	**Max run (m)**
2x 2.5mm² (min)	TWiNtrax cable	**7.4**	2000
2x 4.0mm²	TWiNtrax cable	**4.6**	5000

For decoder, run star cable paths only, not looped

Table 4 (a)

Automatic Control Valve Flow Chart

(design guide max*)

Sol Vlv / Master Vlv	**Model**	**Flow, l/s**	**Hf, m ^**
25mm	IRRITROL 205/2400	**1.5**	2.5
40mm	IRRITROL 216B-M	**4.0**	2.5
50mm	IRRITROL 217B-M	**6.0**	2.5
80mm	RAIN BIRD 300-BPES	**12.5**	2.9
Master Valves			
100mm	Bermad 400	**17**	1.3
150mm	Bermad 400	**35**	0.7

Note: (^) Friction loss is nominal based on globe configuration. Refer individual models for specific Hf

Table 4 (b)

122. Appendix C: Quality Management, Forms & ITP's

122.1 Form 1, Irrigation pre-start checklist

122.2 Form 2, Irrigation works, Inspection & Test Plan

122.3 Form 3, Irrigation pump station ITP

122.4 Form 4, Irrigation pipe pressure ITP

122.5 Form 5, Irrigation inspection, maintenance & defects report

122.6 Form 6, Irrigation program scheduling data sheet

122.7 Form 7A, Irrigation audit ITP – Part A

122.8 Form 7B, Irrigation audit report – Part B

122.9 Form 8, Irrigation handover checklist

FORM 1: IRRIGATION PRE-START CHECKLIST

COD Phone : (08) 8930 0300 or (08) 8980 3616

COD Email : darwin@darwin.nt.gov.au

Attn: COD, Parks and Reserves - Team Leader Irrigation & Turf

Time: _____

Project: _____ Date: _____

Address: _____ COD ref # _____

_____ Job # _____

Pre-start coordinator / phone: _____ / _____

Task	Check	Date	Comments / Follow up	Int
Design submitted & approved	☐			
Irrigation drawings avail on-site	☐			
COD Specifications, Lock/keys for new encl's	☐			
Site Access, Inductions, Storage, Security	☐			
Works by others confirmed	☐			
Review site layout &/or irrig setout	☐			
Construction program, start-finish	☐			
Inspection &/or hold points req'd	☐			
Conduits &/or penetrations req'd	☐			
Existing services drawings	☐			
Dial before dig / 1300 locate	☐			
Water supply infrastructure avail	☐			
Water supply capacity	☐			
Power supply infrastructure avail	☐			
Power supply capacity (if pump req'd)	☐			
Record adjustments on as constructed	☐			
Maintenance period, duration	☐			
Maintenance period, responsibilities	☐			
On maintenance handover, est date	☐			
Comm's module - ID#/SIM#	☐			

Attachments (list):		Water meter reading		Date
	☐		Pre start	

Notes:

Irrigation Contractor representative: _____ Phone: _____

Principal contractor project mgr or COD POCW: _____ Phone: _____

COD TLIT or POCW or authorised rep: _____ Phone: _____

Office	Design approved COD TLIT : (sign) _____ Date: _____

INSPECTION & TEST PLAN				
Form:	**2**	**IRRIGATION WORKS**		
Job ref #:		COD #:		
Date:				COD TLIT or POCW:
Project Name:				
Project Area/Stage: (use form/stage)				Contractor:
Project Address:				Contractor site representative:

Ref No	Description	Stage/ Frequency/ Unit	Requirements/ Standard Specification	Inspection - Initials/sign		
				Contractor	Client	Consultant
1	W/I/C/H	Each stage completion	Prestart, set out main, valve, lat & sprinkler locations as per dwg/spec (ref ITP Form 1)			
2	W/C	On completion	Installation of water supply as per spec & design. Test WS/pump stn (ref ITP form 3)			
3	W	Each stage completion	Installation of Main Line and control valve assembly, control cables a/p spec & design			
4	W/C/H	Each stage completion	Flush main line pipe work & pressure test (ref ITP form 4)			
5	W	Prior to backfill	Installation of lateral pipe work & equipment a/p spec, design & SCD			
6	W	Each stage completion	Flushing of lateral pipe work prior to sprinkler &/or emitter fit-off			
7	W	Each stage completion	Installation, station operation and adjustment of sprinklers (ref ITP Forms 5)			
8	W/C	Each stage completion	Controller programming, operation, IWMP & SV elect cable tests (ref ITP Forms 5 & 6)			
9	W/I/C/H	Final Inspection	Irrigation system inspect, defects & commissioning (ref ITP Forms 5 & 8)			
10	W/I/C	Final Inspection	Handover of O&M Manuals, As constructed Data/Dwg, parts & training (ref ITP Form 8)			

W = Witness; H = Hold Point; I = Inspection by Authority; C = Inspection by Consultant (Certified Irrigation Designer); S = Surveillance or Monitoring; X = Self Inspection by Performer or Worker. Contractor to sign all, client or consult to witness.

Acceptance/Approval				
Date	Organisation	Name	Signature	Dept / Position

Notes: Attach: ☐ (list):

FORM 3: PUMP STATION ITP

Irrigation Water Supply

Date: _____
COD Project ref #: _____
Service Technican: _____
Witness: _____

Site name: _____
Site address: _____

Pump Station Details

Make		Model		Stn/Software version #:	
Design flow, l/s (max)		Duty head, m		Suction head, (+/-) m	
Mechanical drawings	Y / N	Mech drawing #:		Water source:	
Electrical drawings	Y / N	Elec drawing #:		VFD make/model #:	
Operations manuals	Y / N	(circle)	OM copies	hard___ / soft ___	(circle / qty)

Pump details

Pump #	Make	Model	Motor, kW	Duty, Q(l/s) @ H(m)	Current/Volts @ duty
1					
2					
3					
Tank systems, 24hr leak test	Y / N	Record water levels, sketch (attach: IN/OUT/OF/LL/HL)	TOTAL Pump Stn duty test		

Site settings & tests Where not applicable (N/A)

Voltage range set, volts		Overloads set, amps/pmp		Pressure tank set, kPa	
Valve positions checked		Prime/NPSH checked		Rotation check, all pumps	
Low level sensor checked		Temp sensors checked		Ext In/Outputs (details)	
Pressure setpoint, kPa		Start pressure, kPa/sec		Stop pressure, kPa/sec	
Pressure protection, kPa		Low pressure, kPa/sec		High pressure, kPa/sec	
No flow shutdown check		Min flow check (10-20% Q)		High flow check (100% Q)	
No short cycle check		No hunting check		Pressure @ Q max, kPa	
Voltage @ rest, V		Voltage @ Q max, V		Total Current @ Q max, A	

Training completed (int): _____ **Comments/actions req'd:** _____

Office **Appr'd by COD PR/CW rep:** _____ **Sign:** _____ **Date:** _____

FORM 4: PIPE PRESSURE ITP

Irrigation Mains

Date: _____

COD project #: _____ Service person: _____

Project name: _____ Stage: _____ Report sheet #: _____ Start time: _____

Site Address: _____ Time finished: _____

COD TLIT or POCW: _____ Witness: _____

Contractor representative: _____ Signature: _____

Area Desc/Location of test	Start time	Finish Time	Pipe Test Length (km)	DN Pipe Size (m)	Test Pressure Setting (m)	Make up water, W/A (l)	Duration (hrs)	Actual Make Up Water, (lph)	Finish pressure (m)	Pass/Fail - Comments

Allowable Make up water calc's			L - length	D - diameter (nom)	H - ave test head		Q - allowable make water	Combined Area Totals (w/a)
AREA	Description Main	Location	km	m	m		l/hr	l/hr
						Total mainline		

Field test mainline (AS2033-PE & AS2032-PVC): 1.25x design operating pressure for 15min, with no visible signs of leakage = pass

Test pump type: _____

Test pump model: _____

Field test mainline (AS2566.2-Flexible pipelines): Test to 1.25 x design pressure or specified pressure 1000 kPa (do not exceed component PN rating)

Duration, apply make up pressure every 0.5 hr, up to 2 hours. If test time pro-rata, convert to equivalent l/hr

For AS2566.2 Sect 6.3.4.1 constant pressure (water loss) method calculations: Q ≤ 0.14 LDH = pass

Q=Allowable make up water(l/hr), D=nominal diameter of the test length(m), L= length of test length(km), H=average test headoverlength of pipe under test(m)

Other reference documents or attachments (list):

As constructed dwg ☐

_____ ☐

Further comments/actions required: _____

Office **Approved by COD PR/CW rep:** _____ **Sign:** _____ **Date:** _____

FORM 5: IRRIGATION INSPECTION, MAINTENANCE & DEFECTS REPORT

COD Email : darwin@darwin.nt.gov.au

COD phone: (08) 8930 0300 or (08) 8980 3616

Attn: COD - Parks and Reserves, Team Leader Irrigation & Turf

Date: _____

Service person: _____

Project name: _____ Report sheet #: _____ Start time: _____

Site Address: _____ of # sheets: _____ Time finished: _____

COD Authorised Officer: _____ Water meter reading (start): _____ Service Company or COD: _____

Contractor representative: _____ Water meter (finish): _____ Service contact phone: _____

Controller #	Station #	Station details: location, garden/turf, type sprinklers	Controller: operation, runtime, days, WB%	Valves tags, level/grade, ball vlv, filters clean flow/press reg setting (w/a)	Sprinklers: level/grade, arc/rad set, clog/leaks	Comments: actions, timeframe, by who,	completed int/date

Further instructions:

Attachments (list):

As constructed dwg, available ☐

☐

Office	**Approved, COD PR or CW rep:**	**Sign:**	**Date:**

FORM 6: IRRIGATION PROGRAM SCHEDULING & DATA SHEET

Project name: _____ Project #: _____ Comm's type: _____ By: _____ Int: _____ **Current WB set**

Site Address: _____ Link to WS #: _____ Comm ID/IP #: _____ Position: _____ Date: __ / __ / ____ _____%

Total irrigated area (est), m² : _____ FM: _____ (Y/N) **Available Irrigation Days**

FM type/size: _____ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday ☐ Sunday ☐

Sheet _____ **Irrigation Window**

of _____ Earliest start time Water Budget for Peak Month ***100%*** Peak Month Irrig Req'd(@ 100%) _____

Sheets _____ Latest finish Time ***<Peak month = January>*** (BOM Stn: Brisbane Regional Office # 040214) mm/wk

Controller ID # & dec address	Station ID #	Rotor type -Nozzle/Arc - Loc	Number of Sprink/Rotors	Prep rate, mm/hr	Estimated Flow, l/m	Program A Run time, min	Start time Days	Program B Run time, min	Start time Days	Program C Run time, min	Start time Days	Flow, kL/wk WB @ 100%
				Max Hours (@ 100%)							**Total Volume kL/week**	**(WB @100%)**

Notes:

1. To adjust frequency may use seasons for programs. Activate in season & adjust WB% via Et (auto) or mth(man). Eg: A: Dry B=Wet C=Establish
2. Use cycle & soak programming feature to limit continuous run times with intervals in same program schedule, if runoff or ponding were likely to occur
3. Refer App B, tables 1 & 2, for; water budget, irrigation requirements, typical precipitation rates & weekly run times

DATA INPUT BY: _____ DATE: _____

FORM 7A: IRRIGATION AUDIT ITP - PART A

CATCH CAN TEST, SITE DATA & OBSERVATIONS

Part A

COD PR or CW Rep: _____ Time/Date: ____/____

Contractor Rep: _____ Consultant/Auditor: _____

Project name: _____ COD Project Ref #: _____

Site Address: _____ Controller: _____

Known site issues: _____ Area/stn: _____

_____ Sheet: 1 of #

Plant Type: _____ Soil Type: _____ Root Depth, mm: _____

Rotor Manufacturer: _____ Rotor Model: _____ Arc/s (FC/PC/MIX): _____

Rotor Nozzle, 360°: _____ Rotor Nozzle, 180°: _____ Rotor Nozzle, ___°: _____

Rotor Spacing(m): _____ Lateral Spacing(m): _____ Grid Type(SQ/TR/SI): _____

Controller-Stn ID/s: _____ Test Run Time, min: _____ Wind, spd/dir: ____/____

GRID REF:	1	2	3	4	5
A					
B					
C					
D					
E					

Offset to 1st can, m: _____ Catch can grid: _____ x _____

Pitot tube test Ave: _____ kPa Pr. Variation vs ave: _____

High: _____ Low: _____ *Target +/-10% DesPr*

Comments, press.: _____ Opt. design press: _____

Total flow/stn: 1st stn, # ___ _____ l/s Total rotors/arc: _____

2nd stn, # ___ _____ l/s Total rotors/arc: _____

Comments, flow: _____

Rotor Uniformity Radius,m: _____ *Target >Head-Head*

DU %: _____ *Target DU > 80%* Scheduling Coeff: _____ *Target SC <1.3*

Comments, effic'y: _____

Precipitation Tested Rotor Prec. Rate: _____ mm/hr

Controller programmed schedule settings Run time, min: _____ Days/week: _____

Water Budget: _____ Adj Run time/wk: _____ Calc prec/wk: _____

Estimated current irrigation seasonal requirements*: *Based on local BOM historical data, stn#:

Eo - (mth), mm/wk: _____ Ave Et/SC factor: 0.8 Est. Irr.Req'd/wk: _____

Comments, current irrigation schedules: _____

General comments, layout & operation: _____

General observations, plants & soil: _____

Attachments, (^ required): Inspection Form 5 ^: ☐ (required) Audit Report part B ^ ☐ (required)

Site photos: ☐ ____ (qty) As Con dwg/s #: _____ CCan Grid location/s: ☐ (sketch)

FORM 7B: IRRIGATION AUDIT REPORT - PART B
(&/OR IRRIGATION PLANNING REPORT ☐)

SUMMARY REPORT - RESULTS & RECOMMENDATIONS
Part B

COD PR or CW Officer: _____ Date: _____

Contractor Representative: _____ Consultant/Auditor: _____

Project name: _____ COD Project Ref #: _____

Site address: _____ * refer Part A for audit ITP - site data, attached ☐

Consultant/auditor to complete below. * Inspection Form 5: ☐ (required)

INTRODUCTION *Comment on purpose of audit & any known issues.*

Future requirements, if any:

SCOPE OF AUDIT & TESTS, OR PLANNING REPORT

SUMMARY RESULTS OR CRITERIA *If items not tested, insert (N/T)*

Age, condition & AC dwgs

Design & layout, Q@H req'd

Water supply, Q@H capacity

Controls & programming

FM, sensors, valves & wiring

Sprinklers, arcs & nozzles

Catch can test, uniformity

System performance/coverage

General, pipework, stuctures

Observations - plant health

List critical defects identified

RECOMMENDATIONS *List key solutions & priorities to address any performance issues . Note impact on operating costs.*

Master plan, sketch or concept design/attach ☐

BUDGETS *List estimates for recommended renovations or new works, where applicable.*
Include associated costs, such as; design, installation & project management.

Item	Desc	Budget (excl GST)	Comments / priority
TOTAL			

Other references/attach ☐ Attached detailed capital or operating costings & calculations, where breakdown required ☐

Office	Approved by COD TLIT or POCW:	Date:

FORM 8: IRRIGATION HANDOVER CHECKLIST

COD Phone : (08) 8930 0300 or (08) 8980 3616

COD Email : darwin@darwin.nt.gov.au

Attn: COD, Parks and Reserves - Team Leader Irrigation & Turf

Time: _____

Project: _____ Date: _____

Address: _____ COD project ref # _____

_____ Job # _____

Handover coordinator / phone: _____ / _____

Only check boxes applicable & completed. Mark N/A where not applicable

Task	Check	Date	Comments / Follow up	Int
Check drawings & specification are met	☐			
System flushed	☐			
Operation & functions checked	☐			
Backflow &/or PS test certificate c/w Q/H capacity test	☐		Qmin ____ l/s @ ____kPa, Qmax ____ l/s @ ____kPa	
Mainline integrity & supply capacity, verify - press test	☐			
Filters cleaned & pressure reg's set (w/a)	☐			
Sprinklers to grade & arc/radius set	☐			
Drip tube pegged, covered, flush & press test (w/a)	☐			
Valves to grade, tagged, press set, elect test	☐			
Controller mounted, programmed, elect test	☐			
Monthly water budget % set	☐			
Sensors (flow &weather) connected & tested	☐			
Practical Completion achieved	☐			
ITP's & Defects list (w/a) completed	☐			
Earth resistance test or special requirements (w/a)	☐			
As constructed drawings & OM manuals, completed	☐			
Keys, special tools & spare parts, completed	☐			
Maintenance staff training, completed (w/a)	☐			
On maintenance, completed or passed	☐			
Maintenance period, timeframe - (w/a)	☐			
Off maintenance, completed or passed	☐			
Comm's module - ID#/SIM#	☐			
Central control details, database loaded & operational	☐			
Site cleanup & removal	☐			

Attachments (list):		**Flow meter readings**		Date
Defects	☐		Practical Completion	
Other			On maintenance	
			Off maintenance	
Notes:				

Irrigation Contractor representative: _____ Phone: _____

Principal contractor project manager or COD POCW: _____ Phone: _____

COD TLIT representative: _____ Phone: _____

Office	Approved by COD TLIT (sign): _____ Date: _____

123. Appendix D: Standard Construction Details

123.1 Section A Preliminaries & Access

- COD-IM-SC-A1 (0) Irrigation Access Conduit

123.2 Section B Water Supply

- COD -IM-SC-B1 (0) Irrigation Water Supply Tank
- COD -IM-SC-B2 (0) Irrigation Pump Station Shed
- COD -IM-SC-B3 (0) Small Pump Station Enclosure
- COD -IM-SC-B4 (0) Single Pump & Auto Filter Station

123.3 Section C Control System

- COD -IM-SC-C1 (0) Irrigation Central Control
- COD -IM-SC-C2 (0) Irrigation Controller, Wall Mount
- COD -IM-SC-C3 (0) Irrigation Controller, Pedestal Mount
- COD -IM-SC-C4 (0) Controller & Weather Station Post Mount
- COD -IM-SC-C6 (0) Master Valve & Flow sensor
- COD -IM-SC-C7 (0) Automatic Control Valve

