Q35 Landscape maintenance

To be read with Preliminaries/ General conditions.

GENERALLY

110 NOTICE

- Give notice before:
  - Application of herbicide.
  - Application of fertilizer.
  - Watering.
  - Each site maintenance visit.
- Period of notice: 2 weeks.

130 REINSTATEMENT

- Damage or disturbance to soil structure, planting, grass, fencing, hard landscaping, structures, or buildings: Reinstate to original condition.

155 WATERING

- Supply: No site supply available, submit proposals.
- Quantity: Wet to field capacity.
- Application: Do not damage or loosen plants.
- Compacted soil: Loosen or scoop out, to direct water to rootzone.
- Frequency: As necessary for the continued thriving of all planting.

160 WATER RESTRICTIONS

- General: If water supply is, or is likely to be, restricted by emergency legislation, submit proposals for an alternative suitable source of water. Obtain instructions before proceeding.

170 DISPOSAL OF ARISINGS

- General: Unless specified otherwise, dispose of arisings as follows:
  - Biodegradable arisings: Compost on site.
  - Grass cuttings: Compost on site.
  - Tree roots and stumps: Remove from site.
  - Shrub and tree prunings: Compost on site.
  - Litter and nonbiodegradable arisings: Remove from site.

180 CHIPPING OR SHREDDING

- General: Not permitted on site.

190 LITTER

- Extraneous rubbish not arising from the contract work: Collect and remove from site.

197 CLEANLINESS

- Soil and arisings: Remove from hard surfaces.
- General: Leave the works in a clean, tidy condition at completion and after any maintenance operations.

226 TREE STEMS

• Precautions: Do not allow nylon filament rotary cutters and other mechanical tools closer than 100 mm to the stem of any tree.
- Operations close to stems: Complete using hand tools.

250 LEAF REMOVAL

• Operations: Collect fallen leaves.
• Special requirements: Remove by hand raking.
• Disposal: Remove from site for recycling.

460 BEDS OF PERENNIALS OR PERENNIALS AND ANNUALS

- Plant supports: Stake and tie plants using bamboo canes.
  - Length: To suit plant height.
  - Maintain throughout the growing season.
- Gaps in planting: Refill by replanting.
- Watering:
  - New plants: Before and after planting out.
  - Ongoing: As necessary for the continued thriving of all planting.
- Operations at end of growing season:
  - Trim: Older flowering stems of herbaceous perennials.
  - Remove: Redundant plant supports, litter, debris and arisings.
  - Cultivate: Fork over the soil, taking care not to cause undue disturbance to plants.
  - Top dress: Apply sanitized and stabilized compost top dressing.

470 FLOWER BEDS GENERALLY

- Operations:
  - Remove: Dead flower heads, fallen leaves, litter and debris.
  - Weeds: Thoroughly hand weed.
  - Cultivate: Lightly hoe.
  - Trim: Clip grass edges.
- Fungicide: Not required.
- Insecticide: Not required.

490 THINNING BY REMOVAL OF SURPLUS PLANTS

• Plants to be thinned: to be agreed as necessary towards the end of the defects period.
• Standard: BS 7370-4, clause 3.5.17.1.
• Timing: Thin when foliage of adjacent plants has begun to touch.
• Roots:
- Disturbance to adjacent plants: Minimise.
- Soil: Refill holes with topsoil to leave an even graded surface.
- Mulch: Maintain mulch as original specification.
• Adjacent plants: Make good any minor damage immediately.
• Plants for retention: Select plants with a strong healthy habit.
• Mature planting density: to suit selected planting; to be agreed with the CA and landscape architect.

SHRUBS/TREES/HEDGES

500 ESTABLISHMENT OF NEW PLANTING

- Duration: 1 year
- Weed control:
  - Method: Keep planting beds clear of weeds by maintaining full thickness of mulch.
  - Area: Maintain a weed free area around each tree and shrub, minimum diameter the larger of 1 m or the surface of the original planting pit.
- Soil condition: Fork over beds to keep soil loose, with gentle cambers and no hollows. Do not reduce depth or effect of mulch.
- Watering: As schedule and when instructed.

502 ESTABLISHMENT OF NEW PLANTING - FERTILIZER

- Time of year: March or April.
- Type: Organic.
- Spreading: Spread evenly. Carefully lift and replace any mulch materials.
  - Application rate: As manufacturer's recommendations.

515 TREE GUY WIRES

• Inspection/ Maintenance times: during each and every maintenance visit.
• Operations:
- Replace or resecure loose or missing guy wires.
- Adjust to suit stem growth and to provide correct and uniform tension.
• Removal: below ground guy wires- leave in place.

520 REFIRMING OF TREES AND SHRUBS

- Timing: After strong winds, frost heave and other disturbances.
- Refirming: Tread around the base until firmly bedded.
- Collars in soil at base of tree stems, created by tree movement: Break up by fork, avoiding damage to roots. Backfill with topsoil and refirm.

525 TREE GUARDS

- Loose or defective guards: Adjust, refix or replace to original specification and to prevent chafing.

520 REFIRMING OF TREES AND SHRUBS

• Timing: After strong winds, frost heave and other disturbances.
• Refirming: Tread around the base until firmly bedded.
• Collars in soil at base of tree stems, created by tree movement: Break up by fork, avoiding damage to roots. Backfill with topsoil and refirm.

540 PRUNING GENERALLY

- Pruning: In accordance with good horticultural and arboricultural practice.
  - Removing branches: Do not damage or tear the stem or bark.
  - Wounds: Keep as small as possible and cut cleanly back to sound wood.
  - Cutting: Make cuts above and sloping away from an outward facing healthy bud, angled so that water will not collect on cut area.
  - Larger branches: Prune neither flush nor leaving a stub, but using the branch bark ridge or branch collar as a pruning guide.
- Appearance: Thin, trim and shape each specimen appropriately to species, location, season, and stage of growth, leaving a well balanced natural appearance.
- Tools: Use clean sharp secateurs, hand saws or other approved tools. Trim off ragged edges of bark or wood with a sharp knife.
- Disease or infection: Give notice if detected.
- Growth retardants, fungicide or pruning sealant: Do not use unless instructed.

545 PRUNING OF EXCESSIVE OVERHANG

- Timing: Annually.
- Operations: Remove growth encroaching onto grassed areas, paths, roads, signs, sightlines, and road lighting luminaires.
- Special requirements: Allow ground cover plants to partially overlap paths and lawns.

550 PRUNING OF EXCESSIVE HEIGHT

- Timing: Annually.
  Operations: Remove excessive height Above 12m.

555 PRUNING TREES AND SHRUBS

- Standard: To BS 7370-4.
- Special requirements: Growth retardants not permitted.

570 FORMATIVE PRUNING OF YOUNG TREES

- Standard: Type and timing of pruning operations to suit the plant species.
- Time of year: Do not prune during the late winter/ early spring sap flow period.
- Young trees up to 4 m high:
  - Crown prune by removing dead branches and reducing selected side branches by one third to preserve a well-balanced head and ensure the development of a single strong leader.
  - Remove duplicated branches and potentially weak or tight forks. In each case cut back to live wood.
- Whips or feathered trees: Do not prune.
- Operatives: Approved specialist contractor.

575 PRUNING ORNAMENTAL SHRUBS

- General: Prune to encourage healthy and bushy growth and desirable ornamental features, e.g. flowers, fruit, autumn colour, stem colour.
- Suckers: Remove by cutting back level with the source stem or root.

580 PRUNING FLOWERING SPECIES OF SHRUBS AND ROSES

- Time of year:
  - Winter flowering shrubs: Spring.
  - Shrubs flowering between March and July: Immediately after the flowering period.
  - Shrubs flowering between July and October: Back to old wood in winter.
  - Rose bushes: Early spring to encourage basal growths and a balanced, compact habit.

605 TRIMMING SLOWLY ESTABLISHING HEDGES

- Operations:
- - Timing: Cut back hard in June and September to encourage bushy growth down to
- ground level.
- - Form: Allow to reach planned dimensions only by gradual degrees, depending on growth
- rate and habit.

620 REMOVAL OF DEAD PLANT MATERIAL

- Operations: At the end of the growing season, check all shrubs and remove all dead foliage, dead wood, and broken or damaged branches and stems.

625 CLIMBING PLANTS

- Pruning: Remove excess growth, to ensure that signs, light fittings, doors and windows are kept clear at all times.
- Insecure growth: Attach to supporting wires or structures using Stainless steel wire.
- Supporting structures: Check and repair as necessary.

630 DEAD AND DISEASED PLANTS

- Removal: within 1 week.
- Replacement: Within 2 weeks.

635 REINSTATEMENT OF SHRUB/ HERBACEOUS AREAS

- Dead and damaged plants: Remove.
- Mulch/ matting materials:
  - Carefully move to one side and dig over the soil, leaving it fit for replanting.
- Do not disturb roots of adjacent plants.
- Replacement plants:
  - Use pits and plants: To original specification or to match the size of adjacent or nearby plants of the same species, whichever is the greater.
  - Additional requirements: Submit details and cost of plants before ordering.
- Dressing: Slow release fertilizer:
  - Type: Submit proposals.
  - Application rate: As manufacturer's recommendations.