123.4 Section D Pipe & Valves

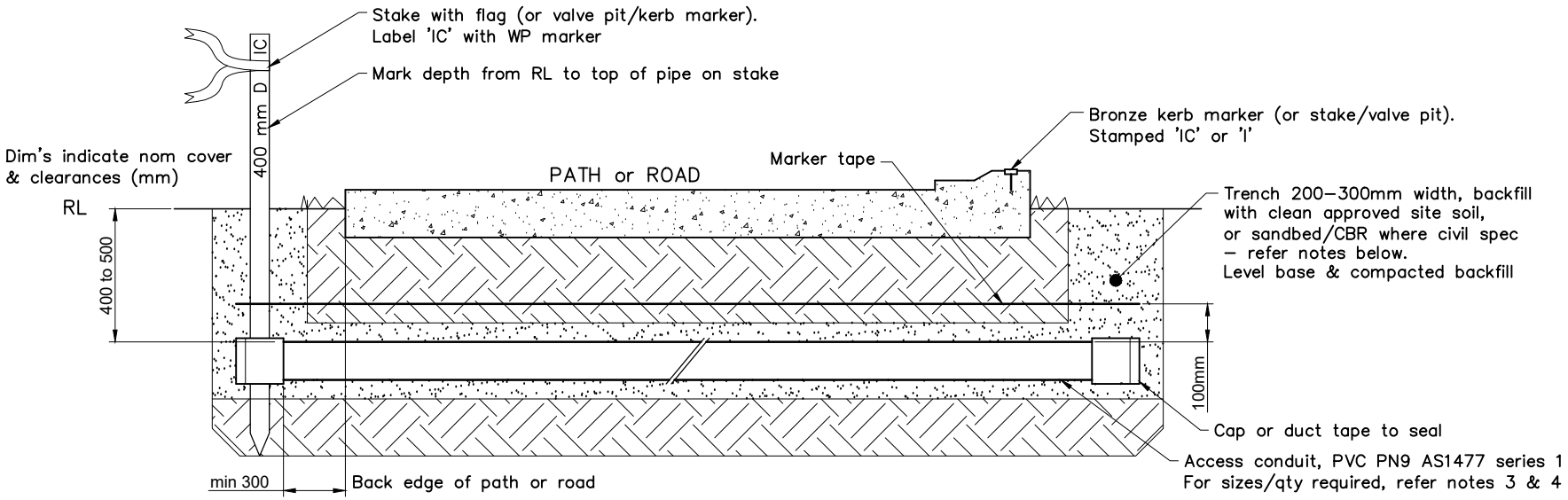
- COD -IM-SC-D1 (0) Backflow Prevention Assembly - RPZD
- COD -IM-SC-D3 (0) Irrigation Pipe Trench, Sports Turf
- COD -IM-SC-D4 (0) Isolation Valve, Small (BSP)
- COD -IM-SC-D5 (0) Isolation Valve, Large (FLG)
- COD -IM-SC-D6 (0) Quick Coupling Valve
- COD -IM-SC-D7 (0) Air Valve, Main

123.5 Section E Irrigation Sprinklers & Rotors

- COD -IM-SC-E1 (0) Garden Sprinklers, popup & shrub
- COD -IM-SC-E2 (0) Turf Rotor, popup

123.6 Section F Micro Irrigation

- COD -IM-SC-F1 (0) Drip Irrigation Layout
- COD -IM-SC-F2 (0) Drip Irrigation Cross Section
- COD -IM-SC-F3 (0) Secondary Drip Filter Assembly
- COD -IM-SC-F4 (0) Drip Air-Vacuum Relief Valve
- COD -IM-SC-F5 (0) Drip Flush Valve



NOTES:

1. Access conduits are the generally responsibility of principal contractor, unless otherwise specified, which may often be delegated to civil contractor or builder. The requirement is to those responsible to follow this detail so as not to create logistics issues or program delays.
2. Where a irrigation access conduits plan is not available the irrigation designer is to facilitate developing an access conduits plan in consultation with the project manager prior to construction. Notate sizes & quantities/crossing on IA conduits plan
3. Access conduit pipes are required under all hard surfaces (roads, paths) & shall nominal 20% greater diameter than irrigation pipe/s &/or electrical conduits. As a guide unless otherwise specified, minimum 100mm access conduit for up to; 1x 63mm main with 1x 32mm lateral plus 1x 13 core cable, refer below point where >100mm required.
4. Where requirement exceeds 100mm access conduit, allow larger pipe &/or multiple pipes, mark sizes/qty clearly on IA conduit plan
5. Maintain 50mm separation between access conduit pipes in common trenches
6. Access conduits must be straight, undamaged & continuous
7. Access conduits must be installed within reasonable (within 100mm) depths & clearances nominated above
8. Access conduits must be clear of rubble, debris, obstructions, and wildlife
9. All access conduits must be clearly marked on–site with either stakes, kerb markers &/or valve pits. Where access conduit locations vary from original conduit design plan, mark up on as constructed access conduits site drawings
10. Site instruction from project manager is required for additional conduits, locating unmarked conduits, or special excavation
11. Generally trench only what can be backfilled the same day
12. Barricade any unfilled pits or trenches at end of each day, or during excavation as required to maintain site safety

IRRIGATION ACCESS CONDUITS UNDER PAVEMENT DETAIL

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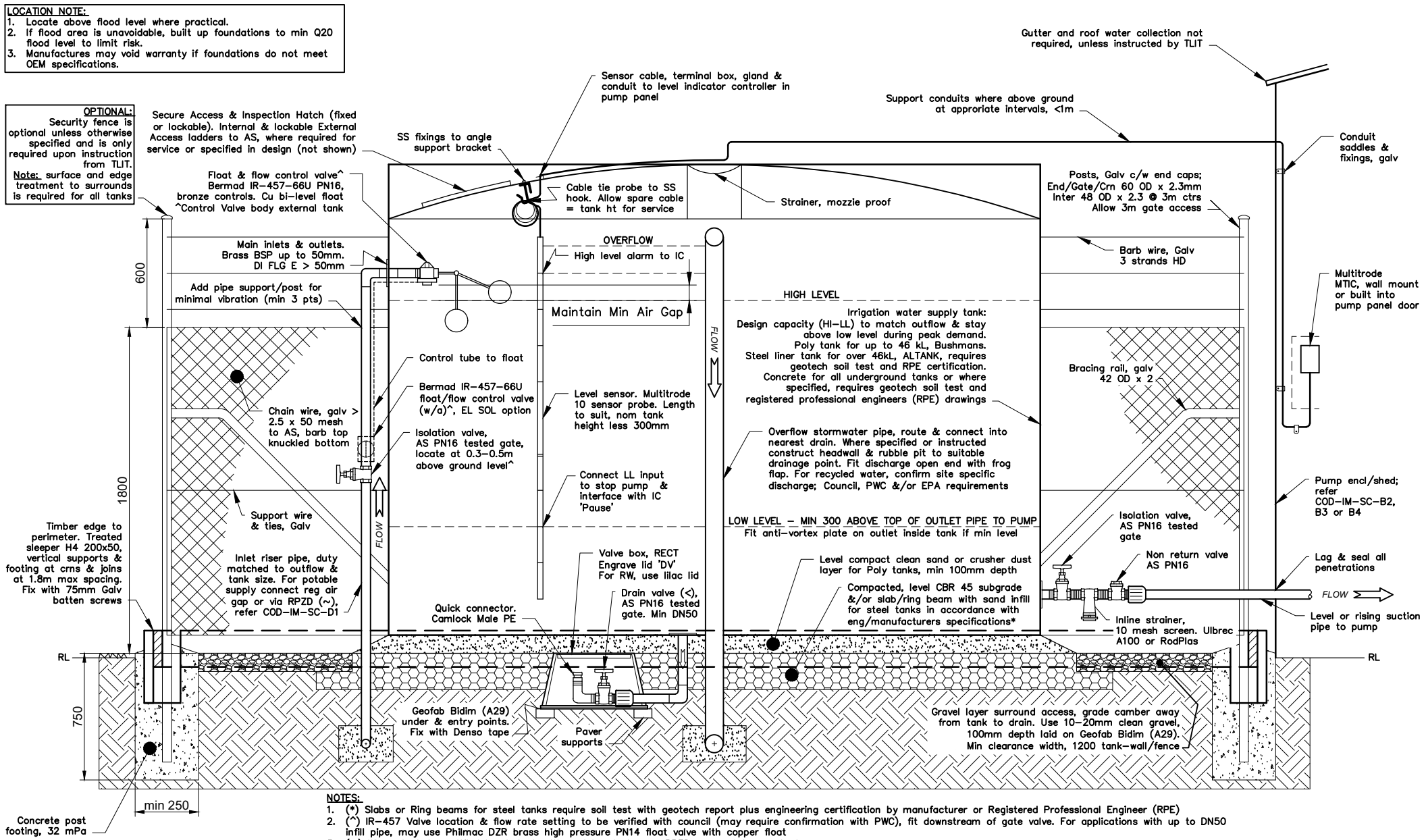
CLIENT: CITY OF DARWIN - PARKS AND RESERVES IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION ACCESS CONDUIT DETAIL

DRAWING No. COD-IM-SC-A1 | SHEET A3 OF | REVISION 0



NOTES:
1. (*) Slabs or Ring beams for steel tanks require soil test with geotech report plus engineering certification by manufacturer or Registered Professional Engineer (RPE)
2. (^) IR-457 Valve location & flow rate setting to be verified with council (may require confirmation with PWC), fit downstream of gate valve. For applications with up to DN50 infill pipe, may use Philmac DZR brass high pressure PN14 float valve with copper float
3. (~) Where tank is certified break tank with registered air gap, RPZD may not be required
4. (<) The drain valve may be optional at the discretion of council TLIT
5. (>) Specific projects may adjustment of fence type or finish colour, eg: posts & mesh may be Black PC, where specified by council TLIT or POCW
6. Extent of works within irrigation scope to be determined within specific project contract
7. Tank capacity, compound size, intake duty to be determined in design layout drawings. Detail to be read in conjunction with COD irrigation assets specification manual

IRRIGATION WATER SUPPLY TANK DETAIL

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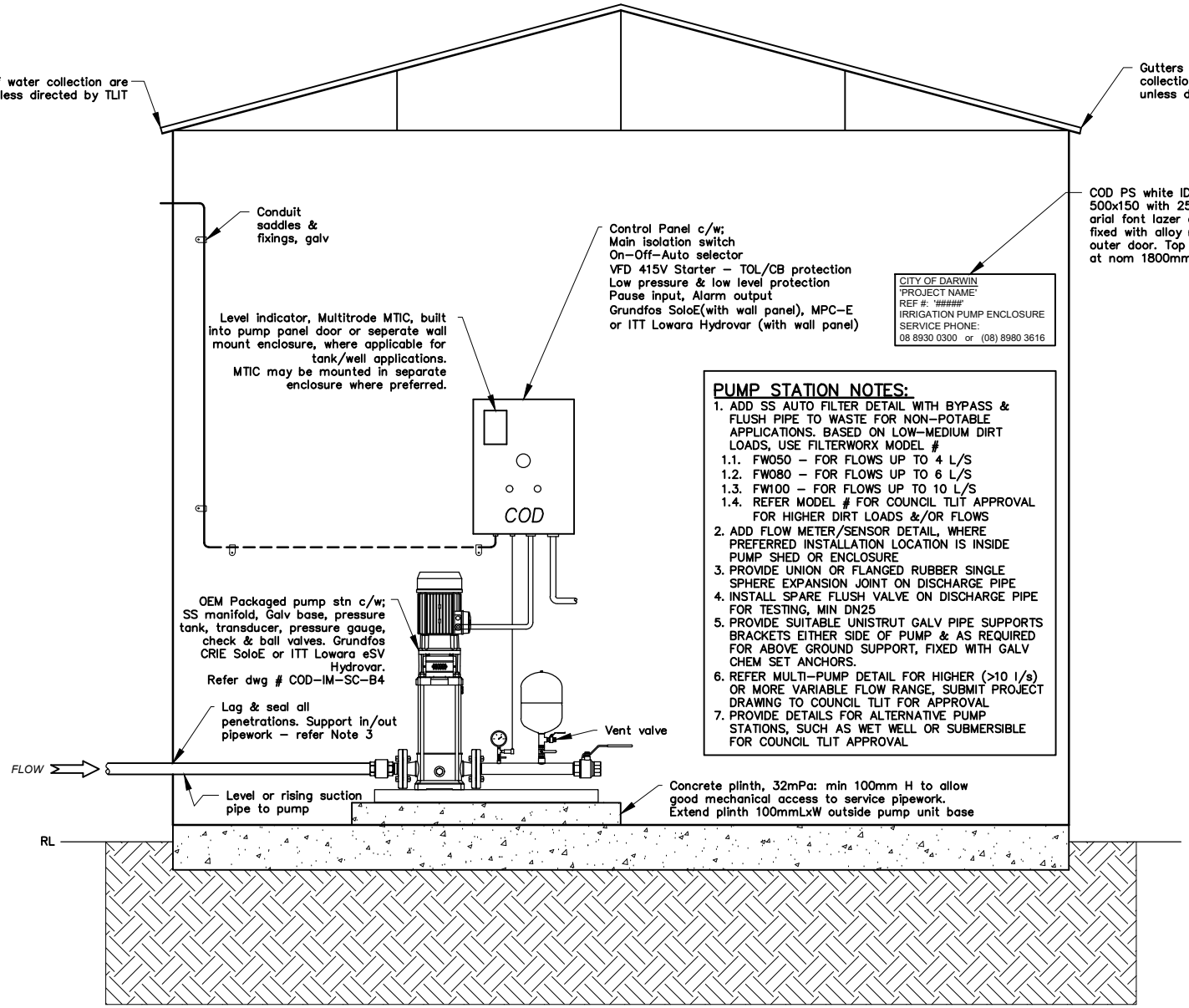
PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION WATER SUPPLY TANK DETAIL

DRAWING No. COD-IM-SC-B1 | SHEET A3 OF | REVISION 0

Building & Construction Notes:

1. Pump enclosure or sheds to be manufactured & erected by approved council shed builder.
2. Detailed structural drawings to be submitted for approval prior to construction.The contractor is responsible for all structural elements, engineering certification & building approvals, where required.
   - 2.1. Shed wind rating, to suit site location
   - 2.2. Slab construction, conduct Geotechical test for footings and specify foundations to suit site soil type
3. Min internal bldg Dim's;
   - 3.1. 3x4m for single pump unit (exception, refer 3.3 below)
   - 3.2. 4x6m for multi-pump unit/s c/w filter
   - 3.3. For smaller units without filter, nom 1.2x1.8m enclosures similar to COD-IM-SC-B3 may be used at council discretion, eg; for low visual impact
4. Min Eave height, 3.0m*. Roof pitch 15d(min).
5. Min clearance* from top of pump/motor to roof eave = 1.25 x pump/motor ht
6. Overhead gantry with multi-directional pulley optional, for larger pumps where specified by; designer(CID), engineer, council TLIT or POCW. Increase min eave height clearance from pump to gantry to suit. Where applicable, Min lift capacity is 1.25 x pump & motor weight, and gantry to be certified by registered professional engineer
7. Building construction, unless otherwise specified:
   - 7.1. Type, Colourbond,
   - 7.2. Finish, 'Wilderness Green' unless otherwise specified.
   - 7.3. Gable roof, corrugated colourbond
   - 7.4. Ventilation (minimum): 1x whirly bird roof vents & 2x 600x900 fix louvre wall vent with security mesh
   - 7.5. All openings and security mesh to be vermin proof
   - 7.6. Optional: insulation &/or sound attenuation, where directed by TLIT
8. Lock types to council standards.
9. Master key all locks to council standards.
10. Lag all pipework through walls. Support all pipework and thrust block where required
11. The contractor & shed builder are responsible for all structural elements, engineering certification & building approvals, where required unless otherwise specified in scope
12. External metered power supply & distribution board generally by others unless otherwise specified. The distribution board would include main circuit breaker with separate circuits for pump control panel, lighting and general power. Surge/lightning/overload protection is required at distribution board.
13. Unless otherwise specified, the contractor shall allow for internal power, including;
    - 13.1. wiring to pump panel &/or motor/s
    - 13.2. 2x double fluoro battens centrally located, with switch beside access door
    - 13.3. Allow 3x double 240V 10A GPO's, locate one @ distribution board, one @ filter controller, and one at discharge pipe (future/dosing)
    - 13.4. Allow electrical access routes for all cabling, via cable zones(trench/tray) or conduits, as required



PUMP STATION NOTES:

1. ADD SS AUTO FILTER DETAIL WITH BYPASS & FLUSH PIPE TO WASTE FOR NON-POTABLE APPLICATIONS. BASED ON LOW-MEDIUM DIRT LOADS, USE FILTERWORX MODEL #
   - 1.1. FW050 - FOR FLOWS UP TO 4 L/S
   - 1.2. FW080 - FOR FLOWS UP TO 6 L/S
   - 1.3. FW100 - FOR FLOWS UP TO 10 L/S
   - 1.4. REFER MODEL # FOR COUNCIL TLIT APPROVAL FOR HIGHER DIRT LOADS &/OR FLOWS
2. ADD FLOW METER/SENSOR DETAIL, WHERE PREFERRED INSTALLATION LOCATION IS INSIDE PUMP SHED OR ENCLOSURE
3. PROVIDE UNION OR FLANGED RUBBER SINGLE SPHERE EXPANSION JOINT ON DISCHARGE PIPE
4. INSTALL SPARE FLUSH VALVE ON DISCHARGE PIPE FOR TESTING, MIN DN25
5. PROVIDE SUITABLE UNISTRUT GALV PIPE SUPPORTS BRACKETS EITHER SIDE OF PUMP & AS REQUIRED FOR ABOVE GROUND SUPPORT, FIXED WITH GALV CHEM SET ANCHORS.
6. REFER MULTI-PUMP DETAIL FOR HIGHER (>10 l/s) OR MORE VARIABLE FLOW RANGE, SUBMIT PROJECT DRAWING TO COUNCIL TLIT FOR APPROVAL
7. PROVIDE DETAILS FOR ALTERNATIVE PUMP STATIONS, SUCH AS WET WELL OR SUBMERSIBLE FOR COUNCIL TLIT APPROVAL

NOTES:
1. Pump capacity, shed size to be determined in design layout drawings. Detail to be read in conjunction with council irrigation assets specification manual
2. Refer dwg COD-IM-SC-B1 for Water Supply Tank detail. Extent of works within irrigation scope to be determined within specific project contract

IRRIGATION PUMP STATION SHED DETAIL

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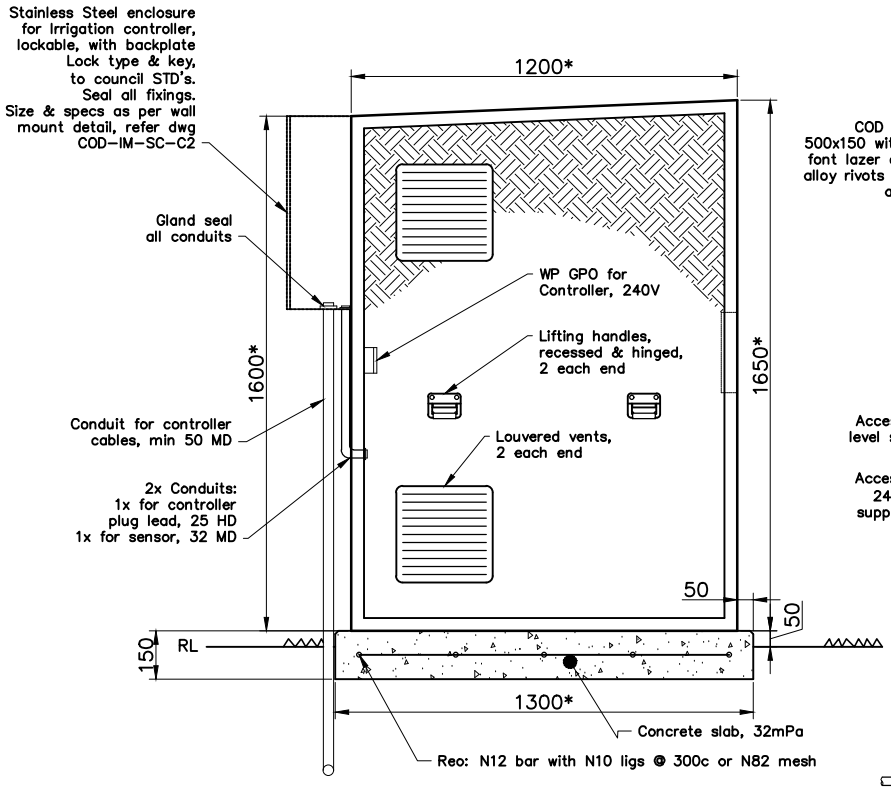
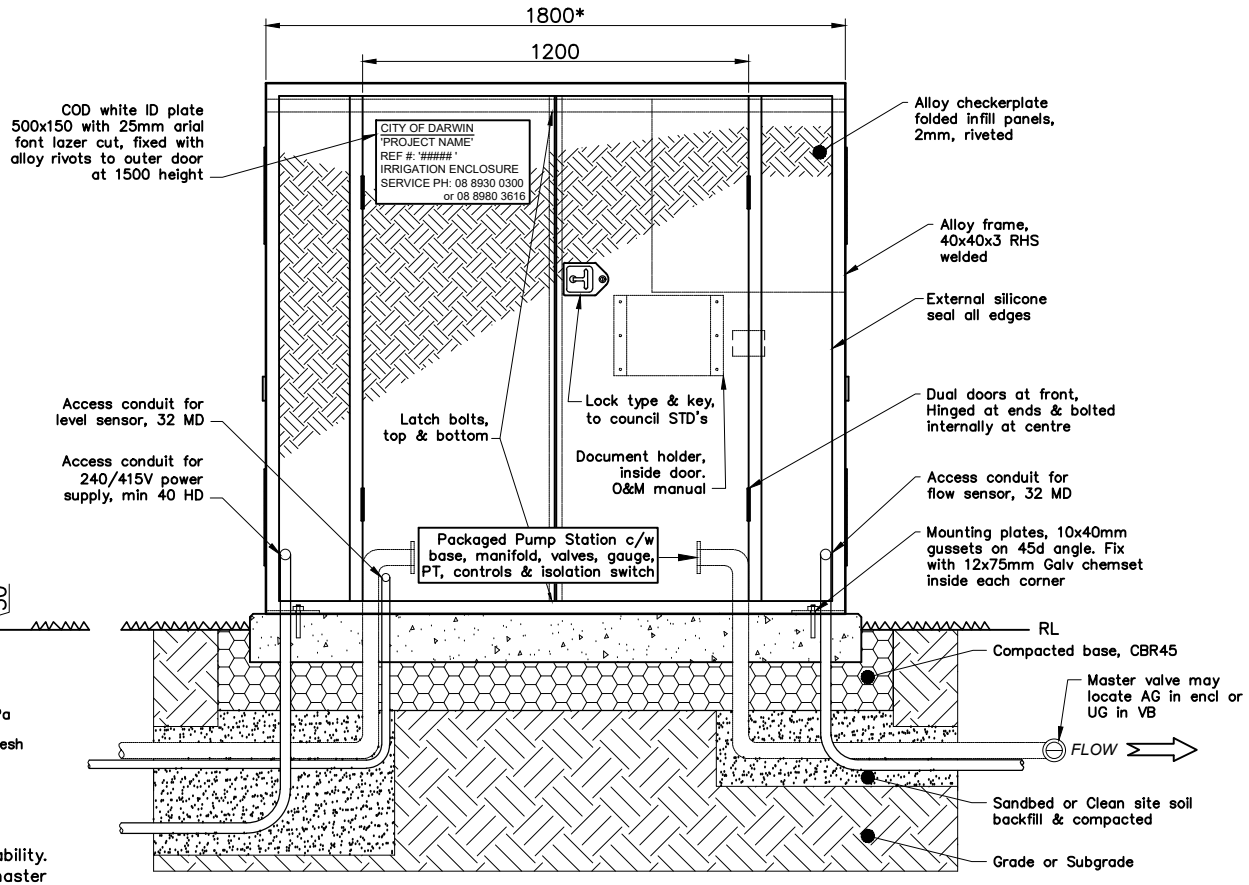
CLIENT: CITY OF DARWIN - PARKS AND RESERVES
IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: STANDARD CONSTRUCTION DETAIL
IRRIGATION PUMP STATION SHED DETAIL

DRAWING No. COD-IM-SC-B2 | SHEET A3 OF | REVISION 0



SIDE ELEVATION



FRONT ELEVATION

NOTES:

1. (*) Sizes are minimum recommended for pump serviceability.
2. (*) Sizes may vary pending pump size or addition of master valve &/or filter. Maintain min clearances as follows
   - 2.1. End of enclosure to in/out vertical risers, 300mm
   - 2.2. Side of enclosure to outer pump base, 300mm
   - 2.3. Slab floor to underside of horizontal pipe 150mm, which may require to build up base with shims or add plinth
   - 2.4. Roof to top of motor/drive, 300mm

SMALL PUMP ENCLOSURE DETAIL

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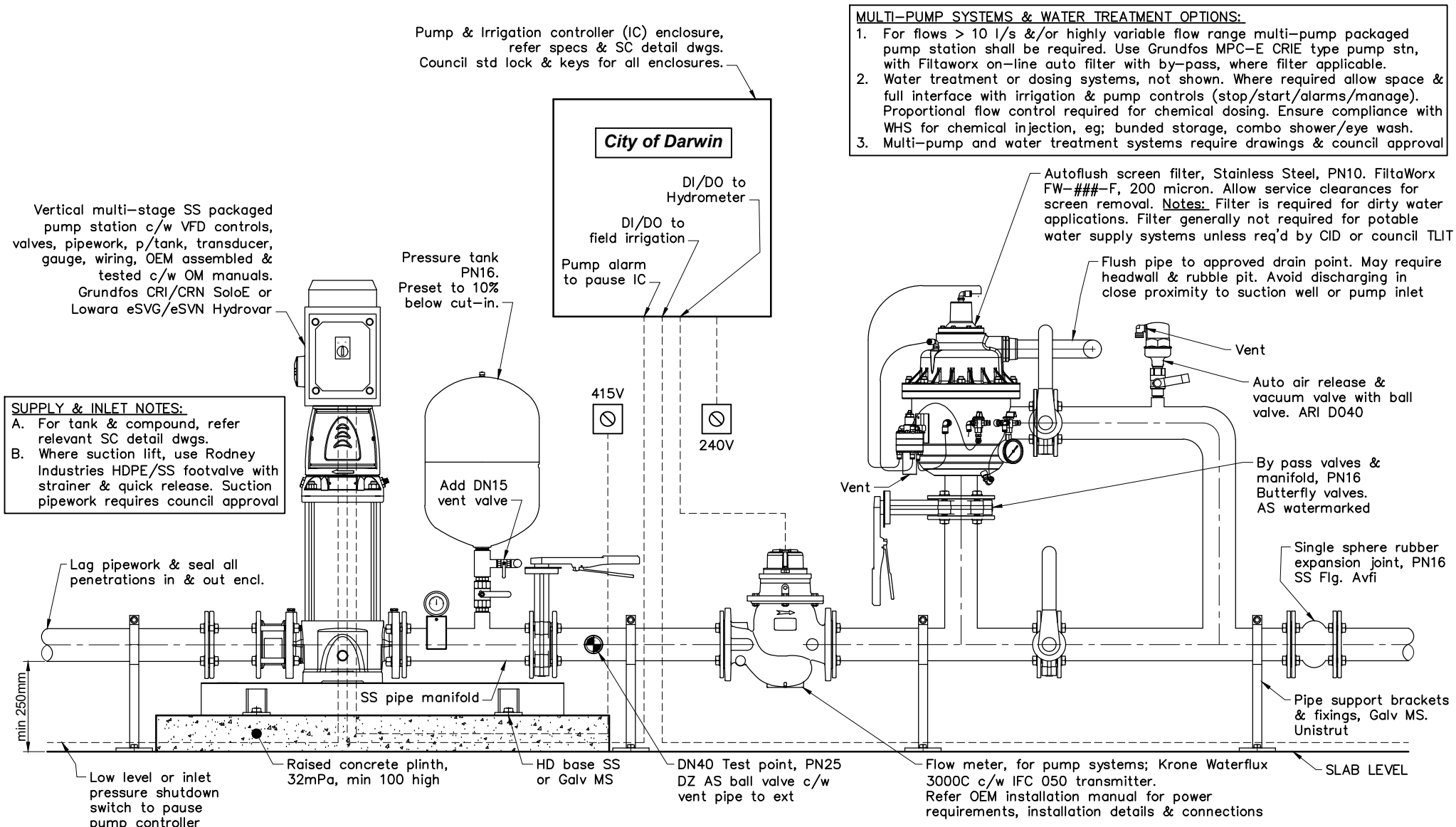
PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION SMALL PUMP ENCLOSURE DETAIL

DRAWING No. COD-IM-SC-B3 | SHEET A3 OF | REVISION 0



MULTI-PUMP SYSTEMS & WATER TREATMENT OPTIONS:

1. For flows > 10 l/s &/or highly variable flow range multi-pump packaged pump station shall be required. Use Grundfos MPC-E CRIE type pump stn, with Filtaworx on-line auto filter with by-pass, where filter applicable.
2. Water treatment or dosing systems, not shown. Where required allow space & full interface with irrigation & pump controls (stop/start/alarms/manage). Proportional flow control required for chemical dosing. Ensure compliance with WHS for chemical injection, eg; bunded storage, combo shower/eye wash.
3. Multi-pump and water treatment systems require drawings & council approval

SUPPLY & INLET NOTES:

A. For tank & compound, refer relevant SC detail dwgs.
B. Where suction lift, use Rodney Industries HDPE/SS footvalve with strainer & quick release. Suction pipework requires council approval

NOTES:

1. Detail to be read in conjunction with irrigation specification manual & assoc std construction details
2. Pump & filter capacity to be determined in design, in accordance with specifications
3. Pump shed or enclosure type, clearances & size in accordance with design (w/a) & specifications
4. Extent of pump station works within irrigation scope to be determined within specific project contract

TYPICAL SINGLE VMS PUMP STATION & AUTO SCREEN FILTER DETAIL

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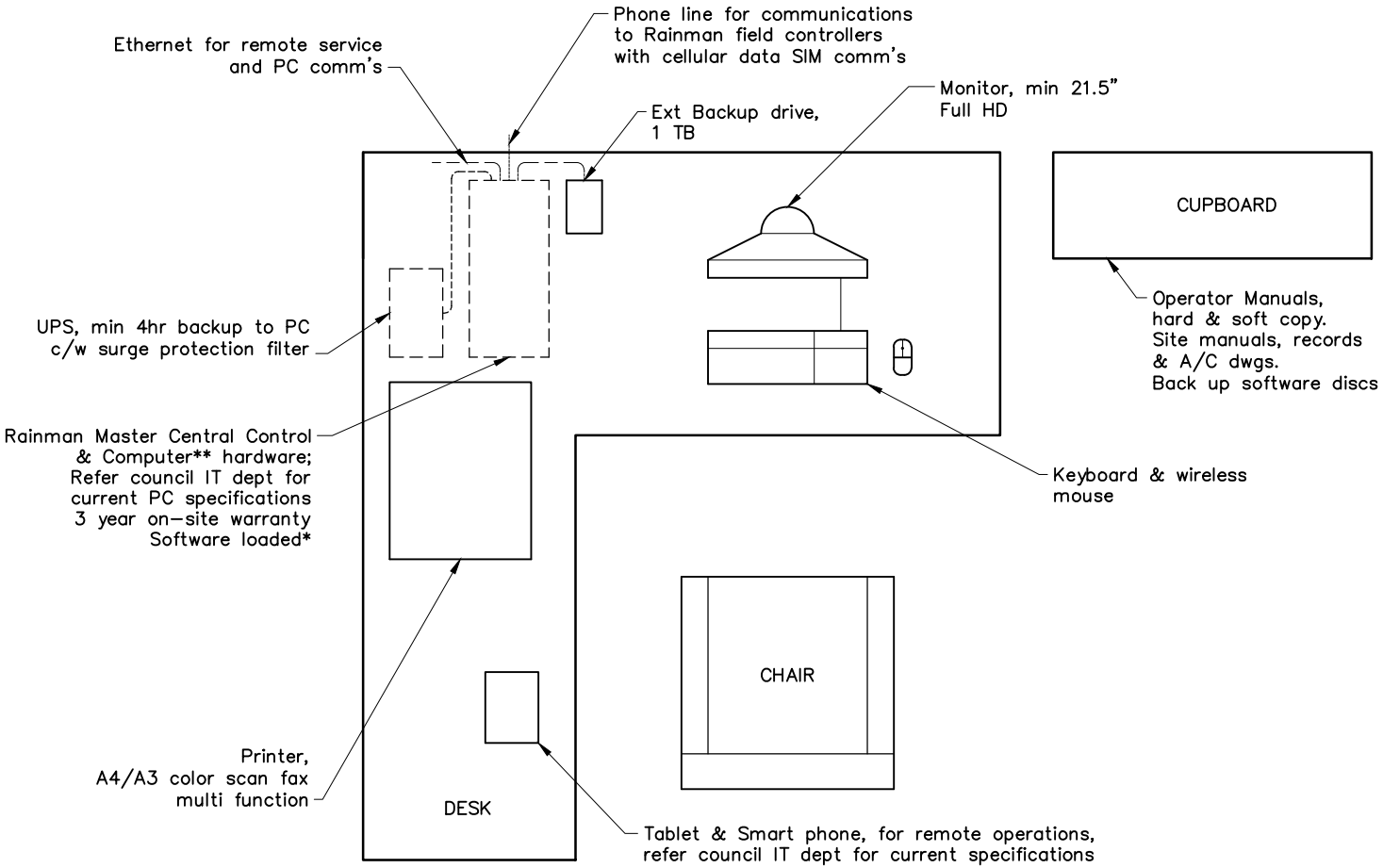
PROJECT: STANDARD CONSTRUCTION DETAIL SINGLE VMS PUMP AND AUTO FILTER DETAIL

DRAWING No. COD-IM-SC-B4 | SHEET A3 OF | REVISION 0



* COMPUTER SOFTWARE requirements.
Irrigation computer loaded with current licensed current versions of:
A. Windows operating system
B. Rainman Master Central Control software
C. Administration software, MS Office & Outlook
D. PDF reader, Adobe
E. Remote management, refer council IT dept
F. Anti virus protection, refer council IT dept

^Includes initial loading of field controllers setup & programs into Rainman Master Central Control database, and connect comm's

** Hardware & software requirements are subject to confirmation & approval at time of each upgrade, to meet current specifications

NOTES:
1. The computer is effectively a dedicated irrigation controller only, not networked for other purposes to limit risks
2. Furniture (desk, chair, cupboard) by others, unless otherwise noted
3. Phone lines & power points by others unless otherwise noted
4. Recommend full back up of PC monthly & data bases at least weekly or after changes
5. Store copy of backup media with database separately &/or download off-site
6. Fix shire site map to wall coded with numerical list of all field controller site names
7. Maintain spreadsheet with estimated annual water budget vs actual usage for all sites

TYPICAL IRRIGATION CENTRAL CONTROL DETAIL

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PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION CENTRAL CONTROL DETAIL

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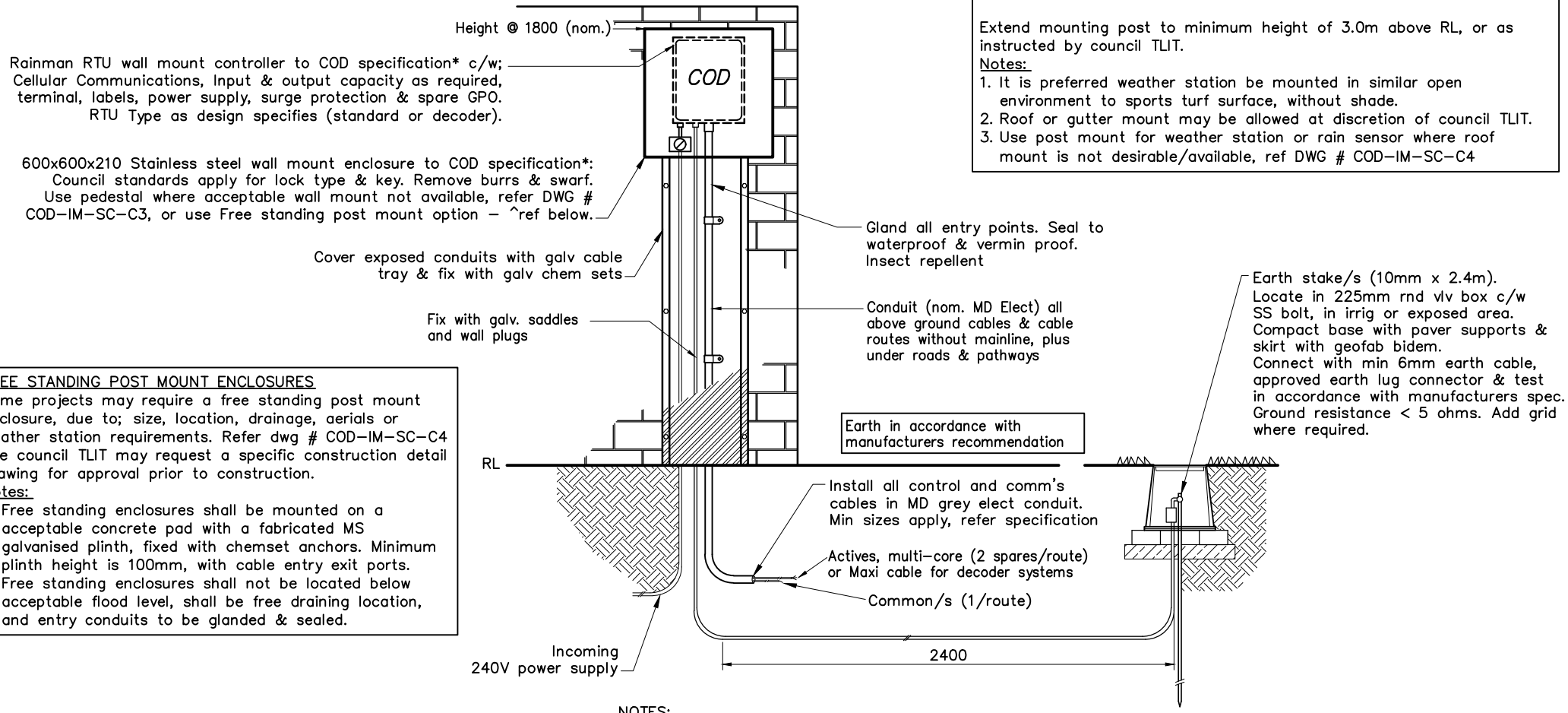

WEATHER STATION & RAIN SENSOR

LUFFT WS700-UMB weather station to be specified for larger sites as required, or controller assigned to nearest existing weather station via central control with council TLIT approval providing acceptable proximity.

iC Rain Sensor is minimum requirement and may be used on smaller sites, as specified

Extend mounting post to minimum height of 3.0m above RL, or as instructed by council TLIT.

Notes:

1. It is preferred weather station be mounted in similar open environment to sports turf surface, without shade.
2. Roof or gutter mount may be allowed at discretion of council TLIT.
3. Use post mount for weather station or rain sensor where roof mount is not desirable/available, ref DWG # COD-IM-SC-C4

FREE STANDING POST MOUNT ENCLOSURES

Some projects may require a free standing post mount enclosure, due to; size, location, drainage, aerials or weather station requirements. Refer dwg # COD-IM-SC-C4 The council TLIT may request a specific construction detail drawing for approval prior to construction.