640 THINNING BY REMOVAL OF SURPLUS PLANTS

• Plants to be thinned: as instructed towards the end of the defects liability period.
• Standard: BS 7370-4.
• Timing: as above.
• Roots:

- Disturbance to adjacent plants: Minimise.
- Soil: Refill holes with topsoil to leave an even graded surface.
- Mulch: Maintain mulch as original specification.
- Adjacent plants: Make good any minor damage immediately.
• Plants for retention: Select plants with a strong healthy habit.
• Mature planting density: tbc on site with the landscape architect.

645 WEED CONTROL GENERALLY

- Weed tolerance: Weed to clear ground every 2 weeks.
- Adjacent plants, trees and grass: Do not damage.

650 HAND WEEDING

- General: Remove weeds entirely, including roots.
- Disturbance: Remove the minimum quantity of soil, and disturb plants, bulbs and mulched surfaces as little as possible.
- Completion: Rake area to a neat, clean condition.
- Mulch: Reinstate to original depth.

651 HAND WEEDING TO SEDUM ROOF

• General: Twice a year, lightly handweed to remove all windblown seeds and weeds entirely, including roots.
• Disturbance: Remove the minimum quantity of soil, and disturb sedum mats as little as possible.
• Completion: Leave in a neat, clean condition.

657 HERBICIDE TO KILL REGROWTH

- Type: Suitable foliar acting herbicide to kill regrowth.
- Timing: Allow recommended period for herbicide to take effect before clearing dead weeds.

665 WEED CONTROL WITH WINTER HERBICIDE

- Type: Suitable residual soil acting herbicide.
- Time of year: Unless otherwise agreed, complete before end of March.
- Timing: Allow recommended period for herbicide to take effect before clearing dead weeds.

670 WEED CONTROL WITH SUMMER HERBICIDE

- Type: Suitable foliar acting herbicide.
- Timing: Allow recommended period for herbicide to take effect before clearing dead weeds.

675 DIGGING OVER

- General: Dig over beds. Do not damage existing plants, bulbs and roots.
  - Depth of dig (minimum): 150 mm.

680 SOIL AERATION

- Compacted soil surfaces:
  - Prick up: To aerate the soil of root areas and break surface crust.
  - Size of lumps: Reduce to crumb and level off.
  - Damage: Do not damage plants and their roots.

685 SOIL LEVEL ADJUSTMENT

- Level of soil/mulch at edges of beds: Reduce to 50 mm below adjacent grass or hard surface.
  - Arisings (if any): Spread evenly over the bed.

690 MAINTENANCE OF LOOSE MULCH

- Thickness (minimum): 75 mm.
  - Top up: Twice per year.
- Mulch spill on adjacent areas: Remove weeds and rubbish and return to planted area.
- Weeding: Remove weeds growing on or in mulch by hand weeding.

695 FERTILIZING ESTABLISHED TREES AND SHRUBS

- Time of year: During February or March.
- Type of fertilizer: Organic.
- Application: Spread evenly.
  - Rate: As manufacturer's recommendations.

TREE WORK

810 TREE WORK GENERALLY

- Identification: Before starting work agree which trees, shrubs and hedges are to be removed or pruned.
- Protection: Avoid damage to neighbouring trees, plants and property.
- Standards: To BS 3998 and Health & Safety Executive (HSE) 'Forestry and arboriculture safety leaflets'.
- Removing branches: Cut vertical branches similarly, with no more slope on the cut surface than is necessary to shed rainwater.
- Appearance: Leave trees with a well-balanced natural appearance.
- Chain saw work: Operatives must hold a Certificate of Competence.
- Tree work: To be carried out by an approved member of the Arboricultural Association.

815 ADDITIONAL WORK

- Defective, diseased, unsafe or weak parts of trees additional to those scheduled for attention: Give notice if detected.

820 PREVENTION OF WOUND BLEEDING

- Standard: To BS 3998.

825 PREVENTION OF DISEASE TRANSMISSION

- Standard: To BS 3998.

830 CLEANING OUT AND DEADWOODING

• Remove:
- Dead, dying, or diseased wood, broken branches and stubs.
- Fungal growths and fruiting bodies.
- Rubbish, wind blown or accumulated in branch forks.
- Wires, clamps, boards and metal objects, if removable without causing further damage and not part of a support structure that is to be retained.
- Other unwanted objects, e.g. tree houses, swings.
- Climbing plants none.

835 CUTTING AND PRUNING GENERALLY

• Tools: Appropriate, well maintained and sharp.
• Final pruning cuts:
- Chainsaws: Do not use on branches of less than 50 mm diameter.
- Hand saws: Form a smooth cut surface.
- Anvil type secateurs: Do not use.
• Removing branches: Do not damage or tear the stem.
• Wounds: Keep as small as possible, cut cleanly back to sound wood leaving a smooth surface, and angled so that water will not collect on the cut area.
• Cutting: Cut at a fork or at the main stem to avoid stumps wherever possible.
Large branches: Remove only with prior approval.
- Remove in small sections and lower to ground with ropes and slings.
• Dead branches and stubs: When removing, do not cut into live wood.
• Unsafe branches: Remove epicormic shoots and potentially weak forks that could fail in adverse weather conditions.
• Disease or fungus: Give notice if detected. Do not apply fungicide or sealant unless instructed.

845 CROWN LIFTING

• Clearances: Remove branch systems to give clearance.
- Height: as instructed by the landscape architect.
• Removing branches: Remove whole branches back to the stem, or cut lower portions of branches back to lateral or sublateral buds or branches. Do not leave stumps.

850 CROWN THINNING

• Removing branches: Remove inward growing, crossing, rubbing, dead and damaged branches.

• Thinning: Selectively remove secondary and small live branch growth evenly throughout the crown.
- Quantity: tba.
• Cutting: Make no cuts of more than 25 mm diameter.
- Branches: Cut back to lateral or sublateral buds or branches without leaving stumps.
• Appearance: Leave a uniform and well balanced structure of branches and foliage.

865 BARK DAMAGE

- Wounds:
  - Do not attempt to stop sap bleeding.
  - Bark: Remove ragged edges using a sharp knife.
  - Wood: Remove splintered wood from deep wounds.
  - Size: Keep wounds as small as possible.
- Liquid or flux oozing from apparently healthy bark: Give notice.

HARD LANDSCAPE AREAS/FENCING

910 HARD SURFACES AND GRAVEL AREAS

- Herbicide: Apply a suitable foliar acting or residual herbicide. Allow recommended period for herbicide to take effect before clearing arisings.
- Hard surfaces: Remove litter, leaves and other debris.
- Surface gutters and channels: Remove mud, silt and debris.
- Drainage gullies: Empty traps and flush clean.
- Gravel areas: Rake over. Remove weeds, litter, leaves and debris, and level off.
- Repairs to flexible bituminous paving: In accordance with the original paving specification or BS 7370-2, clause 4.12.
- Stain removal: In accordance with BS 7370-2, table 4.

930 GRAFFITI REMOVAL

• Method: Pressure wash.
• Subsequent treatment: Transparent, two part, anti-graffiti coating.
- Finish: Matt .

MAGGIES CENTRE

PROPOSED
IRRIGATION SYSTEM

OUTLINE IRRIGATION SPECIFICATION

Document No: 007562-IRR-00-ZZ-SP-L-800

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CONTENTS

1.0 Introduction

Automatic irrigation is required to provide efficient and reliable watering to areas of planting at Maggies Centre.

The following document serves to provide an outline of the required irrigation system arrangement.

The irrigation Contractor install an irrigation system in line with this document and be responsible for specific detailed arrangement of some elements unique to his preferred supplier i.e. pump station / solenoid valve assemblies and the correct and proper operation of the irrigation system.

This document shall be read in conjunction with:-

Drawing no: 007562-IRR-00-ZZ-DR-L-800

2.0 Outline Performance Specification - Irrigation

2.1 Employer Requirements & Outline of Works

For the selected irrigation Contractor to:-

2.1.1 To supply, install, test and commission a new irrigation system as generally detailed to the areas of tree, shrub and roof planting at Maggies Centre Landscape Areas, based upon the supplied specification. The installed system will be based upon the final requirement of the soft landscape areas, and final planting arrangements.

2.1.2 The irrigation Contractor is to visit site and ensure that he can fulfil the requirements as stated in this document; submission of tender deems this to be the case. No allowance will be made for claims due to failure to examine the enclosed specification and the site.

2.1.3 Irrigation Contractors shall design the system and specific elements and acknowledge responsibility for this, e.g. solenoid valves, pumping station / tank arrangement.

2.1.4 The irrigation Contractor will be required to enter into a formal written contractual agreement with the Employer based upon his submission of this document.

Wherever stated, the term 'Contractor' shall refer to the irrigation Contractor.

3.0 Design Requirements

3.1.1 The irrigation system shall be designed / installed particularly in accordance with the following:-

3.1.1.1 Mainline pipe flow velocities shall not exceed 1.53 metres per second (all pipe sections after pump manifold and before the solenoid valve).

3.1.1.2 Lateral pipeline flow velocities shall not exceed 1.9 metres per second (pipe sections after the solenoid valve).

3.1.1.3 Drip line row spacings shall be equal to the emitter spacing either in a square or triangular configuration, based upon the 50% rule for triangular spacing.

3.1.1.4 All solenoid valves shall incorporate pressure regulation and filters.

3.1.1.5 Irrigation products shall be valved according to the type and equal precipitation. Mixing of products or precipitation rates on a common valve is not permissible. All products shall be colour coded to reflect the water quality; overthrow onto hardscape areas and wastage of water is not permissible.

3.1.1.6 Final precipitation rates must be calculated with reference to the configuration spacing and flow of the emitter. Emitters with different flows must not be operated on the same valve unless shown to be matched in precipitation.

3.1.1.7 The irrigation system for the complete system shall run between the hours of 2300 hours and 0600 hours, achieving full irrigation within this window.

3.1.1.8 Peak application rates for planted areas shall be considered as follows (actual daily rates will depend on daily weather fluctuations and will need adjusting as such); these are subject to final planting type, density, and detail. Peak total water usage per day will be approximately $1m^3$/day excluding manual point use:-

Ground Cover Shrubs – approx 5 litres / m^2 / day
Large Trees – approx 40-60 litres / tree / day
Small Trees – approx 15-25 litres / tree / day
Larger Specimen Shrubs – approx 6-10 litres each per day

However each area / type of planting shall be separately valved; mixing of plant types on valves is not permissible. Final water volumes shall be determined by plant species and water requirements. The system shall be adapted by the user to apply water commensurate with the weather conditions and be drained down in winter to avoid frost damage.

3.1.1.9 Water shall be abstracted from a proposed dedicated water storage tank. The supply of a filtered, clean water supply up to the tank for the irrigation system is the responsibility of others at an inflow rate of $1m^3$/hr minimum, however the irrigation Contractor shall ensure that the water is of a volume and quality suitable for irrigation purposes; all selected materials shall reflect this, including emitters, valves, and pump manifold pipework i.e. such problems as potential calcification / Legionella shall be addressed by the irrigation Contractor after the irrigation system pump station.

Any other water supplies into the tank shall be supplied by others and shall be treated prior to entry into the tank.

3.1.1.10 Control system shall be wall mounted decoder based at the pump area or at an alternative location to be suggested by the irrigation Contractor.

4.0 General Conditions

4.1 General Conditions

4.1.1.1 No changes in either plans or specification shall be made by the irrigation Contractor without the written approval of the Employer or his representative.

4.1.1.2 Should the Employer request alterations to the scope of works, these shall be undertaken by the irrigation Contractor without affecting the contract and at the unit rate specified. Should additional work involve additional plant / manpower not previously included, then these shall be provided at an agreed rate, made in writing and accepted by the Employer, prior to the commencement of the additional works.

4.1.1.3 Warranty terms shall be indicated by the irrigation Contractor. A standard minimum of 24 months from handover will be required for the complete system.

4.1.1.4 The irrigation Contractor is solely responsible for the identification of all underground services. He shall contact and liaise with all local utility providers such as gas, oil, telecommunications, water and sewage, etc. The Contractor shall identify all of these services prior to commencement of works and shall have made provision to cross these services in the appropriate manner with regard to the utility.

4.1.1.5 The irrigation Cntractor shall aim to minimise all risk of fire and shall take the appropriate action if fire is discovered.

4.1.1.6 During the duration of the contract, the irrigation Contractor will supply a competent supervisor to ensure that all aspects of the contract are handled in a professional manner.

4.1.1.7 Local /national byelaws / codes of practice will override any section of the enclosed specification with regard to abiding by legislation and law.

4.1.1.8 The irrigation Contractor shall satisfy himself as to the completeness of the outline specification prior to submission of the tender. Submission of the tender document shall be confirmation of this. It is the responsibility of the bidding Contractor to confirm all lengths and quantities at to submission of his tender; submission of the tender document shall be deemed as confirmation of this.

4.1.1.9 The irrigation Contractor shall provide the Employer with written evidence of all requested insurances and liability insurances, including Professional Indemnity Insurance. Insurance of equipment on site remains the responsibility of the Contractor until handover.

4.1.1.10 The tender shall be valid for a period of 90 days from the date of submission.

4.1.1.11 The irrigation Contractor shall submit with his tender a typical method statement for the proposed works, including product samples and a sample of each / every pipe product.

4.1.1.12 Handover date shall be the date when the project is deemed to be completed to the satisfaction of the Employer or Employers representative and all instructions for the operation and maintenance of the system have been provided. The system shall have been proved by visual inspection, pressure testing and in an automatic mode as deemed necessary.

4.2 Site

4.2.1 Scope of work

To install, test and commission a new irrigation system including all necessary labour, mechanical plant equipment and supervision as required based upon the attached detailed specification.

4.2.2 Site address and area of works:-

Maggies Centre

4.3 Materials

4.3.1 The irrigation Contractor shall supply all materials necessary, such as pump stations, tank, underground pipelines, dripline, drip emitters, access chambers, control valves, control system, etc, as well as all other necessary sundry materials required for the full installation of the system such as pipe couplings.

All products shall identify the water in use as non potable i.e. colour coded covers.

4.3.2 All materials used by the irrigation Contractor shall be new and unused and inline with the attached specification. The Employer shall have the right to inspect the materials used at any time.

4.3.3 The irrigation Contractor shall be responsible for the safe storage of all materials and for the safe handling of these materials until the completion of the project.

The irrigation Contractor shall also be responsible for the removal / disposal of all packaging / boxing / pipe cuttings, etc at the end of each day.

4.4 Operation of System

4.4.1 The irrigation Contractor shall be responsible for the full programming and automatic operation of the irrigation system after installation has been completed and until handover and full acceptance.

The irrigation Contractor shall keep a fully qualified engineer on site at all times to effect operation and repair of the system until handover.

4.5 Marking Out / As Laid

4.5.1 The irrigation Contractor shall be responsible for the marking out of the system (mainline pipe, emitter equipment and lateral pipe positioning), unless otherwise indicated by the Employer or his representative. The Contractor cannot start installation until marking out is approved by the Client or his representative.

4.5.2 The irrigation Contractor shall record the 'as laid' position of all irrigation equipment on a plan supplied by the Client. This plan shall be forwarded to the Client as an accurate 'as laid' plan formulated by GPS.

4.6 Valuations

4.6.1 These shall be submitted at periods to be agreed.

4.7 Retention

4.7.1 Retention / liquidated damages / type of contract of works / completion dates to be agreed.

4.8 Terms

4.8.1 The Employer is not bound to accept the lowest price offered and reserves the right to negotiate after receipt of the offers.

5.0 Material Specification

Substitution of any part of the material specification is not permitted, unless in written agreement with the Employer or his representative. It is the irrigation Contractor's responsibility to include all necessary sundry fittings and to check his material quantities.

5.1 Mainline and Lateral Distribution Pipelines

5.1.1 Rising / dropping mains and clipped mains (to underside of slab in basement plant room) shall be supplied as 1" ABS Class D pressure rating, or copper to BS / EN Standard and kitemarked with a rated working pressure of 12 bars; all standards applicable to the safe installation and use of these products shall be adhered to.

Pipelines shall be jointed by approved methods; all joints shall be carried out using products recommended by the manufacturer with a pressure rating equal to or higher than the pipe.

Supporting clips for suspension should be specifically manufactured for such a purpose and be recognised by the pipe manufacturers for such a task.

The irrigation Contractor shall at points where pipe flexibility is compromised, allow necessary rubber bellows in accordance with pipe manufacturers instructions. Plastic to metal connections shall be made only using approved jointing techniques.

The irrigation Contractor shall provide these internal rising / dropping mains from pump room to the upper / lower level planting areas; suitable 25mm lagging / insulation for all exposed / clipped mainline pipes to BS6700 shall be included; sealing and transition fittings for these penetrations shall be provided by the irrigation Contractor, whilst liaising with the M&E engineers / main Contractors regarding the final routing and configuration / location / position; each point of connection shall have an isolation valve.

After slab penetrations mainline pipes shall be supplied as black Medium Density polyethylene to British Standard and kitemarked with a minimum rated working pressure of 10 bars. All standards regarding polyethylene pipe and fittings shall be in accordance with the latest WRC / WRAS code of practice and in accordance with local water provider colour coding guidelines, installed within ducting and with a marker / tracing tape as per local water provider bylaws / guidelines.

Penetrations into planter slab shall be undertaken using the appropriate and necessary fittings and sealants.

Pipelines shall be jointed by either compression or electrofusion fittings. Saddle clamps shall not be used as mainline fittings.
Standards applicable to pipe are:-

EN 12201 / BS 6730 for MDPE pipes up to and including 63mm

Where couplers other than compression or electrofusion are utilised, ie flanges, they will be manufactured to the relevant national standard with stainless steel bolts.

In all cases, the pipe jointing / installation method must be carried out strictly in accordance with relevant code of practice and manufacturers recommendations for that particular piping product. All joints shall be 16 bar rated and shall be approved in writing by the pipe manufacturer.