Notes:

1. Free standing enclosures shall be mounted on a acceptable concrete pad with a fabricated MS galvanised plinth, fixed with chemset anchors. Minimum plinth height is 100mm, with cable entry exit ports.
2. Free standing enclosures shall not be located below acceptable flood level, shall be free draining location, and entry conduits to be glanded & sealed.

NOTES:

1. (*) refer council irrigation assets specification manual for detailed controller & enclosure requirements
2. Maximum low voltage control wire runs, controller to sol.valve:
   (a) Actives: 1.5 sq.mm (7/050) < 230m, (b) 2.5 sq.mm (7/067) < 425m
   (b) Common: 2.5 sq.mm (7/067) < 425m. Min cable sizes
   (c) For cable runs > 400m use decoder system, refer spec for cable sizes
   Distances based on one active cable operating one valve.
   Upsize common for multi-valve operation w/a, Max Vd = 8% for 24V

TYPICAL WALL MOUNT CONTROLLER DETAIL

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PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION CONTROLLER WALL MOUNT DETAIL

DRAWING No. COD-IM-SC-C2 | SHEET A3 OF | REVISION 0

WEATHER STATION & RAIN SENSOR

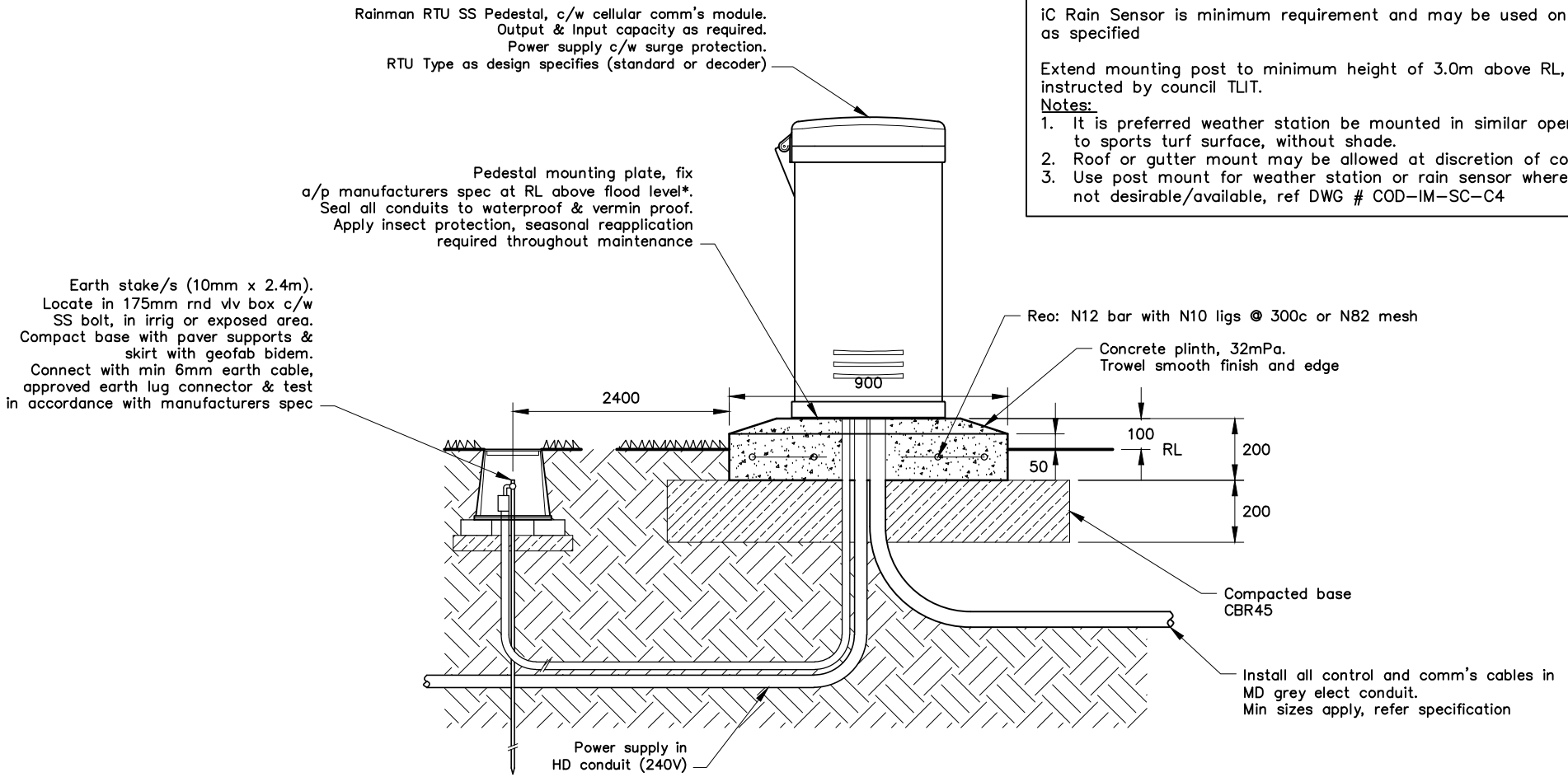
LUFFT WS700–UMB weather station to be specified for larger sites as required, or controller assigned to nearest existing weather station via central control with council TLIT approval providing acceptable proximity.

iC Rain Sensor is minimum requirement and may be used on smaller sites, as specified

Extend mounting post to minimum height of 3.0m above RL, or as instructed by council TLIT.

Notes:

1. It is preferred weather station be mounted in similar open environment to sports turf surface, without shade.
2. Roof or gutter mount may be allowed at discretion of council TLIT.
3. Use post mount for weather station or rain sensor where roof mount is not desirable/available, ref DWG # COD–IM–SC–C4



NOTES:

1. (*) where RL above flood level, use post mount – refer drawing # COD–IM–SC–C4
2. For control cables types & sizes, refer COD Irrigation assets specification manual & appendix B table 4
3. Min 2x spare actives per cable route for standard control cables

PEDESTAL MOUNT CONTROLLER DETAIL

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PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION CONTROLLER PEDESTAL MOUNT DETAIL

DRAWING No. COD-IM-SC-C3 | SHEET A3 OF | REVISION 0

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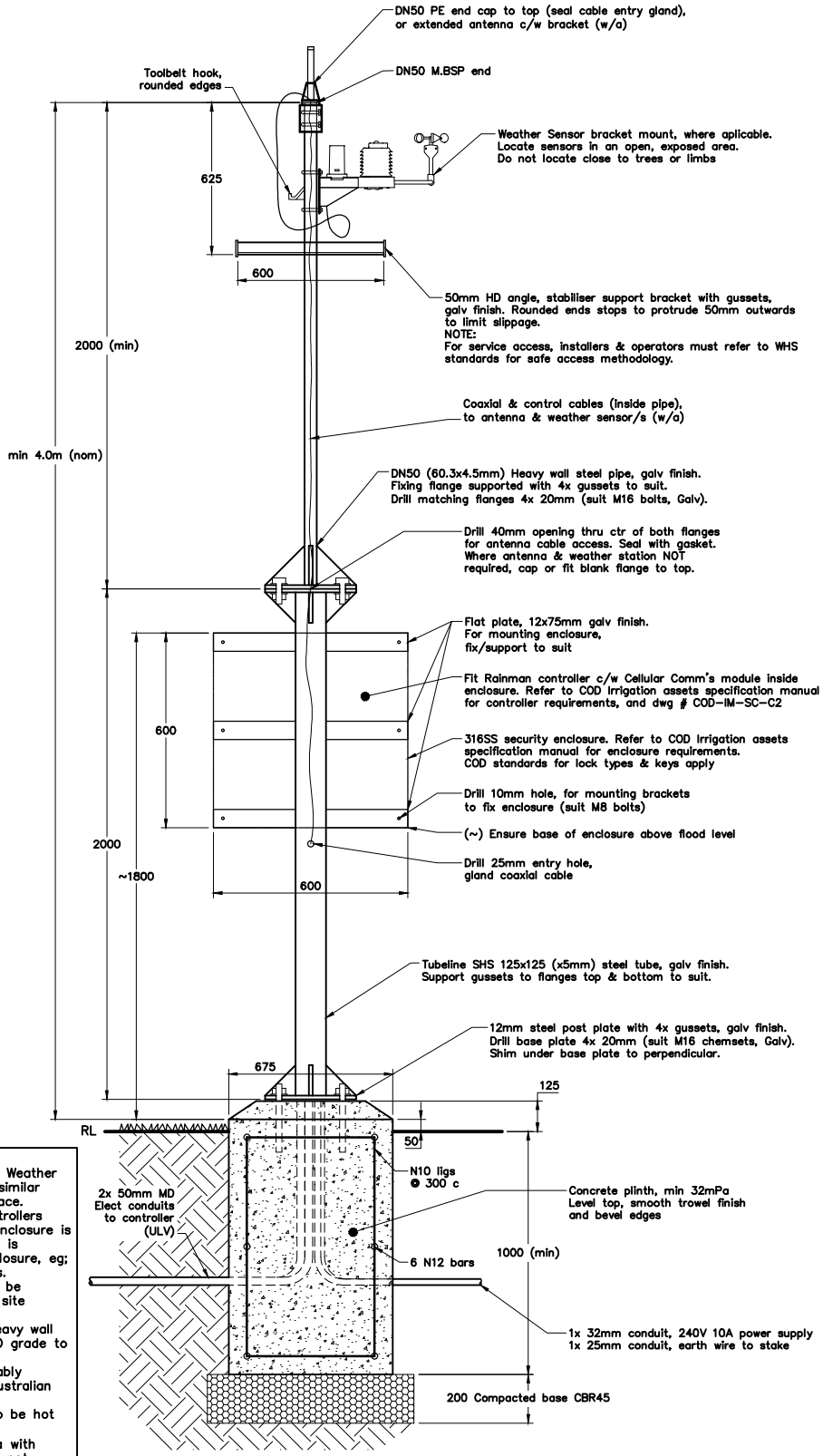
EXCEPTION:
Solar powered RiC controllers may use standard COD/Rainman mounting post arrangement as detailed by COD PR & OEM, unless otherwise instructed by TLIT



NOTES:
1. Post mount is generally preferred for Weather stations, which are to be located is similar open environment to sports turf surface.
2. Post mount may be required for controllers where acceptable wall for mounting enclosure is not available, or where a post mount is preferred option to free standing enclosure, eg; due to flood levels or drainage issues.
3. All dimensions are nominal and must be checked to suit specific enclosure & site requirements.
4. All steel pipe to be grade C250LO heavy wall and meet AS1074. Steel tube C350LO grade to AS1163
5. Fabricated by a fully qualified & suitably experienced boilermaker, welded to Australian Standards
6. Complete fabricated post assembly to be hot dip galvanised to AS 4792
7. Locate post/antenna in an open area with adequate signal strength to base. Do not locate close to trees or limbs

CONTROLLER & WEATHER SENSOR POST MOUNT DETAIL
NTS

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The arrangement and general details as shown on this drawing are essentially diagrammatic and must be applied to the circumstances as found on site.

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DESIGN:	SJ
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APPROVED:	JG
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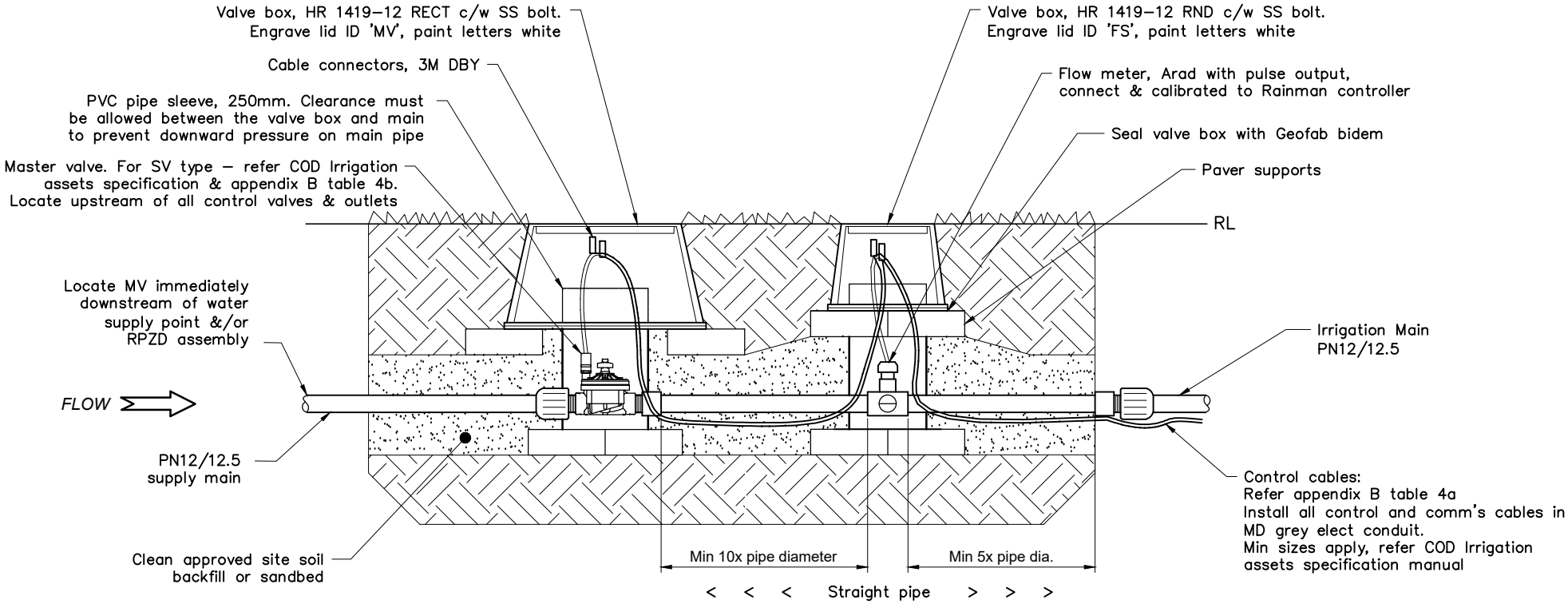
PROJECT: STANDARD CONSTRUCTION DETAIL CONTROLLER & WEATHER SENSOR POST MOUNT DETAIL

DRAWING No.	SHEET	REVISION
COD-IM-SC-C4	A3	0



NOTES:

1. Dedicated Master valve & flow sensor required at each supply point for each irrigation controller.
2. Master valve sized for maximum irrigation system design duty, maximum MV friction loss < 25kPa
3. For Potable supply, located Master valve as close as possible to water supply point and RPZD
4. For pumped systems, Master valve may not be required at discretion of designer(CID) & council TLIT

MASTER VALVE & FLOW METER DETAIL

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PROJECT: STANDARD CONSTRUCTION DETAIL MASTER VALVE & FLOW METER DETAIL

DRAWING No. COD-IM-SC-C6 | SHEET A3 OF | REVISION 0

MASTER VALVE WITH FLOW SENSOR:

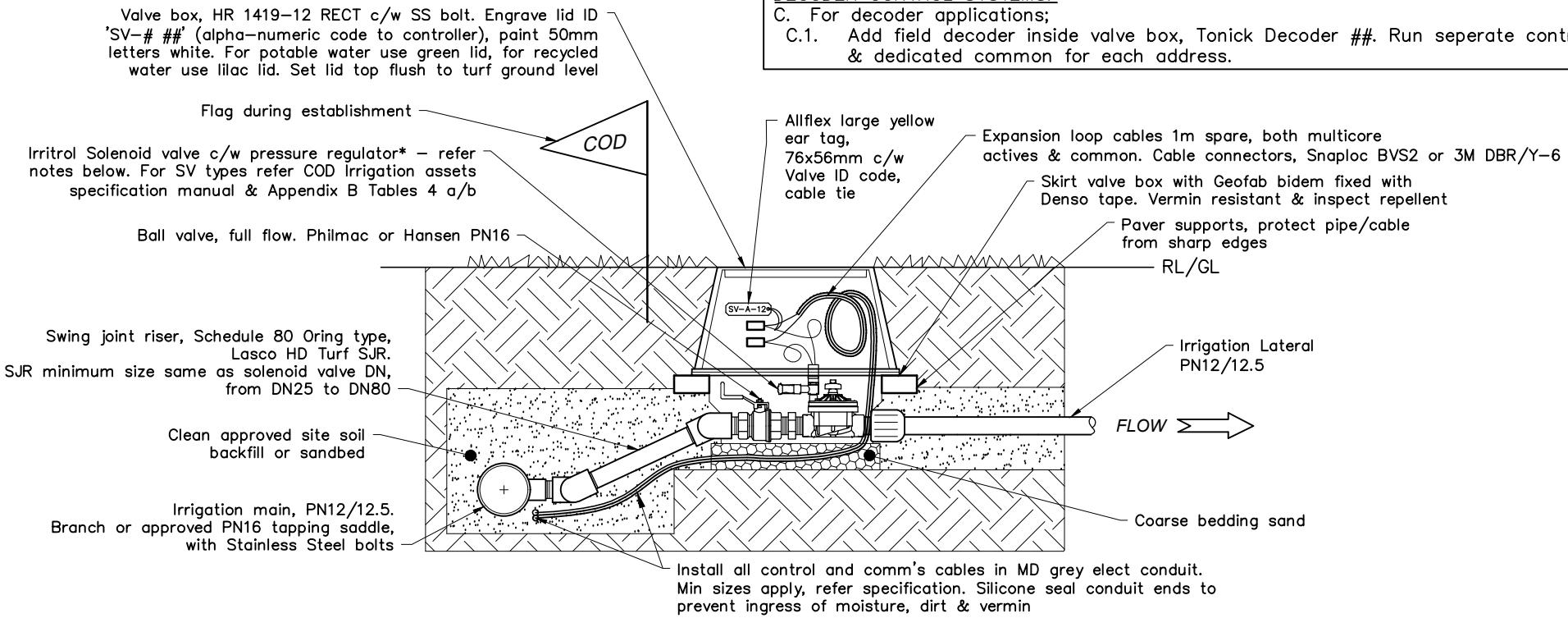
A. All systems require master valve downstream of main connection point or pump.
- A.1. MV assemble to include flow meter, refer dwg # COD-IM-SC-C6.
- A.2. Maybe above ground where inside enclosure/shed, or underground in vlv box.
- A.3. Run separate control & common cables for master valve & flow sensor.

VALVE BOXES IN SPORTS TURF APPLICATIONS:

B. For valve box locations in sports turf projects;
- B.1. Locate valve boxes min 4m from field boundaries, unless otherwise approved.
- B.2. Where approved, valve boxes within 4m surrounds require sports grade synthetic turf to be neatly cut and bonded to valve box lid. Refer COD Irrigation assets specifications.

DECODER CONTROL SYSTEMS:

C. For decoder applications;
- C.1. Add field decoder inside valve box, Tonick Decoder ##. Run seperate control & dedicated common for each address.