Other acceptable pipe products shall be ABS / stainless steel 316 grade used in pump suction / discharge manifolds and at planter entry points; all pipe joints shall be either screwed, glued or flanged in these instances.

5.2 Planter Entry Points / Terracing / Ducting / Penetrations

5.2.1 Cable / pipe entry points in the above areas shall be provided by the main Contractor for use by the irrigation Contractor. It is the irrigation Contractors responsibility to liaise with the main Contractor regarding final entry point positions and sealing materials / transition fittings. The irrigation Contractor shall make provision to provide all necessary sundry fittings to effect full installation including planters that are only accessible below slab.

5.3 Hard Paved Areas

5.3.1 Areas such as paths / paved areas shall be crossed by either ducting prior to path formation. Crossings should be ducted and any reinstatement shall match the existing path / road condition. The irrigation Contractor shall liaise with the main Contractor regarding all penetrations (including into planters) and ducting positions; all penetrations / crossings shall be ducted and undertaken by the irrigation Contractor. Existing paths shall be thrust bored or trenched.

Any and all licences and road closure certificates / searches are the responsibility of the irrigation Contractor. Reinstatement shall be to a standard exactly the same as the original hard paved area.

5.4 Specific Tree Irrigation

5.4.1 Large trees in shrub areas / grills shall be irrigated by pressure compensating non leakage 'push in' emitters with an output of approximately 8 litres per hour. These shall be of a self piercing type, inserted into polyethylene distribution tubing suitable for burial in mulch (minimum pressure rating of tubing shall be 6.0 bar).

Each tree shall have 5 to 10 emitters spaced equally around the rootball (depending on size and species). Final flow / number of emitters to be confirmed by the irrigation Contractor.

Only compression, insert or screwed fittings approved by the manufacturer shall be used.

Emitters and tubing shall be manufactured by Rain Bird, Toro or equal.

5.5 Shrub Irrigation / Green Roof

5.5.1 Pressure compensating non-leakage sub-surface dripline shall be provided for areas of ground cover shrubs / green roof as indicated. The dripline emitters shall be pressure compensating and self cleaning in operation spaced at approximately 30cm intervals at a flow each of approximately 1.6 litres per hour suitable for installation in mulch.

Row spacing shall be even and not exceed emitter spacing. The irrigation Contractor shall configure dripline layouts accordingly and to manufacturer's recommendations.

The dripline shall be of low density polyethylene and the emitters pre-inserted. Outside diameter shall be approximately 16mm, internal diameter approximately 14mm.

Driplines shall be jointed by compression, insert or screwed fittings as approved by the manufacturer. Dripline installation shall include flush end caps for cleaning purposes; necessary check valves and air release valves shall be installed by the Contractor.

Dripline shall be held in place by stakes at approximately 1.0 metre intervals, generally as per manufacturer's instructions. Dripline shall be manufactured by Rain Bird, Netafim or Toro.

Large shrubs that are planted in isolation / part of groundcover areas shall be irrigated using 2 No. dedicated pressure compensating point emitters c/w stake / flying ¼" lead, run off of the dripline layout. Emitter numbers / flow and arrangement shall be inline with shrub size and water requirement which the Contractor shall confirm at installation.

5.6 Solenoid Valve Assemblies

5.6.1 Where required, the system will utilise ¾", or 1" automatic solenoid operated 24 volt, normally closed electric valves. These shall be plastic with a BSP thread featuring manual bypass, manual operation and each valve assembly and shall have adjustable pressure regulation fitted.

Solenoid valves shall be incorporated into an irrigation valve chamber. A maximum of 2 No. valves shall be installed in one chamber. Chambers shall be installed at a suitable location away and not in the way of either pedestrians, or maintenance machinery.

Solenoid valves shall also be incorporated into an assembly. This assembly shall be constructed of a material unaffected by water treatment regimes with MDPE pipework (connections into and out of the assembly), jointed onto pipelines by either electrofusion or compression fittings. The assembly shall include solenoid valve isolation valve (same bore as solenoid valve), and inline filter.

Final assembly design is the irrigation Contractor's responsibility. It shall be fit for the purpose intended and drawings & material lists shall be submitted with the tender.

Any / all steel assemblies (if installed) will be denso taped to minimise corrosion (this applies to all galvanised steel products). All products shall be selected by the irrigation Contractor so that they are not affected by any proposed water treatment regime or future fertigation system; this may require internal epoxy coating of products.

The solenoid valve shall not be installed within 40mm of the top of the valve chamber.

Approved valve manufacturer's are Rain Bird and TORO, ie Rain Bird .75DV with PSiM and RBY filter or Rain Bird 1" PGA c/w PRSD and RBY.

5.7 Quick Coupling Valves

5.7.1 Manual watering points specified as ¾" quick coupling valves shall be installed at each solenoid valve / group of solenoid valves indicated including a stainless steel riser and concrete anchor block for support shall be installed strategically; valves shall be manufactured from cast brass with rubber covers and mounted onto ¾" swing joints, housed within the solenoid valve chamber.

Necessary coupling keys shall be provided. All to be installed exactly as per manufacturer's instructions; manufactured by either Rain Bird or Toro.

5.8 Isolating Valves

5.8.1 Isolation valves used for the mainline or within solenoid valve assemblies shall have a minimum pressure rating of 16 bar and be suitable for direct burial, offering a watertight seal at 16 bar pressure.

Valves of 2" or smaller shall be either wedge type or brass / stainless steel lever arm ball valves to BS standard, either threaded or flanged in connection. Threaded valves shall include a union for ease of removal.

All valves shall be installed within appropriate irrigation chambers and according to local byelaw regulations.

5.9 Air Valves

5.9.1 Air valves shall be installed at the highest point of installation within a shared solenoid valve chamber. Valves shall be rated to a minimum of 10 bar and shall be 2-way in operation. Each air valve shall include an isolation valve within its assembly; both installed onto a triple swing joint and housed within a chamber.

5.10 Drain Valves

5.10.1 Drain valves shall be generally 1" in size and as per general valve description enclosed. Pipes shall extend into a suitable drainage material / position where flooding will not be experienced. Each drain valve shall be housed in its own chamber with a specific drain valve at the pump station.

5.11 Valve Chambers

5.11.1 All isolation, drain, air and automatic valves shall be installed within a valve chamber.

Chambers shall be corrosion resistant, supplied with a lockable cover, be suitably sized to enable easy access to all equipment and allow a minimum of 40mm clearance of the valve chamber lid above the manual watering point. Valve lids shall be lockable and vandal resistant.

Chambers where installed in hardscape / paved areas / aesthetic gravels shall be approximately 600mm x 600mm c/w recessed valve chamber cover able to accept loading weights (Contractor to confirm loading) and the type of paving used.

When used, circular chambers shall be installed with a length of reinforced PVC drainage pipe or equivalent, permitting easy access to the valve.

All chambers will be installed with concrete blocks preventing the load of the chamber and associated traffic from touching the pipelines.

All chambers will have a textile membrane installed at the chamber base, covered with 50mm of pea gravel.

Signal cable, where sited in the chamber, will be clipped to the chamber to prevent obstruction of operation of the products within the chamber.

Approved chamber manufacturers include Carson Brooks, Rain Bird and Toro.

5.12 Communication Cable / Signal Cable

5.12.1 All communication cable / signal cable shall be suitable for direct underground burial and of a solid copper conductor, with all cores being polyethylene insulated with a polyethylene impact resistant outer sheath. The cable is to be checked by the irrigation Contractor to ensure that his specific control system selection does not cause excessive volt drop.

The irrigation Contractor shall be responsible for ensuring that his selected control system in operation does not conflict with any other electrical services and conforms to all national and local regulations and safety laws. All cables shall be ducted throughout the mainline route.

The irrigation Contractor is responsible for calculating the cable size / route / decoder configurations required due to the various arrangements used by the controller manufacturers.

The cable shall be approved for use by the control system manufacturer, for the environment within its operation.

All cables will be UV resistant and have a temperature operating range suitable for the climate. Signal cables will be jointed using grease filled crimps with silicon joints such as DBY/DBR connectors.

Electrical communication / power cables will be jointed / installed using approved national techniques and as per manufacturer's instructions.

Cables shall **not** be installed in the formation of a continuous circuit at any point and shall avoid routing adjacent to main power cables.

5.13 Control System and Central Operating System

5.13.1 The selected control system shall be either Rain Bird ESP-LXD IQ , Hunter ACC, or Toro TDC. The irrigation contractor shall include within the control system a rain switch, and necessary cables / software to enable full and complete operation of the control system and its associated functions.

The control system shall be located within the complex identified. The irrigation Contractor shall include all necessary new signal cable back to this position including necessary ducting and clipping.

The irrigation Contractor shall also ensure that the control system has the ability to accept remote control, (any necessary radio licence and local licence application shall be submitted and dealt with by the irrigation Contractor).

Programming, installation, and testing of the control system shall be the responsibility of the irrigation Contractor. The irrigation Contractor shall liaise with the Designer regarding run times, hydraulic optimisation and flow branch allocation where applicable.