NOTES:

1. Pressure regulators may not be required in the following applications;
   - 1.1. where the inlet pressure is within 100kPa of design operating pressure (Ho) & flat topography
   - 1.2. sports fields & inlet pressure is within 100kPa of design Ho
   - 1.3. systems supplied by VFD pump station & inlet pressure is within 100kPa of design Ho
2. For design maximum valve flow rates & min cable sizes refer Appendix B
3. Allow 2 spare cables per cable route, refer specification
4. For drip stations add secondary filter assembly & QCV per stn, refer drip irrigation & QCV SC details

AUTOMATIC CONTROL VALVE DETAIL

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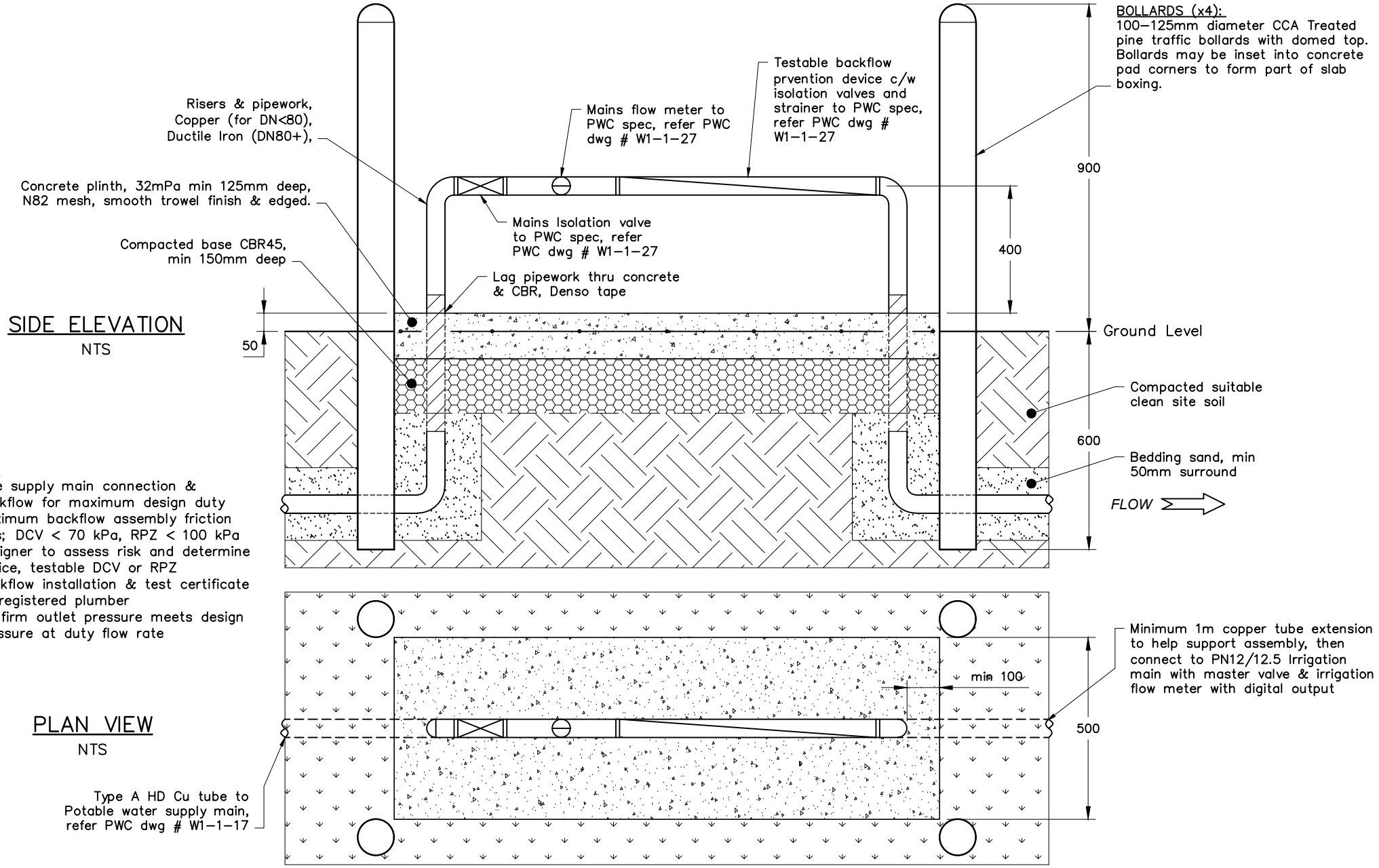
PROJECT: STANDARD CONSTRUCTION DETAIL AUTOMATIC CONTROL VALVE DETAIL

DRAWING No. COD-IM-SC-C7 | SHEET A3 OF | REVISION 0



BACKFLOW PREVENTION ASSEMBLY & BOLLARD DETAIL

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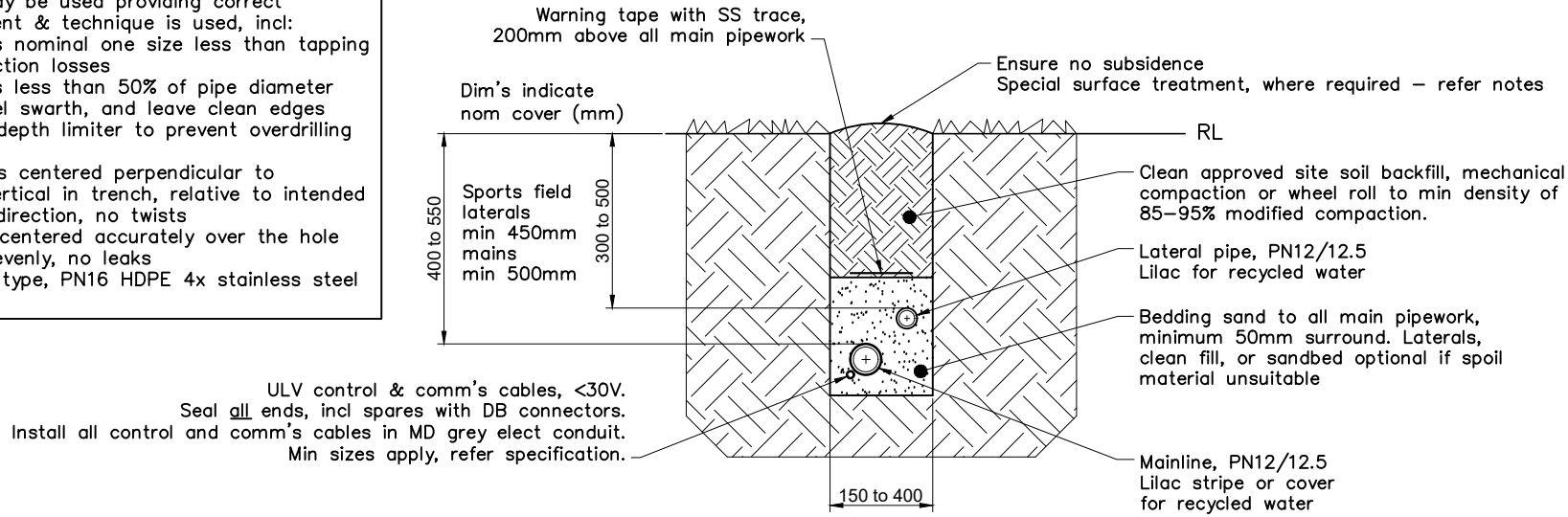
PROJECT: STANDARD CONSTRUCTION DETAIL BACKFLOW PREVENTION ASSEMBLY & bollard DETAIL

DRAWING No. COD-IM-SC-D1 | SHEET A3 OF | REVISION 0

THRUST BLOCKS:
All rubber ring joint bends, junctions, valves, puddle flanges & end caps shall be thrust blocked.
- Min 32mPa concrete thrust blocks, sized & installed in accordance with manufacturers installation manual and Australian Standards, based on site soil type/s.
- Lag all pipework through concrete thrust blocks with Denso WP pipe wrap or approved equal.
- No cables are to contact concrete, or routed through concrete unless in conduit.

PE pipe installed underground is generally not required to be thrust blocked, unless recommended by manufacturer or specified.
All above ground pipework shall be supported & anchored in accordance with manufacturers installation manual & AS, refer 'Above ground pipework' specifications

INSTALLATION NOTES:
Tapping saddles may be used providing correct installation equipment & technique is used, incl:
1. Drill diameter is nominal one size less than tapping size for low friction losses
2. Drill diameter is less than 50% of pipe diameter
3. Drill bit to expel swarth, and leave clean edges
4. Drill bit has a depth limiter to prevent overdrilling into pipe
5. Tapping angle is centered perpendicular to horizontal or vertical in trench, relative to intended take off point direction, no twists
6. The tapping is centered accurately over the hole and tightened evenly, no leaks
7. Tapping saddle type, PN16 HDPE 4x stainless steel bolts



NOTES:
1. As a guide, min cover for mainlines up to 63mm can be reduced to 300mm in 'landscaped' areas, outside sports surfaces
2. For maximum pipe velocities & hydraulic friction loss limits refer COD Irrigation specifications manual and Appendix B table 3
3. For all fittings & connections refer specifications and appendices standard construction details
4. Request site instruction from site project manager for any special excavation, such as; rock, sandbedding, trench shoring, turf cutting/reinstatement, &/or seeding where not specified.
5. Refer specifications for landfill sites, spoil/overburden removal, sandbeb/fill & surface treatments.
6. Maintain 25mm separation between pipes in common trenches, avoid crossovers
7. Generally trench only what can be safely backfilled the same day
8. Pressure test mainlines to AS2566.2. ITP record to be signed by witness.
9. Barricade any unfilled pits or trenches at end of each day, or during excavation as required to maintain site safety
10. Flush all pipework to nearest low drainage point prior to sprinkler nozzle installation

IRRIGATION PIPE TRENCH DETAIL
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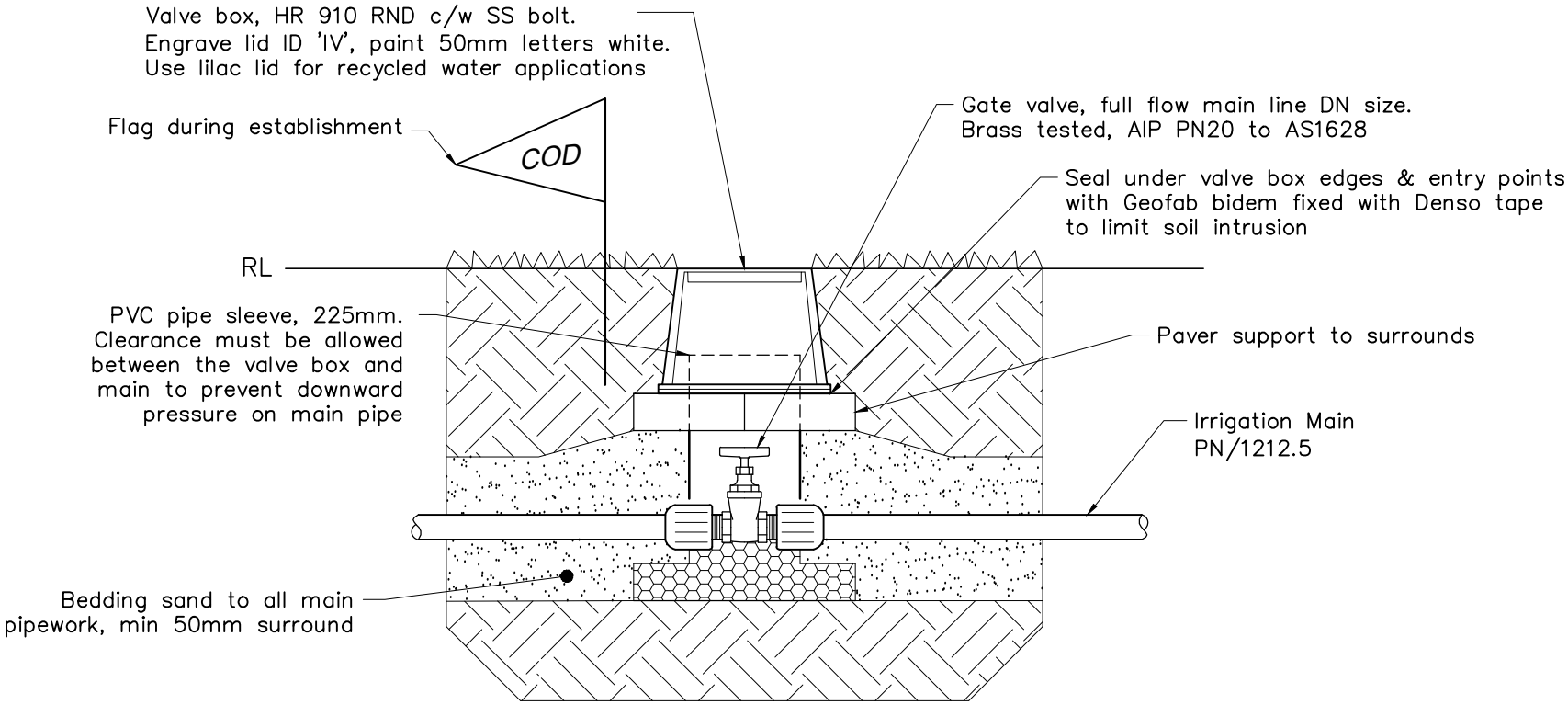
PROJECT: STANDARD CONSTRUCTION DETAIL IRRIGATION PIPE TRENCH DETAIL
DRAWING No. COD-IM-SC-D3 | SHEET A3 OF | REVISION 0

VALVE BOXES IN SPORTS TURF APPLICATIONS:

A. For valve box locations in sports turf projects;

A.1. Locate valve boxes min 4m from field boundaries, unless otherwise approved.

A.2. Where approved, valve boxes within 4m surrounds require sports grade synthetic turf to be neatly cut and bonded to valve box lid. Refer COD specifications.



NOTES:

1. Use BSP AS 1628 type gate valves up to DN50 main lines. Refer DWG # COD–IM–IS–D5 for >DN50 (flanged)
2. Locate at mainline branches and intervals <200m along main to facilitate system service

MAIN ISOLATION VALVE SMALL BORE BSP DETAIL

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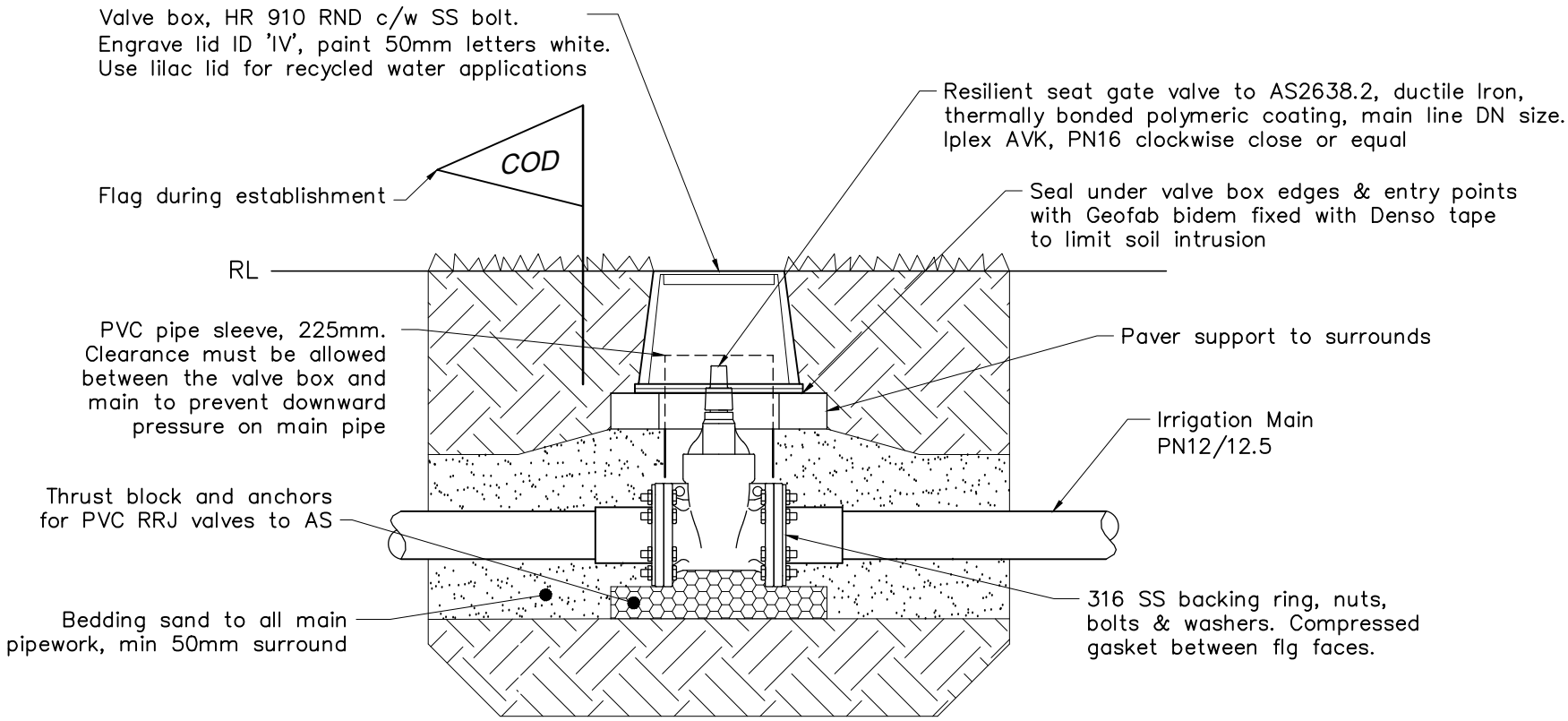
PROJECT: STANDARD CONSTRUCTION DETAIL MAIN ISOLATION SMALL BORE BSP DETAIL

DRAWING No. COD-IM-SC-D4 | SHEET A3 OF | REVISION 0

PIPE SUPPORTS:
PE pipe installed underground is generally not required to be thrust blocked, unless recommended by manufacturer or specified for specific applications.
All above ground pipework shall be supported & anchored in accordance with COD specifications, manufacturers installation manual & AS, refer 'Above ground pipework' specifications

VALVE BOXES IN SPORTS TURF APPLICATIONS:
A. For valve box locations in sports turf projects;
A.1. Locate valve boxes min 4m from field boundaries, unless otherwise approved.
A.2. Where approved, valve boxes within 4m surrounds require sports grade synthetic turf to be neatly cut and bonded to valve box lid. Refer COD specifications.