The irrigation Contractor shall also supply the necessary number of decoders required – 1x per solenoid valve. Decoders shall be fully compatible with the central controller and installed with the central control system exactly as per manufacturers recommendations. Each station shall be operated individually, and shall have coils compatible with the mode of control.

Soil moisture sensors (4 No.) c/w necessary software and cables / repeater stations shall be supplied by the irrigation Contractor. Final locations of soil moisture sensors shall be confirmed on site by the irrigation Contractor.

The contractor shall include and identify earthing and surge protection. The irrigation Contractor must include these as per manufacturers minimum recommendations.

5.14 Electric Supply To The Pump Station, To The Control System Position

The provision of a power supply into the pump room is the responsibility of others. The irrigation Contractor shall provide all necessary electrical loading requirements to the main Contractor.

The irrigation Contractor shall provide all necessary SWA power cable from the distribution point in the pump room supplied by the Client to the pump / control system inclusive of all sundry electrical fittings, enclosures, clipping, ducting, and marking tape to comply with national laws.

The irrigation Contractor shall size the power cable using IEE approved techniques based upon the maximum draw of the unit.

5.15 Pumping Station – Irrigation System

The pump station manifold shall be skid mounted compact unit and be manufactured by Grundfos / Lowara / Dab or equal – it shall feature a vertical multistage centrifugal pump. All necessary items to effect a complete and operational pumping station shall be included, including a pressure vessel and integral tank of approximately 300 litres.

This element of the works is irrigation Contractor design specific; the pumping station shall have an operating flow of 1.0m³/hr at 48 metres pressure. The irrigation Contractor shall include all pump duty performance curves with his submission. The final design of the pumping station (flow / pressure) and its associated pipework to meet the specification is the responsibility of the irrigation Contractor.

The pumping unit shall be designed to provide a constant pressure, whilst dealing with variable flow demands including necessary pressure regulation on the dropping pipe network as required.

It is the irrigation Contractor's responsibility to ensure that all necessary ancillary equipment required in order to ensure the correct operation of the pumping station is provided (communication cable, motor cables, operations manuals, service schedules, etc). The irrigation Contractor shall ensure that all necessary hoisting and off loading points are including on the pump station skid.

The irrigation Contractor shall also supply full technical data of the proposed pumping station within his tender submission including:-

- Pump Manufacturer
- Pump Type & Motor Size and Number of Pumps
- Station Duty (Flow /mtrs Pressure)
- NPSH Calculations
- Motor Full Load Current
- Combined Start Up Loading
- Tank Volume & Arrangement

5.16 Suction and Delivery Manifolds

Suction manifold velocity shall not exceed 2.0 mtrs/second; discharge manifold velocity shall not exceed 2.0 mtrs/second.

Suction shall be from an integral dedicated water storage tank (to be provided and sized by the irrigation Contractor); necessary inflow vortex inhibitors if required, shall be supplied by the irrigation Contractor / pump manufacturer. The irrigation Contractor shall make provision within their tender to liaise with the tank manufacturer regarding suction pipework arrangement and to allow for all materials to facilitate complete and proper installation.

The delivery manifold shall include a water meter and self flushing automatic filter to a filtration size as approved by the Contractor's emitter / product manufacturer.

Butterfly style isolation valves shall be incorporated on both suction and discharge manifolds to enable isolation from the water supply / feed into the irrigation main (all pump materials shall be selected by the irrigation Contractor with regard to the water quality, and be unaffected by the water treatment regimes).

The pumping station should include as standard the following items:

- Pump Non Return Valves (per pump)
- Pump Suction & Discharge Isolation Valves (per pump)
- Pressure Relief Valve Set At Approximately ½ Bar (5mtrs) Above The Working Pressure Complete With Pipework Back To Water Storage Reservoir
- 2 № Pressure Gauges For Manifold And Discharge Line Pressure Interpretation c/w Pressure Transducers
- Steel Base Frame / Skid
- Dry Running Protection
- Maximum Footprint Of 1.5m x 1.5m x 1.8m High

<u>The Contractor shall provide a layout of his proposed pumping / tank arrangement with his tender submission.</u>

The irrigation Contractor shall note the requirement to place the pump station in a pump room and to, if necessary, dismantle / reassemble to effect full installation whilst liaising in full with M&E engineers and the water feature specialists.

The irrigation Contractor should include to provide a suitable electrolysis based water softening system and a UV treatment system, both based upon the maximum flow of the pump station. The UV filter shall be self cleaning in operation and inclusive of all electrical work and plumbing fitments.

5.17 Variable Frequency Drive

The pump arrangement shall be managed by a variable frequency drive which shall maintain a constant pressure (as that stated in the pump duty performance) at a variable flow.

In the event of drive failure, the control panel must have an arrangement that allows safe manual operation of the pumps.

The frequency drive shall be part of the pump management control panel. Suitable cooling for the drives shall be included by the irrigation Contractor / pump station supplier.

It is the irrigation Contractor's responsibility to ensure that the 'harmonics' of the drive meets with the approval of the local and national electricity regulations.

The control panel will include necessary equipment to suppress incoming voltage surge. The control panel will also include all necessary equipment for the safe and reliable operation of the pumps and shall fall within all national and international electrical safety requirements.

All other pump pressure safety requirements will also be managed by the panel, i.e. high pressure cut out, low flow cut out and dry run protection and should be included as such within the panel reacting to variables such as low water level etc.

5.18 Delivery / Commissioning

The Contractor shall include within his price all necessary personnel and time to satisfactorily deliver, install, run up and test the pumping station and ancillary equipment.

5.19 Pump Room – Irrigation Pump Station

This is currently not part of the irrigation Contractor's responsibility. The irrigation Contractor shall make provision to liaise with the main Contractor undertaking the pump room fit-out regarding ingress / egress / ducting / ventilation / drainage and installation of his pump / tank.

Any pump station arrangement modifications shall be the responsibility of the irrigation Contractor and he shall liaise with the plant room constructing contractor regarding this element.

5.20 Water Level Sensing Equipment

The irrigation Contractor shall include water level sensing equipment for the pump station / tank. Selected level indication / measurement equipment shall be suitable for the water quality. The irrigation Contractor should ensure that the equipment does not interfere or inhibit any associated or localised other system.

Typical acceptable equipment shall be manufactured by either Stuart Turner or Hawker Electronics and may be either float switches (typically for simple high level / low level indication only), or sensing probes where other types of associated sensing equipment is specified.

In all cases the irrigation Contractor shall ensure that all equipment and installation techniques are in compliance with all relevant local & national standards / codes of practice, and within the manufacturers recommended tolerances / specifications for usage / material and that necessary high / low level signals are correctly interpreted.

5.21 Water Storage Tank (Integral Unit)

Water for the proposed irrigation system shall be provided by others to the base of the tank.

All products necessary to effect full installation shall be included by the irrigation Contractor.

Necessary tank infill points (1 No. for mains water) shall be included, as well as necessary suction fittings / connections for leak back pipework. The irrigation Contractor is to ensure that the storage facility complies with all local regulatory bylaws.

The irrigation Contractor shall ensure that tank infill pipework shall be arranged so as to meet the local bylaw and Water Authority requirements regarding air breaks for potable water supplies, including material type and insulation / isolation / drain off points.

Final exact water storage tank location and pump station arrangement shall be coordinated by the irrigation Contractor with the M&E engineers and water feature specialists.

The irrigation Contractor shall be approved by the water provider for undertaking such work, inclusive of necessary drawings if required. This infill arrangement shall also include a WRC approved solenoid valve and timer.

Water meters for incoming mains supply volume measurement shall be provided by the main Contractor to a point within the plant room. The irrigation Contractor shall connect into the water pipes supplied into the plant room by others, and shall include rising tank infill pipework as required for infill points. A minimum inflow rate of $1m^3/hr$ shall be provided by the M&E contractor; water shall be clean / disease free and suitable for irrigation purposes (Contractor to confirm prior to installation).

6.0 Installation

The irrigation Contractor must ensure that his obligations under all relevant national Health & Safety laws have been met prior to commencement of works. This includes all risk assessments and operator training.

The irrigation Contractor shall undertake to install all equipment including pipe, valves, sprinklers, control cable and electric power cable, exactly as per manufacturers recommendations and within all national and local regulations / bylaws including all National directives, electrical harmonics, and work regulations.

Emitters shall be installed as per final submitted approved layout plans; final positions subject to exact planting arrangement and are the responsibility of the irrigation Contractor to arrange and confirm. If the irrigation Contractor has any doubt he should seek advice from either the Employer or his representative prior to installation of that product. The irrigation Contractor is responsible for ensuring that correct and uniform irrigation occurs and marking out correct emitter spacings.

Should the irrigation Contractor at any time have failed to meet the requirements set out, he shall either re-install the equipment or replace and re-install the equipment at his own cost. This includes improper emitter / sprinkler positioning / drip line staking and mainline pipework.

The irrigation Contractor shall make available his work for regular inspection. The passing of the work by the Employer or his representative shall not be acceptance of the standards. The Employer or his representative does not accept liability for faulty installation / poor workmanship on behalf of the irrigation Contractor.

Any work that fails to meet an acceptable standard within the installation warranty period will be re-done.

6.1 Pipe Installation

6.1.1 All pipelines shall be new and unused prior to installation and conform to the relevant national standards.

Pipelines installed into trenchlines will be placed only onto level bases; bases shall be periodically inspected and at the Employer or Employer's representative's discretion be levelled to meet the requirements at the irrigation Contractors expense.

All rising / dropping mains shall be clipped / supported as per manufacturers recommendations; all pipework penetrations shall be undertaken by the irrigation Contractor whilst liaising with the main Contractor.

All pipelines and joints shall be installed as per manufacturer's instructions. Under no circumstances shall the pipe exceed manufacturer's recommendations for curvature or be bent / re-heated by the irrigation Contractor during installation.

Routing shall be as per final irrigation Contractor submitted layout plan; where routing changes due to ground conditions or layout changes, the Employer or his representative shall be consulted prior to installation in order to check the hydraulic implications. Deviation from specified routing is not permitted unless agreed prior to the installation of the pipe. The irrigation Contractor shall note the positions of penetrations and ensure that the pipe routing accommodates these.

Services must be clearly marked by the irrigation Contractor prior to the commencement of pipe installation operations.

Pipe coils shall be stored and handled in accordance with the manufacturer's minimum recommendations. All coils shall be unwound in a pipe trailer.

The irrigation Contractor shall thrust all direction changes / valve positions in accordance with manufacturer's recommendations. Backfilling shall not take place until thrust blocks have set.

Pipeline routes shall be marked out by the irrigation Contractor. If marked out by the irrigation Contractor, work cannot begin until the routing has been agreed by the Employer or his representative. The irrigation Contractor should include the necessary time allocation for marking out within his price.

Any agreement as made by the Employer's representative does not relieve the irrigation Contractor of his responsibility in ensuring that he installs a system to the Employer's requirements.

The irrigation Contractor shall liaise with the main Contractor regarding all required pipeline penetrations / ducts / crossings, and areas of clipping. All pipelines and all cable shall be ducted for protective purposes.

6.2 Trenching of Mainline Pipework

6.2.1 Any excavation works shall be undertaken with prevalent Health & Safety standards in operation. All trenchlines shall be marked and fenced / taped to, as far as is practicable, minimise any risk to Health & Safety of the public, or the Contractor's employees.

Mainline trenchlines will generally be 100mm wider than the outside diameter of the pipe (50mm clearance either side). Trenchlines shall be deep enough to ensure cover from the top of the pipe radius to finished ground level is a minimum of 450mm. It is anticipated that all mainline pipework in soft areas will be trenched into position (or to a depth as required by bylaws) and subject to slab location.

Any existing pipelines shall be crossed with due care and diligence according to any / all local bylaws and the main Contractors clearance prior to work around the pipeline. All pipelines in exposed areas shall be ducted by the irrigation Contractor. Any existing irrigation pipes that are required shall be connected into using approved fittings / techniques.

6.3 Excavation

6.3.1 All trenchlines shall be kept free of water. Lengths of opened trenchlines shall not exceed 50 metres at any one time. All trenchlines shall be excavated with sound construction practice in evidence.

During excavation topsoil and subsoil shall, as far as is practicable, be separated and stored on ground sheets, any areas of fine turf excavation shall be sheeted where necessary. Machinery if working within fine turf areas shall be operated upon boards; this will be at the discretion of the Client / Client's representative.

If repair trenchlines are to be excavated in areas of planting, it shall be the responsibility of the irrigation Contractor to strip the planting before trench excavation and to reinstate the planting after pipeline / cable installation. The planting shall be maintained in good condition by the irrigation Contractor during its removal from the trenchline route, if this is not undertaken then the Contractor shall be responsible for the supply of suitable planting (all above applicable to re-visit / repair).

All trench bases will be level and free of sharp, irregularly shaped objects. The pipeline will be placed into the trenchlines as per manufacturers recommendations. Pipes that are left open ended at the termination of the day shall be capped to prevent the ingress of debris. Upon installation, pipelines shall not exceed manufacturers stated angle of maximum curvature.

Any thrusting blocks required will be undertaken by the Contractors according to the manufacturer's recommendations / specification. Misshapen or damaged pipe coils shall not be cut into smaller sections and re-used. Any pipe fitting that is installed and found to be faulty / outside of acceptable specification will be replaced by the irrigation Contractor at his own cost.

After installation of the pipeline / signal cable and associated pipe joints, backfilling shall take place. Backfilling shall initially be undertaken by hand and then mechanically if by approved methods. Backfill shall be mechanically compacted to achieve a firm finish that minimises settlement.

All pipe shall also be installed with a marking tape to identify position.

The trenchlines shall be backfilled until finished level is achieved – level to be equal to surrounding ground. Excess spoil shall be removed by the irrigation Contractor to an agreed on site storage area as work progresses. Any trenchline settlement will be made good by the irrigation Contractor up to a period of 12 months from handover.

Backfilling around pipe joints / valves and other reasonably delicate products shall be done with care to avoid undue material stress and to ensure that the pipe where installed is protected from compaction by traffic.

It will be the irrigation Contractor's responsibility to ensure that all pipe / cable is installed and backfilled with a suitable friable material, free of large stones, and sharp objects. The irrigation Contractor will include within this price a sum for the use of a specialised pipe bedding material. It is the irrigation Contractors responsibility to ensure that the ground conditions are suitable / unsuitable for direct backfilling of trenchline spoil. Completion of this document indicates that the irrigation Contractor has assessed the ground conditions. Rock trenching clauses will not apply; rock trenching if required will be included within the irrigation Contractor's installation rate. The irrigation Contractor shall inspect the site and satisfy himself regarding this clause.

6.4 Lateral Pipelines (Solenoid Valves To Distribution Products)

6.4.1 Lateral pipe installation shall be undertaken to the same installation specification as mainline pipeline installation.

All pipeline routes / sizes shall be agreed prior to installation by the Employer or his representative.

Lateral pipelines shall be installed to a depth of approximately 300mm from finished ground level to the top of the pipe radius, up to distribution products.

6.5 Valve Installation

6.5.1 Access to all system isolation, pressure regulation, drain, air and solenoid valves shall be by a valve chamber. The chamber will be large enough to provide unhindered access to the valve. All chambers will be supported on concrete blocks to prevent damage to the irrigation pipe / cable.

Top soil and subsoil shall be separated upon excavation and any spoil that is excess removed to an agreed on site storage area. Spoil shall be stored upon ground sheeting.

Backfilling of holes shall be as per trenching techniques and the irrigation Contractor shall be responsible for reinstatement. Any subsidence or sinkage is the irrigation Contractor's responsibility for a period of up to 12 months after handover.

All chambers will have a textile membrane installed within the base, complete with a 50mm layer of pea gravel (or equal) above the membrane. All valve chambers in soft landscape will be installed at approximately 10mm below finished ground level and located on stable level ground in a free draining position. The irrigation Contractor is, unless otherwise directed, responsible for the final valve box position. Solenoid valves shall be installed at a suitable location away from the throw of the sprinklers and not in the way of either pedestrian or maintenance machinery.

Chambers in hard landscape areas will be level with the proposed paving, installed with recessed covers c/w paving stones to match the surrounding area.

All isolation valves will be installed within their chambers in a normally closed position, as per valve manufacturers recommendations (use of thrusting block etc).

Drain valve and air valve positions are subject to land contours and will be confirmed on site by the Contractor.

6.6 Dripline Installation

6.6.1 Driplines shall be installed by the irrigation Contractor at the required site specific spacing (as per plant spacing). They shall be installed as per manufacturer's recommendations with regard to bank / angle & slope with regular flushing during installation to remove debris. Run lengths shall not exceed the maximum stated by the manufacturer. The Contractor shall be fully responsible for all dripline configurations / spacings and any associated level changes and must include necessary fittings and check valves as required.

Point emitters shall be installed by the irrigation Contractor to specific shrubs as needed.

Driplines shall be laid into place on the soil and staked prior to mulching. Driplines will be run off a sub main header where applicable. This will be sized within flow velocity restrictions and as per dripline, staked into position. Driplines shall be tested visibly prior to mulching to ensure satisfactory operation.

Flush caps and anti-syphon valves will be fitted as required to each valve zone. Kinked or damaged pipe shall not be installed or re-used by the irrigation Contractor. An end crimp shall be fitted where necessary to close each end of line. The Employer or his representative, reserve the right to check spacings of driplines and if applicable instruct the irrigation Contractor to re-install these correctly.

All necessary wall / paving penetrations shall be identified by the irrigation Contractor whilst liaising with the main Contractor and shall be ducted / installed by the irrigation Contractor.

6.7 Manual Watering Points – QCV's

6.7.1 ¾" manual watering points shall be installed exactly as per manufacturer's instructions and mounted onto a 3-way 'O' ring sealed swing joint riser, bolted to a stainless steel support.

6.8 Tree Drip Installation

6.8.1 Tree irrigation shall be installed after tree installation and before final mulching / backfilling.

Pressure compensating emitters shall be spaced evenly throughout the distribution piping surrounding the tree. The distribution piping being installed at approximately halfway between the base of the shrub and its canopy in a loop to suit the rootball area.