NOTES:
1. Use Resilient seat type gate valves for greater than DN50 main lines. Refer DWG # COD-IM-SC-D4 for <DN80.
2. Locate at mainline branches and intervals <200m along main to facilitate system service

MAIN ISOLATION VALVE LARGE BORE FLG DETAIL

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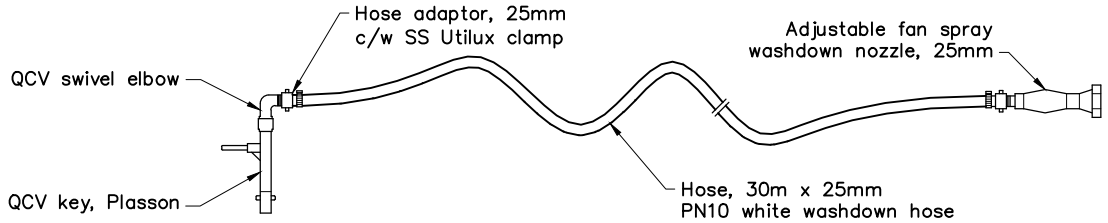
PROJECT: STANDARD CONSTRUCTION DETAIL MAIN ISOLATION VALVE LARGE BORE FLG DETAIL
DRAWING No. COD-IM-SC-D5 | SHEET A3 OF | REVISION 0

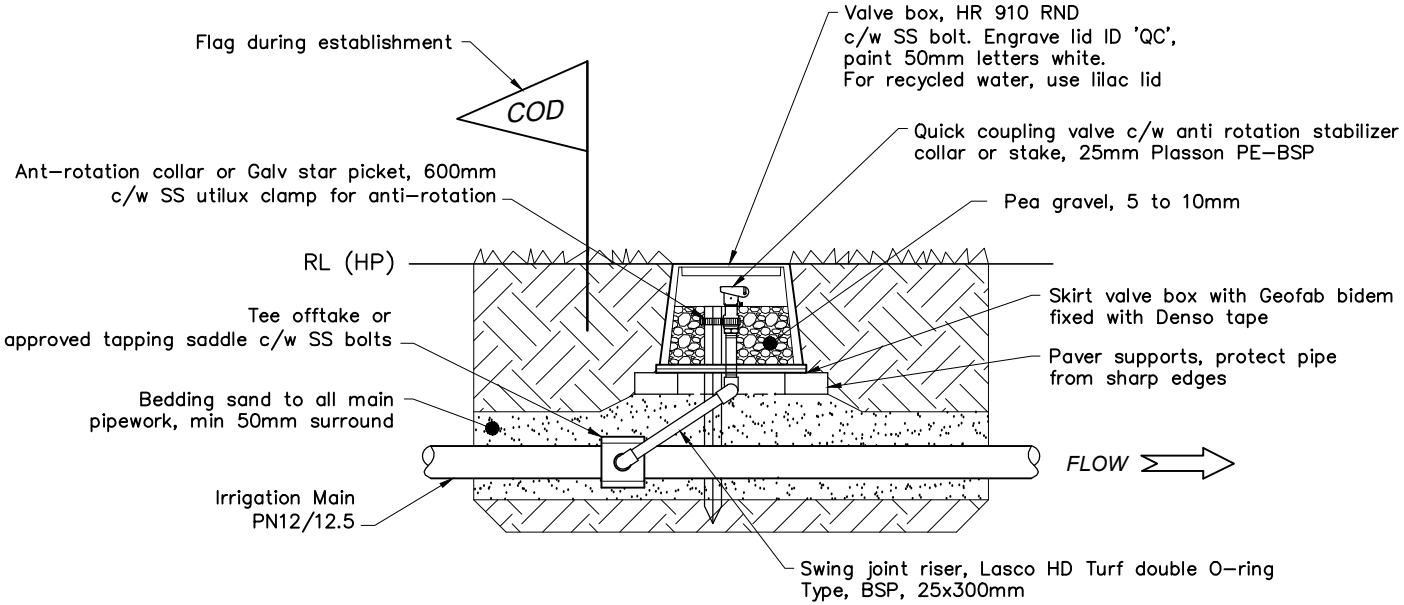


FLUSH & MANUAL WATERING HOSE KIT C/W QCV KEY & SWIVEL ELBOW

VALVE BOXES IN SPORTS TURF APPLICATIONS:

A. For valve box locations in sports turf projects;
- A.1. Locate valve boxes min 4m from field boundaries, unless otherwise approved.
- A.2. Where approved, valve boxes within 4m surrounds require sports grade synthetic turf to be neatly cut and bonded to valve box lid. Refer COD specifications.

INSTALLATION NOTE:
Finished height of QCV to allow adequate clearance for valve key & valve box lid operation



NOTES:
1. Located at main branches & end/s of main to facilitate flushing/testing during commissioning & service. Nominal max spacing 200m along mains unless otherwise specified.
2. Locate at 50m nominal intervals, where manual or temporary establishment watering is required
3. Locate immediately upstream of solenoid valves for all drip stations, to facilitate establishment watering
4. Supply 1x 30m x 25mm QCV hose kit c/w key & swivel per project site unless otherwise specified

QUICK COUPLING VALVE DETAIL

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CLIENT: CITY OF DARWIN - PARKS AND RESERVES IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: STANDARD CONSTRUCTION DETAIL QUICK COUPLING VALVE DETAIL

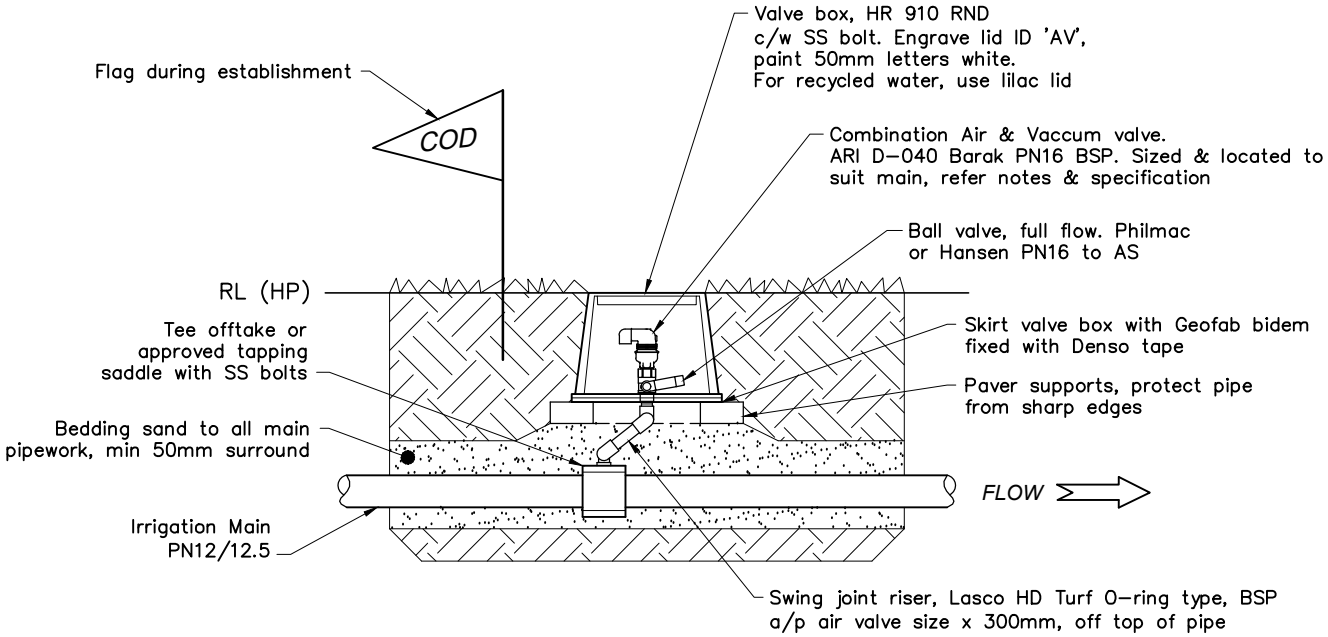
DRAWING No. COD-IM-SC-D6 | SHEET A3 OF | REVISION 0

VALVE BOXES IN SPORTS TURF APPLICATIONS:

A. For valve box locations in sports turf projects;

A.1. Locate valve boxes min 4m from field boundaries, unless otherwise approved.

A.2. Where approved, valve boxes within 4m surrounds require sports grade synthetic turf to be neatly cut and bonded to valve box lid. Refer COD specifications.



NOTES:

1. Minimum 1x 25mm for up to 63mm mains up to 200m total length, located at high point/s or end/s of main on relatively flat ground
2. Minimum 1x 50mm for >63mm mains up to 200m total length, located at high point/s or end/s of main on relatively flat ground
3. For mainline >200m locate at 200m intervals at high points & immediately upstream of main isolation valves & at end of line/s, or as per designers (CID) recommendations based of drawings

MAINLINE AIR VALVE DETAIL

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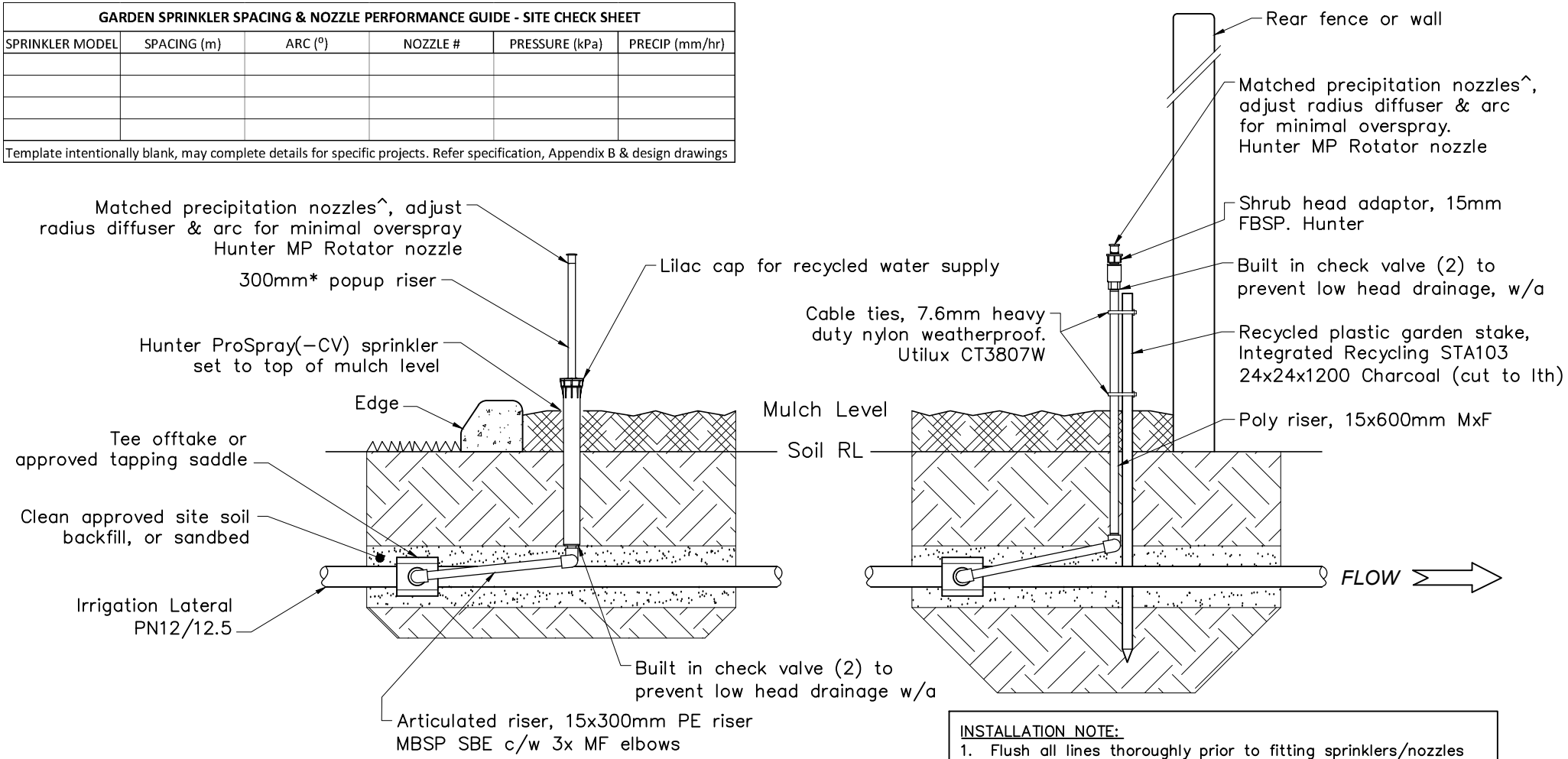
PROJECT: STANDARD CONSTRUCTION DETAIL MAINLINE AIR VALVE DETAIL

DRAWING No. COD-IM-SC-D7 | SHEET A3 OF | REVISION 0

GARDEN SPRINKLER SPACING & NOZZLE PERFORMANCE GUIDE - SITE CHECK SHEET					
SPRINKLER MODEL	SPACING (m)	ARC (°)	NOZZLE #	PRESSURE (kPa)	PRECIP (mm/hr)
Template intentionally blank, may complete details for specific projects. Refer specification, Appendix B & design drawings					



INSTALLATION NOTE:
1. Flush all lines thoroughly prior to fitting sprinklers/nozzles
2. Ensure filters are clean & no nozzle blockages on completion

NOTES:
1. For sprinkler selection, spacing & performance criteria refer council specification and Appendix B
2. Built in check valves only required where topographic elevation varies >1m with a station/zone
3. (^) Rotary nozzles are required for majority of garden irrigation applications
4. Popups must be used on all edges readily exposed to public visibility or assess
5. Shrub heads may be used in centre or rear of garden beds where not readily exposed

GARDEN IRRIGATION SPRINKLER DETAIL

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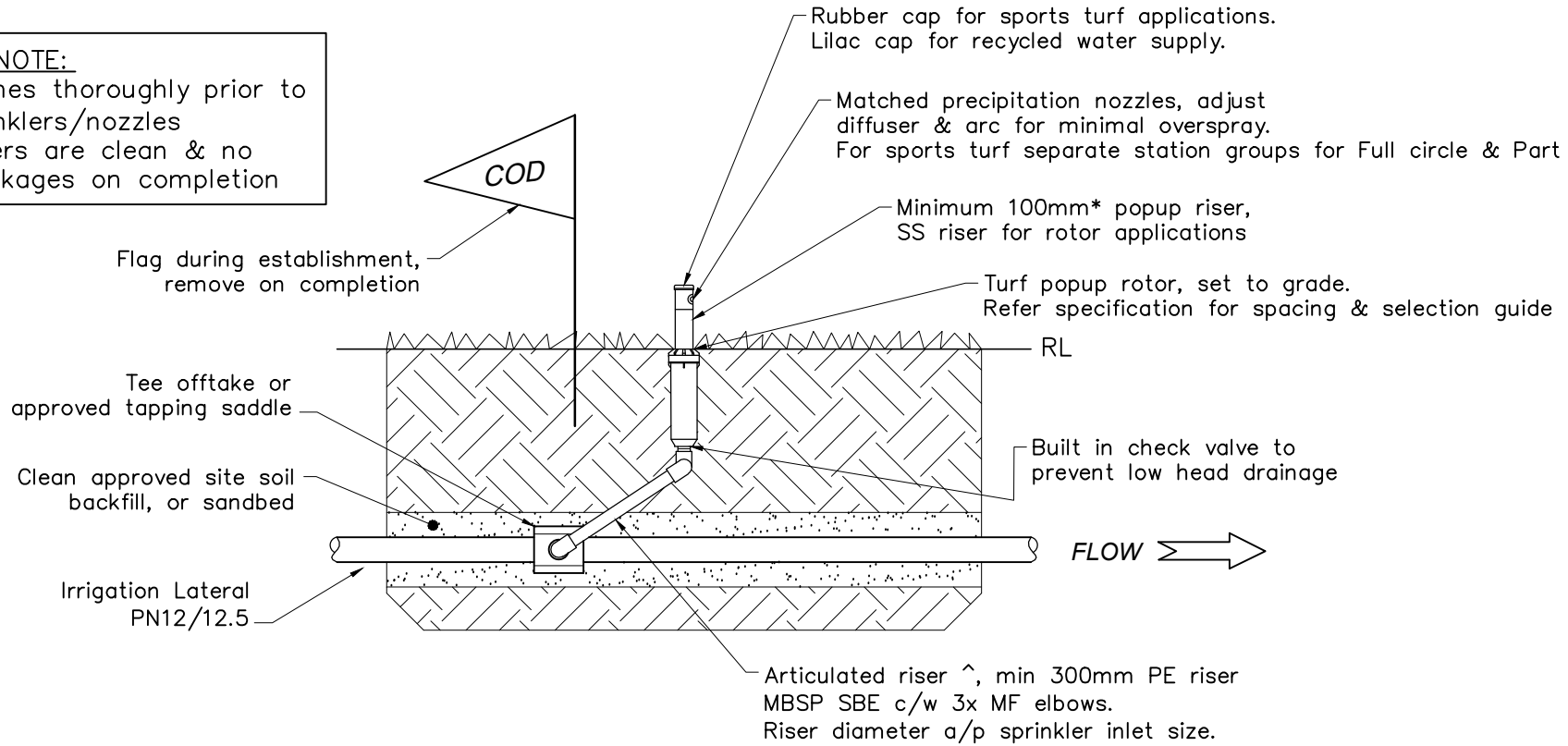
PROJECT: STANDARD CONSTRUCTION DETAIL GARDEN IRRIGATION SPRINKLER DETAIL

DRAWING No. COD-IM-SC-E1 | SHEET A3 OF | REVISION 0

TURF ROTOR SPACING & NOZZLE PERFORMANCE GUIDE - SITE CHECK SHEET					
ROTOR MODEL	SPACING (m)	ARC (°)	NOZZLE #	PRESSURE (kPa)	PRECIP (mm/hr)
Template intentionally blank, may complete details for specific projects. Refer specification, Appendix B & design drawings					

INSTALLATION NOTE:
1. Flush all lines thoroughly prior to fitting sprinklers/nozzles
2. Ensure filters are clean & no nozzle blockages on completion



NOTES:
1. For sprinkler selection, spacing & performance criteria refer council specification and appendix B table 2
2. (^) for valve in head applications, use double O–ring type Lasco HD Turf swing joint riser

TURF IRRIGATION POPUP ROTOR DETAIL
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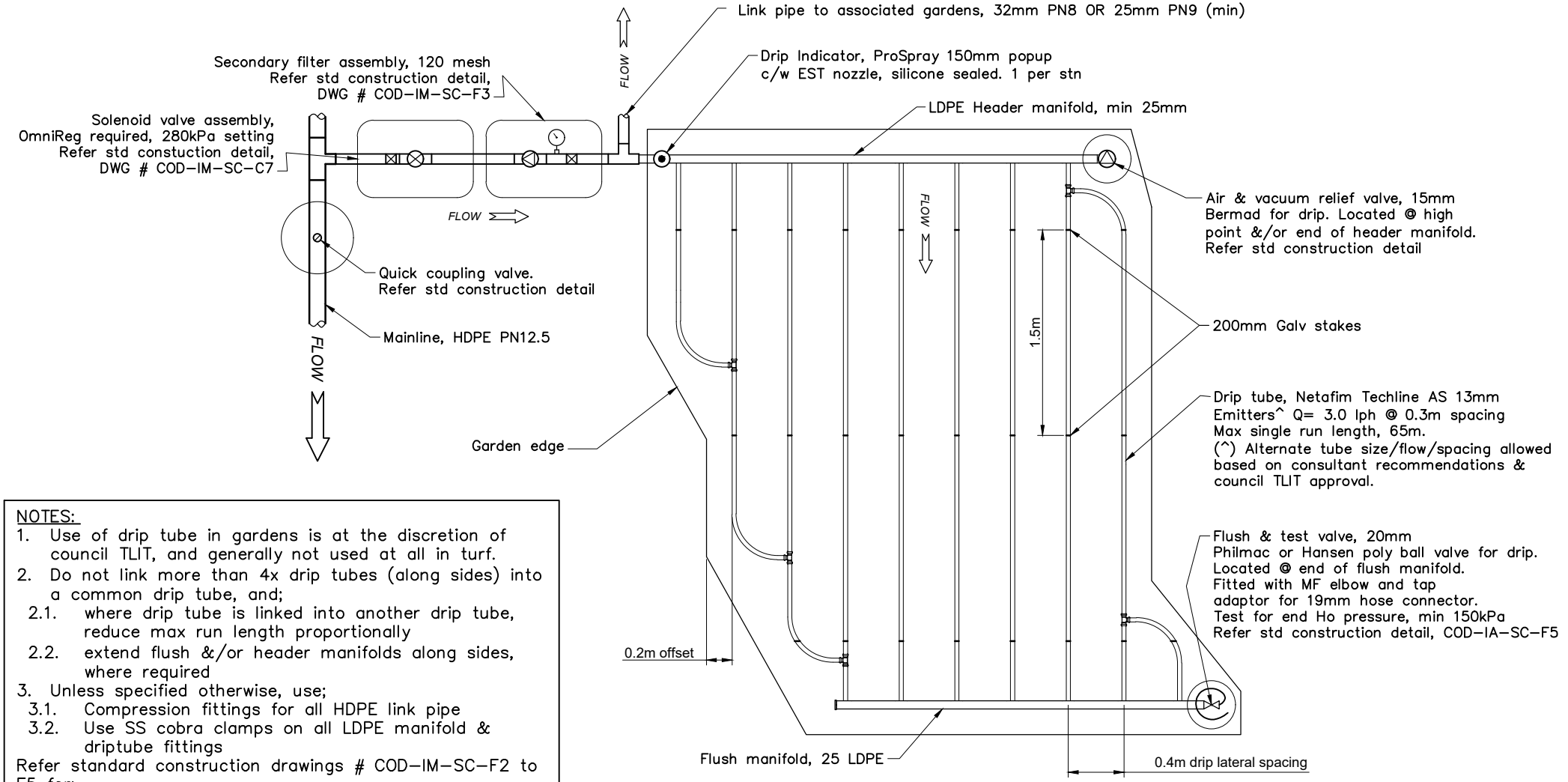
PROJECT: STANDARD CONSTRUCTION DETAIL TURF IRRIGATION POPUP ROTOR DETAIL