The irrigation Contractor shall ensure that the final spacing shall water the soil area effectively, reaching the root zone of each tree and that final configurations and flows match the tree species.

The lateral distribution pipe shall be flushed prior to final connection.

The Employer or his representative reserve the right to check the spacing and number of emitters fitted and if applicable, to instruct the irrigation Contractor to re-install the loop and emitters.

6.9 Control System / Power Cable

6.9.1 All control system equipment shall be installed exactly as per manufacturers requirements and as per any relevant national codes of practice and byelaws, particularly electrical.

The control system shall be installed within the designated building. The irrigation Contractor shall include all necessary cables, ducting, and clipping where required.

6.10 Signal Cable

6.10.1 Signal cable shall be installed in such a manner that ensures that it is not stretched / scraped / damaged / laid down under tension. The cable will be laid and supported throughout its length. All cable joints will be made ensuring that at least one metre of cable is slack. Signal cable shall not be installed as a ring main.

All cable joints shall be housed in a chamber. If not with another irrigation product, then a separate chamber shall be made available. Joints directly under valve in head sprinkler heads will be permitted.

Cable joints shall be made by using grease filled caps and 3M DBY / DBR joints or approved equal (proof of approval for this type of installation shall be required).

Cable shall be laid to a minimum depth of 450mm in mainline trenchlines and ducted (depth subject to soil / slab arrangement).

The irrigation Contractor shall ensure that the control signal cable does not lie directly adjacent to any 240v / 415v power cable or other communications cable.

Crossing of signal cable at right angles should be avoided wherever possible. However if necessary, cables should clear each other by approximately 100mm and maintain minimum cover.

Cables that are clipped into position shall be suitably protected.

Signal cables shall be tested during installation to ensure that there is no earth leakage and that continuity is present.

Cables shall be tested in sections and the results noted and kept for inspection. Cables shall be manufactured and supplied by the irrigation control system manufacturer.

Services must be clearly marked / identified by the irrigation Contractor prior to the installation of the signal cable.

All electrical supply works carried out by the irrigation Contractor shall be to local bylaw acceptance and shall conform to all state / local safety directives, including voltage drop and testing certificate. All power supply cables shall be steel wire armoured and where necessary shielded cables or ducts will be provided by the irrigation Contractor.

6.11 Water Storage Tank / Pump

6.11.1 This shall be installed exactly as per manufacturers recommendations including necessary base works and loading calculations (all provided by the irrigation Contractor).

6.12 Flushing of System

6.12.1 The irrigation Contractor shall flush the installed irrigation pipe system at regular available opportunities. It is the irrigation Contractor's responsibility to ensure that all pipelines, valves and sprinklers are free from debris. Any equipment that fails due to blockage shall be replaced by the irrigation Contractor at his cost.

6.13 Testing

6.13.1 It shall be the irrigation Contractor's responsibility to test the system as work progresses. The provision of equipment necessary to test the system is the responsibility of the irrigation Contractor.

Pressure testing shall be carried out after backfilling; sections of the mains / lateral pipework will be tested for leaks and static pressure loss. Testing procedures shall be recorded and results noted. Type 1 Creep tests shall be used.

Emitters and valves shall be operated for at least 30 minutes during the testing period to ensure correct arc setting, speed of rotations, pressure continuity and operating pressure. The irrigation Contractor shall balance the system during a full cycle to ensure pressure settings at each station are correct. The Employer or his representative reserve the right to randomly check the pressures prior to acceptance.

The control system shall be tested at each station for a minimum of 30 minutes. Prior to the final inspection and handover, the system will have performed 3 No. run sequences, the irrigation Contractor ensuring that each station functions both electronically and hydraulically to the full.

The irrigation Contractor is responsible for the setting up and programming of the control system to the Employer or the Employer's representative's satisfaction.

Any repairs or leaks shall be made good by the irrigation Contractor at his expense prior to handover.

The irrigation Contractor shall be responsible for the operation of the irrigation system until full handover and acceptance. The date for acceptance / handover is subject to final inspection / approval by the Employer or Employer's representative, but generally shall be as per the finish date stipulated in the contract terms.

6.14 Responsibility

6.14.1 During the irrigation contract, the irrigation Contractor shall keep a technically qualified operator on site at all times to repair leaks or failed components. If repair is not undertaken immediately, then the irrigation Contractor shall be responsible for the manual application of water preventing damage to the designated area.

If work should stop on site prior to completion, the irrigation Contractor shall ensure that materials are kept on site so that repairs can be made to the equipment and that staff remaining on site are adequately trained in the repair of these faults.

If the repair is due to negligence or poor installation, the irrigation Contractor shall bear the expense of the repair.

6.15 Damage

6.15.1 The irrigation Contractor shall be responsible for any damage that occurs to planted / seeded / constructed areas due to irrigation system failure (in-operation / washout / flooding / deep erosion).

The irrigation Contractor shall undertake the cost of irrigation works and corrective ground works including re-planting / re-shaping. The groundworks will be undertaken by a qualified person or persons and charged by the Employer to the irrigation contractor.

Should irrigation works be damaged by persons other than the irrigation contractor, then the repair shall be made by the irrigation contractor after instruction in writing from the Employer.

6.16 Handover / Final Inspection

6.16.1 The irrigation Contractor shall inform the Employer / Employer's representative at least 14 days prior to the final system inspection.

Final system inspection will involve the proof and witness of station operation, control system operation and the supply of the as laid plans.

Subject to the correct operation of the system and, if necessary, subsequent repair of failures, the system shall be approved as satisfactory by the Employer or his representative in writing. This may be conditional upon the completion of a snag list.

Corrections / repairs to the system will be done by the irrigation Contractor within one week of this document – Snag List.

6.17 Site Clean Up

6.17.1 At all times it is the irrigation Contractor's responsibility to ensure that the site remains clear of debris and rubbish. He shall remove his offices, machinery, surplus materials, etc within 2 weeks of handover. The Employer will reserve the right to charge storage for these items after this period.

6.18 Guarantee

6.18.1 Following written acceptance of the system, the irrigation Contractor shall guarantee the system for a period of two years, and include a full spare parts package.

This guarantee will be applicable to component failure through improper installation, faulty workmanship or general component failure due to a manufacturing defect.

The irrigation Contractor is not liable to effect the repair if it is found that the fault is due to negligence or improper use by the Employer or indeed acts of vandalism / misuse by a third party.

6.19 Marking Out and Operations Manuals

6.19.1 The irrigation Contractor is responsible for the supply and installation of the irrigation system so that it will correctly irrigate the areas required within the product parameters and local bylaws / water provider guidelines. Attention to specific plant locations and their water requirements must be observed.

The irrigation Contractor shall mark the dripline / emitters using approved techniques and shall be fully responsible for the uniformity and areas of coverage / final system operation.

Mainline pipe routing shall generally be as per Contractors irrigation plans, however lateral pipelines will need to be adjusted to suit final planting arrangements. The Employer or his representative reserve the right to change the route and or pipe depth if required. Changes shall not affect the price, unless agreed in writing prior to the work being undertaken.

The irrigation Contractor may also, after written instruction from the Employer, alter the route of the pipelines to avoid obstacles – as long as the hydraulic integrity of the design is not compromised.

As installed and as marked products will be identified by flags and posts until that area is complete.

6.20 As Laid Plans

6.01.1 The irrigation Contractor shall supply an accurate GPS record of the installed irrigation materials identifying, but not limited to, pipelines & sizes, cables, sprinklers, emitter devices, solenoid valve boxes, cable joint boxes, pump position, tank position, water source, isolation valves, air valves and drain valves. All installed products shall be logged within 24 hours of installation and made available for inspection.

The final as laid plans shall be supplied at the time of final inspection.

6.21 Operations & Maintenance Manuals

6.21.1 The irrigation Contractor shall supply the Employer with 3 No. sets of O & M Manuals at the time of final inspection / handover. This is in addition to all the training required by the Employer to ensure a safe and understanding knowledge of the as installed irrigation system. Training shall be undertaken both prior to and after handover, until the Employer or his representative is satisfied.

The irrigation Contractor shall also provide full training on each and every aspect of the irrigation system over a period of time acceptable to the Client.

6.22 Contingency

6.22.1 The irrigation Contractor shall include a 5% contingency figure. This will only be used under written instruction of either the Employer or his representative.

6.23 Health & Safety Requirements

6.23.1 A design risk overview has to be undertaken by the Designer in accordance with the European CDM / Health & Safety regulations.

The irrigation Contractor will be responsible to fulfil his required duties.

The irrigation Contractor shall not commence any site works until his safety plan and method statement has been issued and approved by the planning supervisor.

All suppliers, contractors and designers appointed by the Employer shall undertake their own Health & Safety regulation obligations which include liaising with designers, contractors, principle contractor and planning supervisor with relevance to all Health & Safety matters, and with this in mind the principle contractor shall ensure that all his suppliers and sub contractors comply with this requirement.

6.24 Services

6.24.1 The irrigation Contractor is responsible for the identification and marking of all underground services. Surveys for these must be completed prior to the commencement of works.