DRAWING No. COD-IM-SC-E2 | SHEET A3 OF | REVISION 0



NOTES:

1. Use of drip tube in gardens is at the discretion of council TLIT, and generally not used at all in turf.
2. Do not link more than 4x drip tubes (along sides) into a common drip tube, and;
   - 2.1. where drip tube is linked into another drip tube, reduce max run length proportionally
   - 2.2. extend flush &/or header manifolds along sides, where required
3. Unless specified otherwise, use;
   - 3.1. Compression fittings for all HDPE link pipe
   - 3.2. Use SS cobra clamps on all LDPE manifold & driptube fittings

Refer standard construction drawings # COD-IM-SC-F2 to F5 for;

- 3.1. Drip cross section for methodology, and associated valves & details

DRIP IRRIGATION LAYOUT DETAIL

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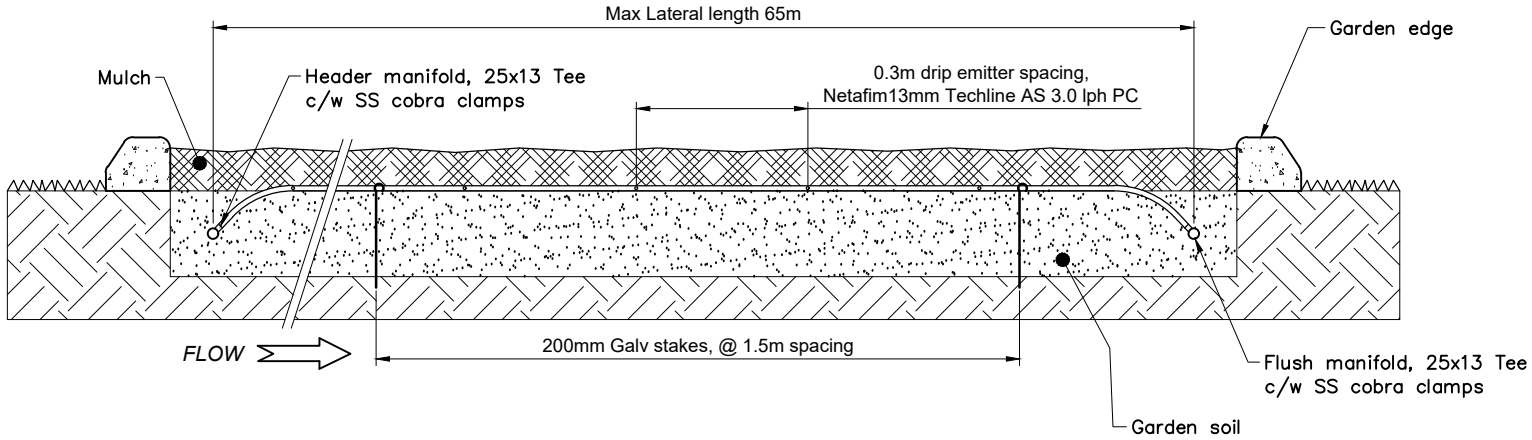
PROJECT: STANDARD CONSTRUCTION DETAIL DRIP IRRIGATION LAYOUT DETAIL

DRAWING No. COD-IM-SC-F1 | SHEET A3 OF | REVISION 0

INSTALLATION METHODOLOGY:

In general, the order of construction sequence shall be as follows;

1. Landscape contractor to achieve finished grade with garden soil. Manifold pipes may be installed during this process by irrigation contractor, if on site
2. Landscape contractor to plant all large trees & specimen plants, >25 litre bags
3. Irrigation contractor to install irrigation tube & stake. Flush & test at this stage where possible.
4. Landscape contractor to install minor planting & then mulch, taking reasonable care not to damage drip tube & pipework.
5. All damages must be flagged, reported & rectified same day.



NOTES:

1. Do not link more than 4x drip tubes (along sides) into a common drip tube (ie: use DN25 manifold), and;
   1.1. where drip tube is linked into another drip tube, reduce max run length proportionally
   1.2. extend flush &/or header manifolds along sides, where required
2. Unless specified otherwise, use;
   2.1. Compression fittings for all HDPE link pipe
   2.2. Use SS cobra clamps on all LDPE manifold & driptube fittings
3. Refer standard construction drawings # COD–IM–SC–F1 to F5 for; Drip layout, secondary filter, drip air/flush valves and associated details

DRIP IRRIGATION CROSS SECTION GARDEN DETAIL

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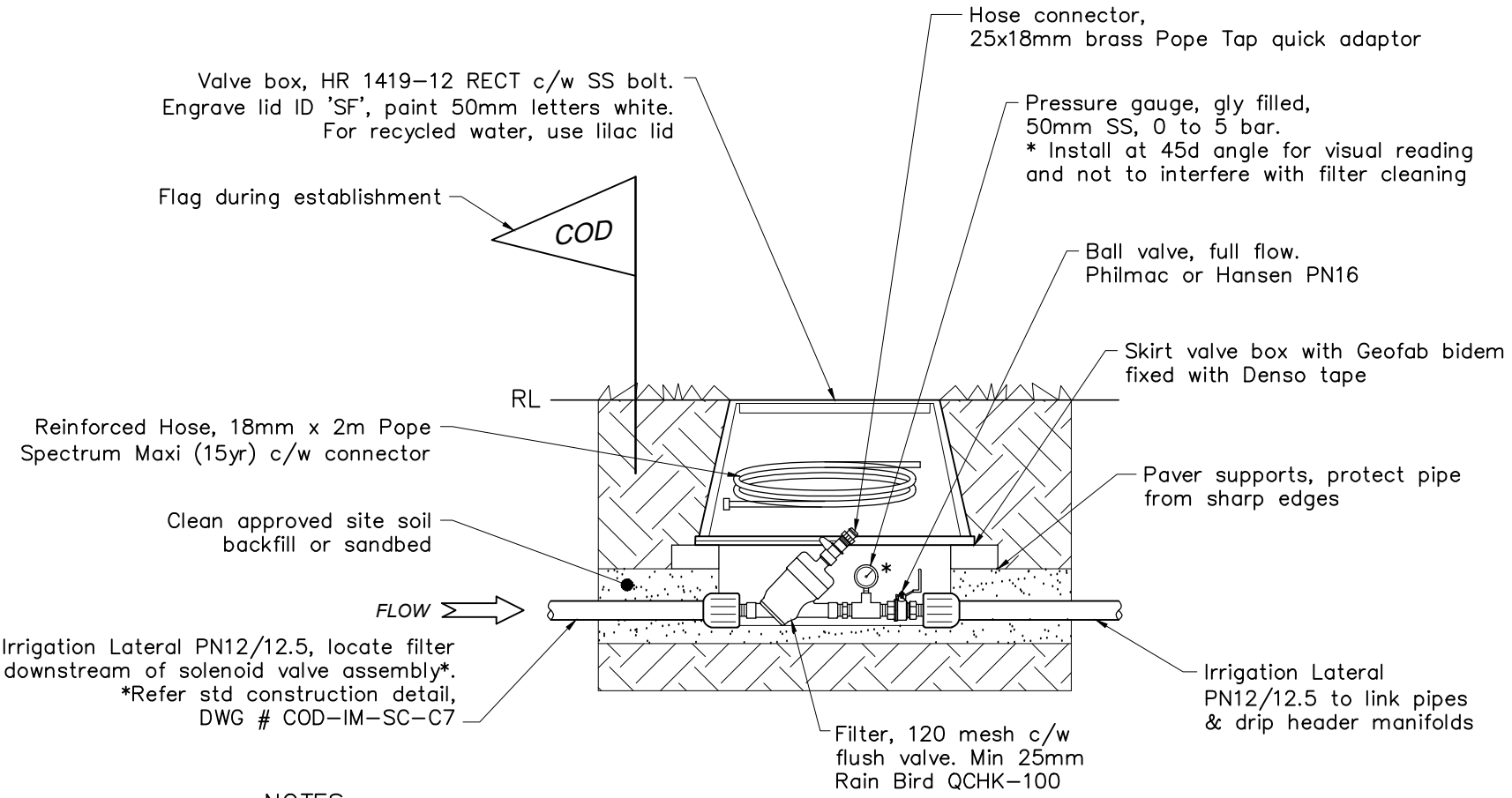
PROJECT: STANDARD CONSTRUCTION DETAIL
DRIP IRRIGATION GARDEN CROSS SECTION DETAIL

DRAWING No. COD-IM-SC-F2 | SHEET A3 OF | REVISION 0



NOTES:

1. Clean filter when outlet pressure >50kPa lower than inlet pressure regulator setting.
   Eg: for inlet set OmniReg at 280kPa, clean where filter outlet pressure <230kPa
2. Clean filter element thoroughly on practical completion and during seasonal services

SECONDARY DRIP FILTER ASSEMBLY DETAIL

NTS

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0	16-03-18	SJ	JG	ORIGINAL ISSUE - DRAFT FOR REVIEW

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CERTIFIED IRRIGATION DESIGNER – IRRIGATION AUSTRALIA – LANDSCAPE/TURF/GOLF

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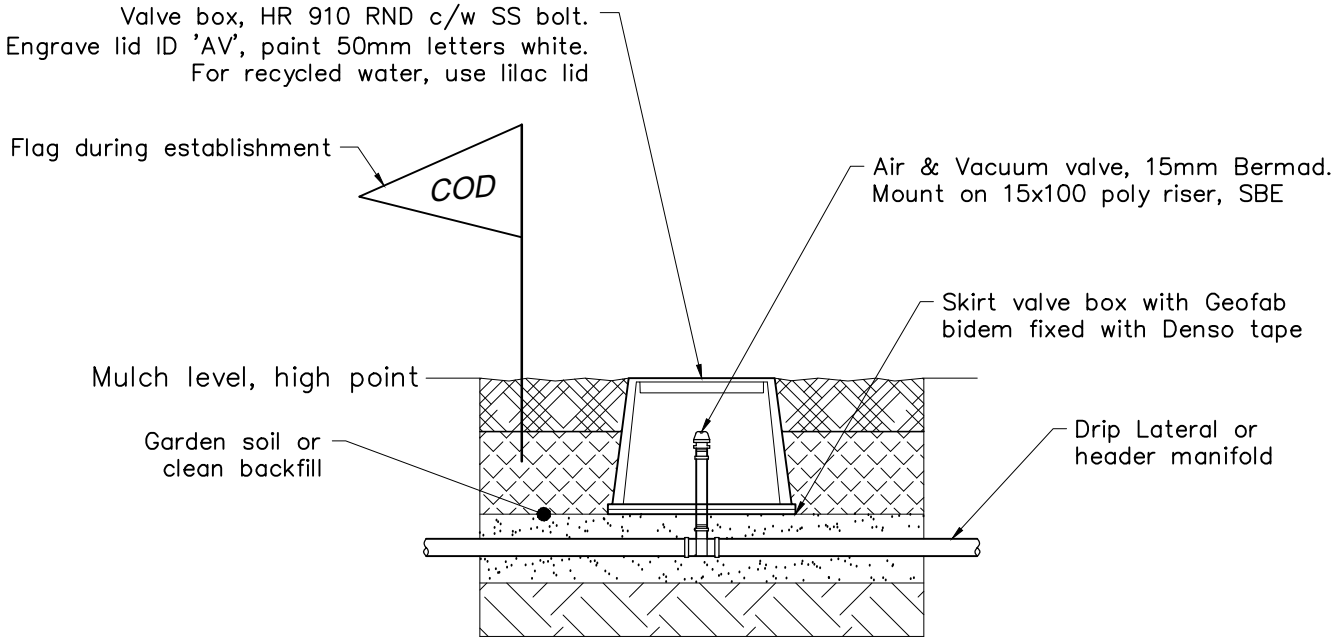
PERTH ADELAIDE MELBOURNE SYDNEY BRISBANE BEIJING

DRAWN:	SJ
DESIGN:	SJ
CHECKED:	HR
APPROVED:	JG
DRAFT REF:	RS/IS

CLIENT: CITY OF DARWIN - PARKS AND RESERVES IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: STANDARD CONSTRUCTION DETAIL SECONDARY DRIP FILTER ASSEMBLY DETAIL

DRAWING No. COD-IM-SC-F3 | SHEET A3 OF | REVISION 0



NOTES:

1. Min 1 Air valve per drip station
2. Locate at high point/s on lateral or header manifold pipe.

DRIP AIR & VACUUM RELIEF VALVE DETAIL

NTS

REV	ISSUED	D.DWN	APRVD	REVISION DESCRIPTION
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APPROVED:	JG
DRAFT REF:	RS/IS

CLIENT: CITY OF DARWIN - PARKS AND RESERVES IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: STANDARD CONSTRUCTION DETAIL DRIP AIR & VACUUM RELIEF VALVE DETAIL

DRAWING No. COD-IM-SC-F4 | SHEET A3 OF | REVISION 0

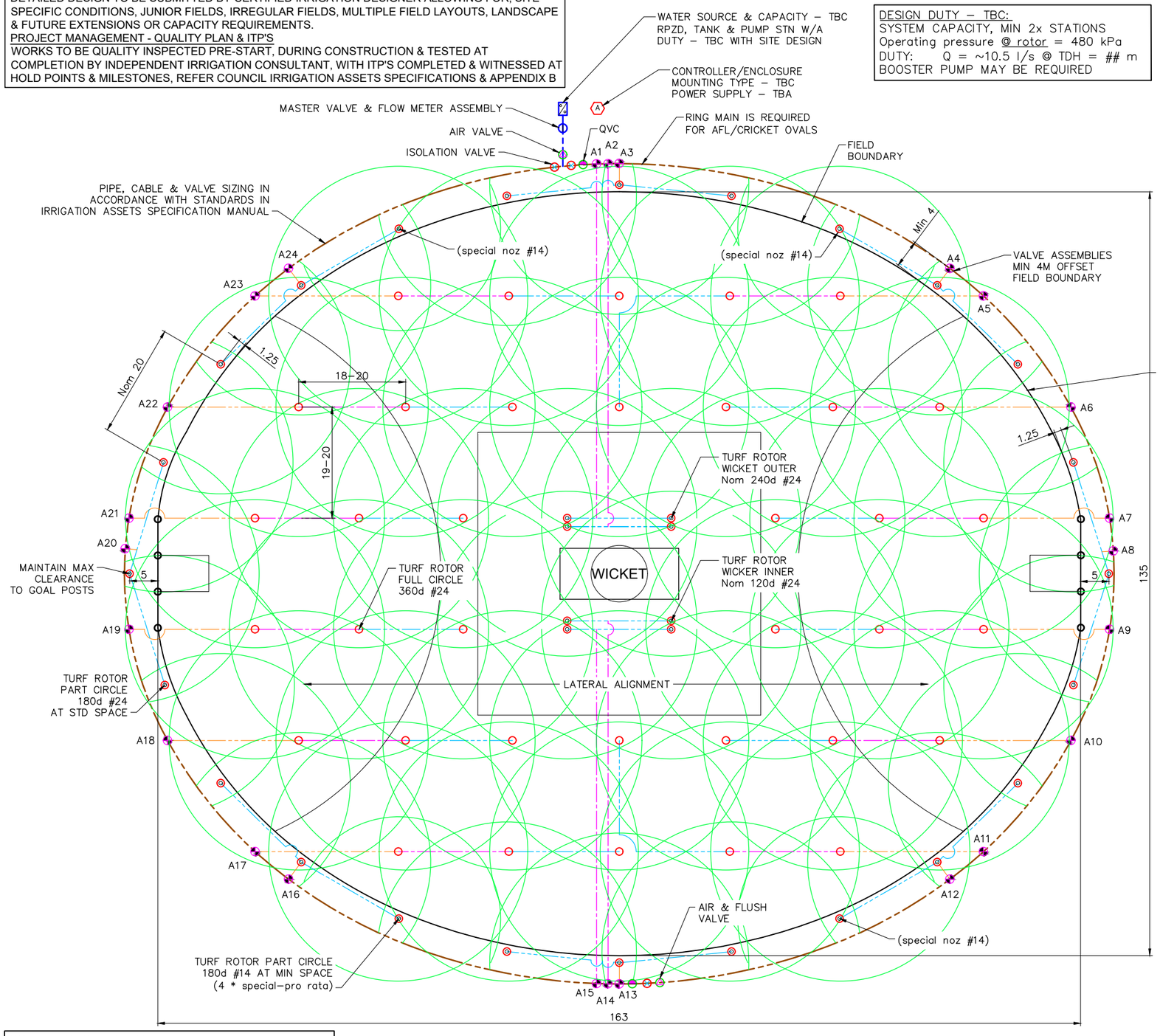
124. Appendix E: Standard Sports Field Irrigation Layout Drawings

124.1 Section 1 Typical Sports Field Irrigation Layouts

- COD -IM-SF-01 (0) AFL & Cricket/Wicket, full size
- COD -IM-SF-02 (0) Rugby League/Union, senior size
- COD -IM-SF-03 (0) Soccer, international size

TYPICAL SINGLE FIELD SAMPLE LAYOUT FOR INTENT ONLY - NOT FOR CONSTRUCTION
DETAILED DESIGN TO BE SUBMITTED BY CERTIFIED IRRIGATION DESIGNER ALLOWING FOR; SITE SPECIFIC CONDITIONS, JUNIOR FIELDS, IRREGULAR FIELDS, MULTIPLE FIELD LAYOUTS, LANDSCAPE & FUTURE EXTENSIONS OR CAPACITY REQUIREMENTS.
PROJECT MANAGEMENT - QUALITY PLAN & ITP'S
WORKS TO BE QUALITY INSPECTED PRE-START, DURING CONSTRUCTION & TESTED AT COMPLETION BY INDEPENDENT IRRIGATION CONSULTANT, WITH ITP'S COMPLETED & WITNESSED AT HOLD POINTS & MILESTONES, REFER COUNCIL IRRIGATION ASSETS SPECIFICATIONS & APPENDIX B

DESIGN DUTY – TBC:
SYSTEM CAPACITY, MIN 2x STATIONS
Operating pressure @ rotor = 480 kPa
DUTY: Q = ~10.5 l/s @ TDH = ## m
BOOSTER PUMP MAY BE REQUIRED



NORTH

LEGEND:

	## mm RPZD assem/enc, or PS
A	Rainman controller–stn##/Cell/encl
	##mm Master vlv & flow sensor
	Isolation valve (LineSize), c/w VB
	Air valve 50mm c/w BV & VB
	Quick Coupling valve, 25mm & VB
A1	##mm Sol.Vlv c/w SJR, BV & VB
	###–SS popup, FC rotor, ##
	###–SS popup, PC rotor, ##
	### mm ### PN12/12.5 pipe
	## mm ### PN12/12.5 pipe
	75 mm HD PE100 PN12.5 pipe
	63 mm HD PE100 PN12.5 pipe
	50 mm HD PE100 PN12.5 pipe
	## C / ## mm2 Cable route A
	## C / ## mm2 Cable route B

NOTES:
1. (##) refer sizing tables, App B
2. Add filter for dirty water applic.
3. Provide cable routing table
4. Provide rotor precip tables & program data sheets
5. Sandbed all main pipework
6. Conduit all control/comms cables

DESIGN NOTES:
A. MINIMUM CRITERIA FOR SINGLE FIELDS.
B. FIELD SIZES MAY VARY.
C. MULTIPLE FIELDS WILL HAVE INCREASED CAPACITY REQUIREMENTS.
D. INCLUDE WATER SUPPLY DUTY (Q/H) & ROTOR PERFORMANCE DATA (CU/DU/SC) ON LAYOUT DRAWINGS
E. SHOW CRITICAL DIMENSIONS ON LAYOUT DRAWINGS, INCLUDING; FIELD BOUNDARIES, ROTOR SPACINGS.
F. RING MAIN ARE PREFERRED AROUND FIELD/S WHERE PRACTICAL.
G. MAINTAIN MINIMUM 4M OFFSET FROM VALVE BOXES TO FIELD BOUNDARIES.
H. OFFSET ROTORS &/OR EXTEND ARCS OUTSIDE FIELD BOUNDARIES TO 3M WHERE PRACTICAL, WITH EXCEPT DEAD BALL LINE ON RUGBY FIELDS WHERE ROTORS CAN BE INSIDE DBL APPROX 1.2M.
I. USE PART CIRCLE ROTORS ON SEPARATE STATION GROUPS FOR OUTER BOUNDARIES TO ALLOW TARGET FIELD IRRIGATION.
J. MAINTAIN MAXIMUM PRACTICAL CLEARANCE TO GOAL POSTS.
K. DETAIL ROTOR NOZZLE # & ARCS ON DRAWINGS.
L. CODE ALL SOLENOID VALVES WITH STN #.
M. INCLUDE DETAILED LEGEND WITH ALL KEY COMPONENTS IDENTIFIED
N. INCLUDE CABLE ROUTES TABLE ON LAYOUT DRAWINGS, CODING CABLES TO SOLENOID VALVES.
O. REFER TO COD IRRIGATION ASSETS SPECIFICATION MANUAL FOR DESIGN , PRODUCT & INSTALLATION REQUIREMENTS.

CONSTRUCTION NOTES:
A. Layout drawings are schematic and setout must be verified onsite. Setout & adjustments to be approved by client representative.
B. Underground services & conduits to be located prior to excavation
C. Drawings to be read in conjunction with specifications & construction details
D. If in doubt, ask consultant for confirmation

TYPICAL AFL OVAL WITH CRICKET PITCH – SENIOR SIZE

- 0 - - - - 20 40m
SCALE 1:400 ORIGINAL SIZE A1

CRICKET WICKET:
LAYOUT SHOWN WITH WICKET IN, WHICH REQUIRES BACK–BACK ROTORS ON SEPARATE STATIONS. SAME INTENT APPLIES TO WICKET BETWEEN RECTANGULAR FIELDS. WHERE THERE IS NO WICKET, DELETE WICKET INNER STATION, AND OPEN WICKET OUTER ROTORS TO FULL CIRCLE

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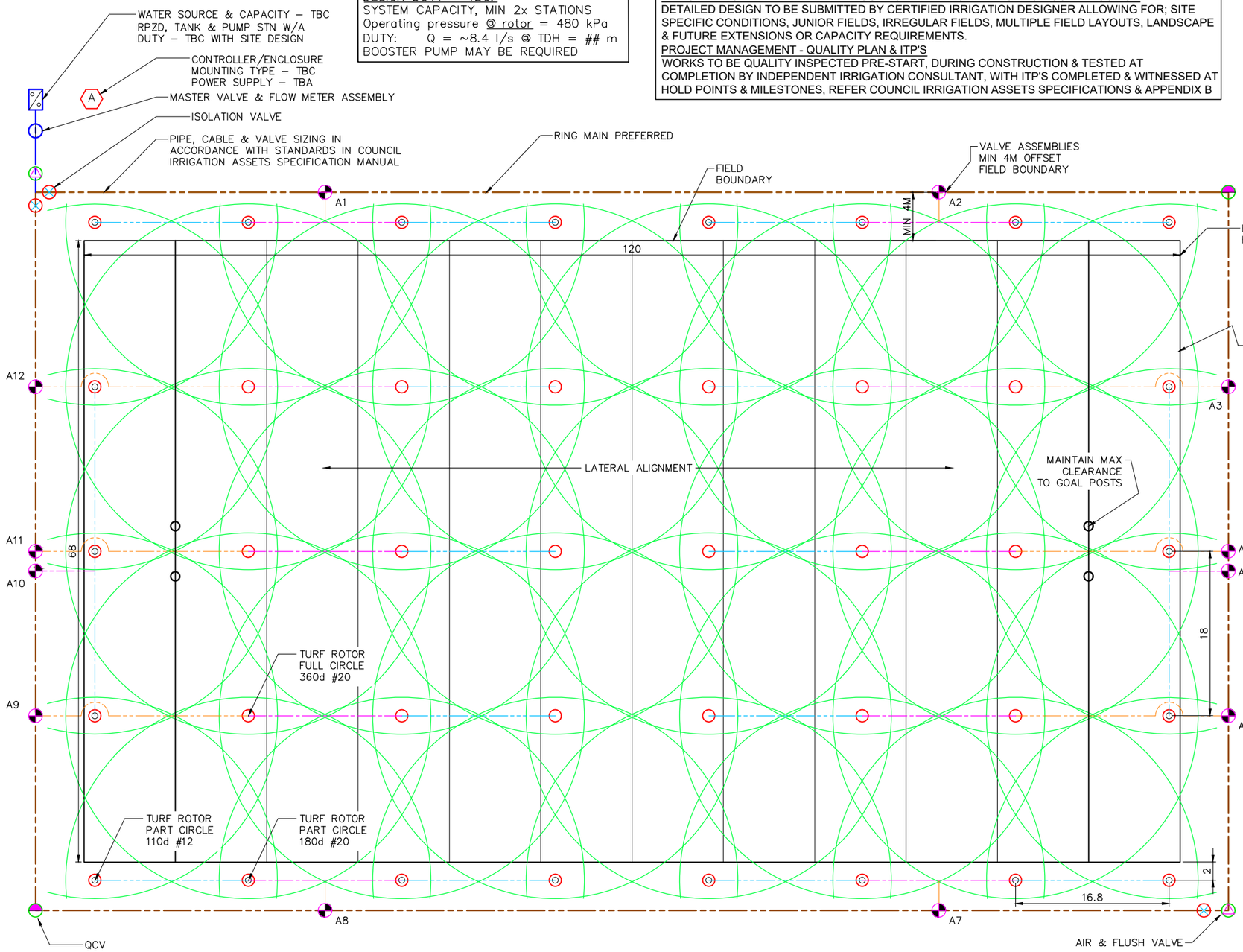
DRAWN:	SJ
DESIGN:	SJ
CHECKED:	HR
APPROVED:	JG
DRAFT REF:	RS/IS

CLIENT: CITY OF DARWIN - PARKS AND RESERVES
IRRIGATION ASSETS SPECIFICATION MANUAL
PROJECT: SPORTS FIELD LAYOUT
AFL OVAL WITH CRICKET PITCH TYPICAL LAYOUT
DRAWING No. COD-IM-SF-01 | SHEET A1 OF | REVISION 0

DESIGN DUTY – TBC:
SYSTEM CAPACITY, MIN 2x STATIONS
Operating pressure @ rotor = 480 kPa
DUTY: Q = ~8.4 l/s @ TDH = ## m
BOOSTER PUMP MAY BE REQUIRED

TYPICAL SINGLE FIELD SAMPLE LAYOUT FOR INTENT ONLY - NOT FOR CONSTRUCTION
DETAILED DESIGN TO BE SUBMITTED BY CERTIFIED IRRIGATION DESIGNER ALLOWING FOR; SITE SPECIFIC CONDITIONS, JUNIOR FIELDS, IRREGULAR FIELDS, MULTIPLE FIELD LAYOUTS, LANDSCAPE & FUTURE EXTENSIONS OR CAPACITY REQUIREMENTS.
PROJECT MANAGEMENT - QUALITY PLAN & ITP'S
WORKS TO BE QUALITY INSPECTED PRE-START, DURING CONSTRUCTION & TESTED AT COMPLETION BY INDEPENDENT IRRIGATION CONSULTANT, WITH ITP'S COMPLETED & WITNESSED AT HOLD POINTS & MILESTONES, REFER COUNCIL IRRIGATION ASSETS SPECIFICATIONS & APPENDIX B



LEGEND:

	## mm RPZD assem/enc, or PS
A	Rainman controller–stn##/Cell/encl
	##mm Master vlv & flow sensor
	Isolation valve (LineSize), c/w VB
	Air valve 50mm c/w BV & VB
	Quick Coupling valve, 25mm & VB
A1	##mm Sol.Vlv c/w SJR, BV & VB
	###–SS popup, FC rotor, ##
	###–SS popup, PC rotor, ##
	### mm ### PN12/12.5 pipe
	## mm ### PN12/12.5 pipe
	75 mm HD PE100 PN12.5 pipe
	63 mm HD PE100 PN12.5 pipe
	50 mm HD PE100 PN12.5 pipe
	## C / ## mm2 Cable route A
	## C / ## mm2 Cable route B

NOTES:
1. (##) refer sizing tables, App B
2. Add filter for dirty water applic.
3. Provide cable routing table
4. Provide rotor precip tables & program data sheets
5. Sandbed all main pipework
6. Conduit all control/comms cables

DESIGN NOTES:
A. MINIMUM CRITERIA FOR SINGLE FIELDS.
B. FIELD SIZES MAY VARY.
C. MULTIPLE FIELDS WILL HAVE INCREASED CAPACITY REQUIREMENTS.
D. INCLUDE WATER SUPPLY DUTY (Q/H) & ROTOR PERFORMANCE DATA (CU/DU/SC) ON LAYOUT DRAWINGS
E. SHOW CRITICAL DIMENSIONS ON LAYOUT DRAWINGS, INCLUDING; FIELD BOUNDARIES, ROTOR SPACINGS.
F. RING MAIN ARE PREFERRED AROUND FIELD/S WHERE PRACTICAL.
G. MAINTAIN MINIMUM 4M OFFSET FROM VALVE BOXES TO FIELD BOUNDARIES.
H. OFFSET ROTORS &/OR EXTEND ARCS OUTSIDE FIELD BOUNDARIES TO 3M WHERE PRACTICAL, WITH EXCEPT DEAD BALL LINE ON RUGBY FIELDS WHERE ROTORS CAN BE INSIDE DBL APPROX 1.2M.
I. USE PART CIRCLE ROTORS ON SEPARATE STATION GROUPS FOR OUTER BOUNDARIES TO ALLOW TARGET FIELD IRRIGATION.
J. MAINTAIN MAXIMUM PRACTICAL CLEARANCE TO GOAL POSTS.
K. DETAIL ROTOR NOZZLE # & ARCS ON DRAWINGS.
L. CODE ALL SOLENOID VALVES WITH STN #.
M. INCLUDE DETAILED LEGEND WITH ALL KEY COMPONENTS IDENTIFIED
N. INCLUDE CABLE ROUTES TABLE ON LAYOUT DRAWINGS, CODING CABLES TO SOLENOID VALVES.
O. REFER TO COD IRRIGATION ASSETS SPECIFICATION MANUAL FOR DESIGN , PRODUCT & INSTALLATION REQUIREMENTS.

TYPICAL RUGBY LEAGUE & UNION FIELD – SENIOR SIZE

CONSTRUCTION NOTES:
A. Layout drawings are schematic and setout must be verified onsite. Setout & adjustments to be approved by client representative.
B. Underground services & conduits to be located prior to excavation
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SCALE 1:250 ORIGINAL SIZE A1

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CHECKED:	HR
APPROVED:	JG
DRAFT REF:	RS/IS

CLIENT: CITY OF DARWIN - PARKS AND RESERVES
IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: SPORTS FIELD LAYOUT
RUGBY LEAGUE & RUGBY UNION TYPICAL LAYOUT

DRAWING No. COD-IM-SF-02 | SHEET A1 OF | REVISION 0

DESIGN DUTY – TBC:
SYSTEM CAPACITY, MIN 2x STATIONS
Operating pressure @ rotor = 480 kPa
DUTY: Q = ~6.4 l/s @ TDH = ## m
BOOSTER PUMP MAY BE REQUIRED

TYPICAL SINGLE FIELD SAMPLE LAYOUT FOR INTENT ONLY - NOT FOR CONSTRUCTION
DETAILED DESIGN TO BE SUBMITTED BY CERTIFIED IRRIGATION DESIGNER ALLOWING FOR; SITE SPECIFIC CONDITIONS, JUNIOR FIELDS, IRREGULAR FIELDS, MULTIPLE FIELD LAYOUTS, LANDSCAPE & FUTURE EXTENSIONS OR CAPACITY REQUIREMENTS.
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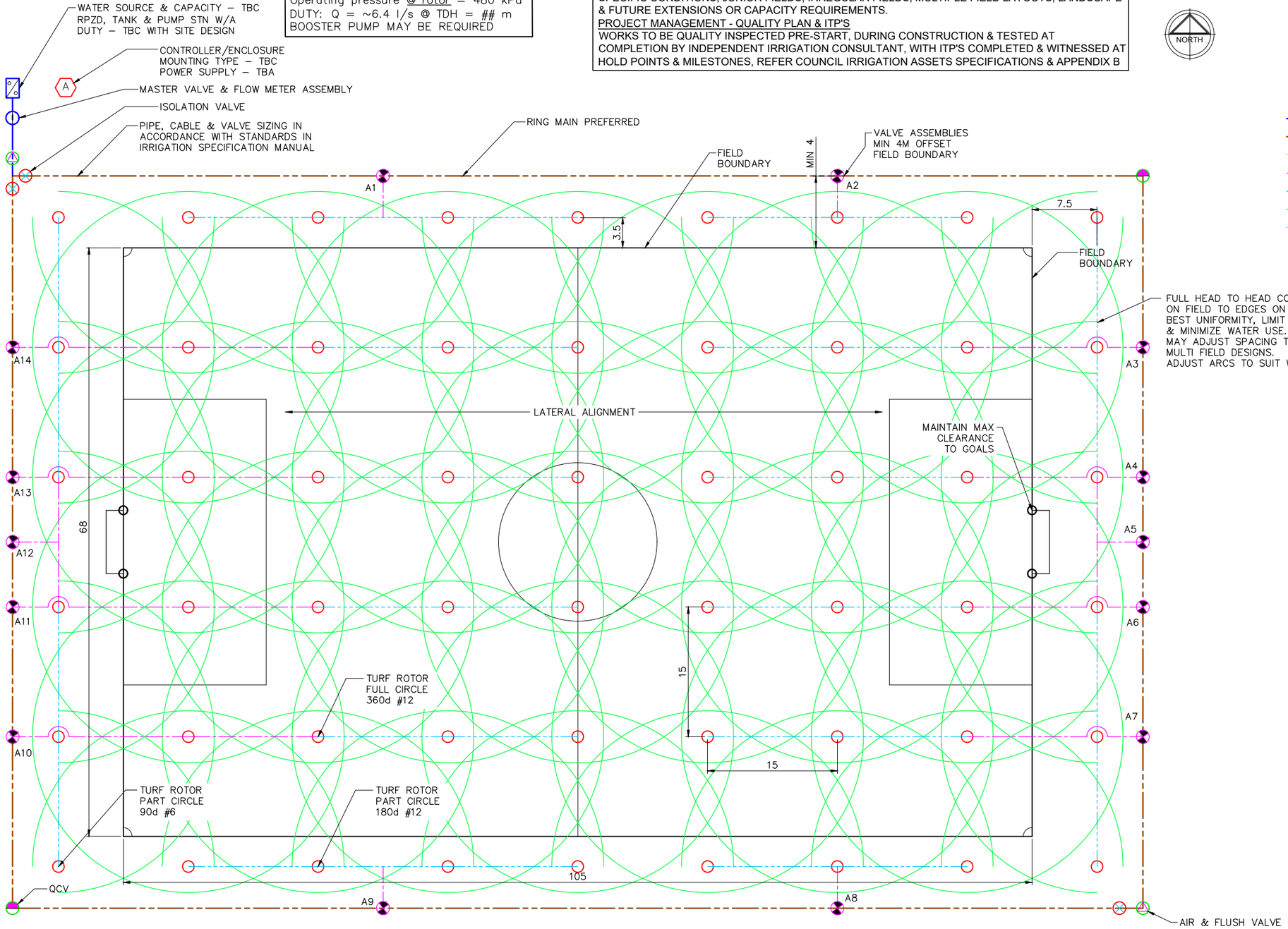

NORTH

FULL HEAD TO HEAD COVERAGE
ON FIELD TO EDGES ON ALL FIELDS FOR BEST UNIFORMITY, LIMIT OVERTHROW & MINIMIZE WATER USE.
MAY ADJUST SPACING TO ACCOMMODATE MULTI FIELD DESIGNS.
ADJUST ARCS TO SUIT WHERE REQUIRED

LEGEND:

- ## mm RPZD assem/enc, or PS
- Rainman controller–stn##/Cell/encl
- ##mm Master vlv & flow sensor
- Isolation valve (LineSize), c/w VB
- Air valve 50mm c/w BV & VB
- Quick Coupling valve, 25mm & VB
- A1 ##mm Sol.Vlv c/w SJR, BV & VB
- ###–SS popup, FC rotor, ##
- ###–SS popup, PC rotor, ##
- ### mm ### PN12/12.5 pipe
- ## mm ### PN12/12.5 pipe
- 75 mm HD PE100 PN12.5 pipe
- 63 mm HD PE100 PN12.5 pipe
- 50 mm HD PE100 PN12.5 pipe
- ## C / ## mm2 Cable route A
- ## C / ## mm2 Cable route B

NOTES:
1. (##) refer sizing tables, App B
2. Add filter for dirty water applic.
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D. If in doubt, ask consultant for confirmation

TYPICAL SOCCER FIELD – INTERNATIONAL SENIOR SIZE

- 0 - - - 10 - 20 25m
SCALE 1:250 ORIGINAL SIZE A1

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DRAWN:	SJ
DESIGN:	SJ
CHECKED:	HR
APPROVED:	JG
DRAFT REF:	RS/IS

CLIENT: CITY OF DARWIN - PARKS AND RESERVES
IRRIGATION ASSETS SPECIFICATION MANUAL

PROJECT: SPORTS FIELD LAYOUT
SOCCER FIELD INTERNATIONAL TYPICAL LAYOUT

DRAWING No.	SHEET	OF	REVISION
COD-IM-SF-03	A1		0