The irrigation Contractor is responsible for the identification and marking of all overhead services.

6.25 Insurances

6.25.1 The irrigation Contractor and his employees shall be covered by suitable policies such as public, professional indemnity (£1 million), and employers liability insurance; proof of this shall be submitted at time of bid.

It is the irrigation Contractor's responsibility to indemnify against all damages received or sustained by persons as a result of undertaking the works through negligence, consequence, improper management, ground conditions, weather, neglect or defective materials.

The irrigation Contractor shall be liable for all costs arising out of claims or actions which may be brought against the Employer or Employer's representative by the above.

6.26 Programme of Works

6.26.1 One month prior to the start of the project, the irrigation Contractor shall issue his full programme of works to the Employer or his representative.

6.27 Method Statement

6.27.1 The irrigation Contractor is responsible for the issue of required method statements associated with his activities prior to the commencement of works. Should the irrigation Contractor encounter hazardous material within his specific tasks, he should carry out COSSH or other risk assessments regarding the safe use and handling of these substances and shall in undertaking the contract abide by all European CDM regulations.

6.28 General Public

6.28.1 The irrigation Contractor must identify all measures necessary to protect the general public within his operations. This includes preparation of risk assessments, method statements and provision of signage and hoardings indicating the hazard and, where possible, creating segregation.

6.29 Health & Safety Plan

6.29.1 The irrigation Contractor must under his obligations provide a Health & Safety plan prior to the commencement of the project.

Appendix A – Risk Overview

DESIGN RISK OVERVIEW

The irrigation design for Maggies Centre is based upon the current standards within the landscape irrigation industry and the minimum standards laid down by the British Turf and Landscape Irrigation Association.

Risk overview has been undertaken by the designer. Significant residual hazards which cannot be reasonably designed out are noted and included within this document.

However, the enclosed does not claim to cover every site risk. Contractors must point out in their tender submission other hazards that they believe cannot be controlled during installation and therefore require design review.

Hazard Type	Risk	Personnel At Risk	Action To Control Risk
Machinery movement on site	Medium	Irrigation Contractor Other Contractors	Irrigation Contractor to undertake risk assessment and issue method statement, machinery movement routing and programme of works. Warning signage for footpaths. Erection of barriers within vicinity of footpaths.
Installation of irrigation materials; pipelines, control cables, valves	Medium	Irrigation Contractor Other Contractors	Irrigation Contractor to undertake risk assessment and issue method statement, and adherence to method statement. Use of marking tape and signage where applicable. Issue detailed programme of works and undertake search of services within area of work i.e. working at height. Solenoid valve assemblies shall be serviced with care paying attention to water features and slip hazards. A full operating risk assessment must be put in place by the end user.
High water pressure in pumping station, underground pipeline	Medium	Irrigation Contractor Other Contractors Maintenance Staff	Ensure high pressure main is isolated and residual pressure removed before attempting service work. Ensure all operatives have received relevant training regarding product operation. Specification of products that are designed for use within the stated system operating pressure.

Installation of new pumping station / water treatment plant including access to pump	High	Irrigation Contractor	Irrigation Contractor to undertake risk assessment and issue method statement for manual lifting. Ingress and egress safety issues (gas, ventilation, steps, confined spaces operation) all to be addressed by the irrigation Contractor.
Electricity within pump room	Medium	Irrigation Contractor Other Contractors Maintenance Staff	Isolation of electrical supply at pump to prevent electrocution risk if working within pump area. Only authorised and qualified operatives to use and maintain equipment. Lockable pumphouse doors.
Installation of pipework through slab into planters and clipping of pipework / signal cable	Medium	Irrigation Contractor Other Contractors	Irrigation Contractor to undertake risk assessment. Use of proper access equipment – scaffolding tower. Issue of method statement and proof of scaffolding licence if required.
Identification of underground services	High	Irrigation Contractors Machinery Operatives	Irrigation Contractor to undertake survey of site with relevant service bodies, and liaise with Main Contractor
Identification of overhead services	High	Irrigation Contractors Machinery Operatives	Irrigation Contractor to undertake survey of site with relevant service bodies, and liaise with Main Contractor
Ground conditions - Slippery Surfaces	Medium	Irrigation Contractors Machinery Operatives	Irrigation Contractor to undertake risk assessment and issue method statement for work in associated risk areas.
Excavations - Spoil heaps, trenchline collapse, trespassers	Medium	Irrigation Contractors Machinery Operatives M & E Engineers	Irrigation Contractor to undertake risk assessment and issue method statement for associated works.
Small electrical equipment and compressed air tools	Medium	Irrigation Contractors M & E Engineers	Irrigation Contractor to undertake risk assessment and issue method statement; to include daily maintenance regime if applicable. Wearing of PPE.

Legionnaires disease, associated risk of disease in water	Medium	Main Contractor M & E Engineers	Main Contractor to assess risk of Legionnaires disease through storage of water within a tank with regard to water storage temperature and public Health & Safety with regard to use of water. Any grey water to be UV treated and filtered prior to entry into the irrigation tank. Water to be regularly tested by Client after handover as part of operating risk assessment and further treatment may be required.

Appendix B – Valve Schedule

Maggies Centre - Shrub Drip / Green Roof

Stn	Dripline mtrs	Emitter Flow	Valve Flow m3/hr	Water use m3/day	Peak Daily Run Time Mins
SD1	70	1.6l/hr	0.37	0.08	13
SD2	30	1.6l/hr	0.16	0.03	13
SD3	30	1.6l/hr	0.16	0.03	13
SD4	30	1.6l/hr	0.16	0.03	13
SD5	20	1.6l/hr	0.11	0.02	13
SD6	45	1.6l/hr	0.24	0.05	13
SD7	30	1.6l/hr	0.16	0.03	13
SD8	45	1.6l/hr	0.24	0.05	13
SD9	105	1.6l/hr	0.56	0.12	13
SD10	60	1.6l/hr	0.32	0.07	13

TREE DRIP EMITTERS 5 per tree at a flow of 7.6 litres per hour each

Stn	No. Trees	Emitters	Valve Flow m3/hour	Water use m3/day	Approx Peak Daily Run Time Mins
TD1	3	15	0.11	0.08	40
TD2	1	5	0.04	0.03	40
TD3	2	10	0.08	0.05	40
TD4	2	10	0.08	0.05	40
TD5	2	10	0.076	0.05	40
TD6	1	5	0.038	0.03	40
TD7	3	15	0.114	0.08	40

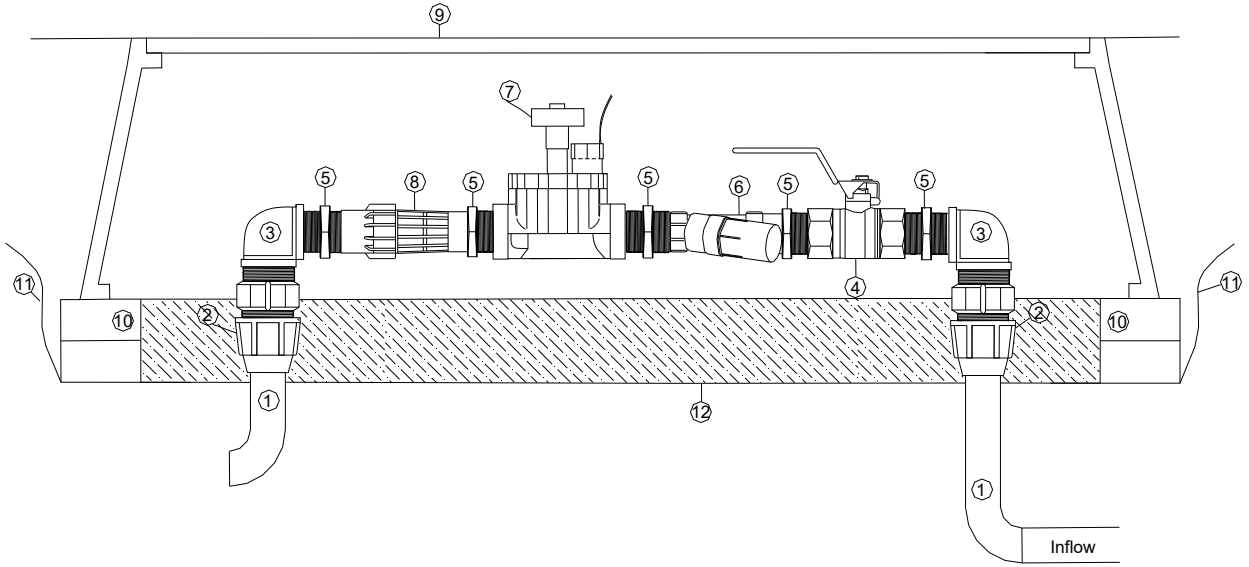
Final station flow is subject to planting arrangements.
Final run time is subject to product arrangement.
Contractor to confirm station flow and lateral pipe / solenoid size according to final planting.
Run times to be confirmed by contractor.

Appendix C – Drawings

Solenoid Valve Assembly c/w Pressure Regulator & Filter
Typical Schematic Tree Drip Arrangement
Typical Schematic QCV
Typical Schematic Dripline Layout

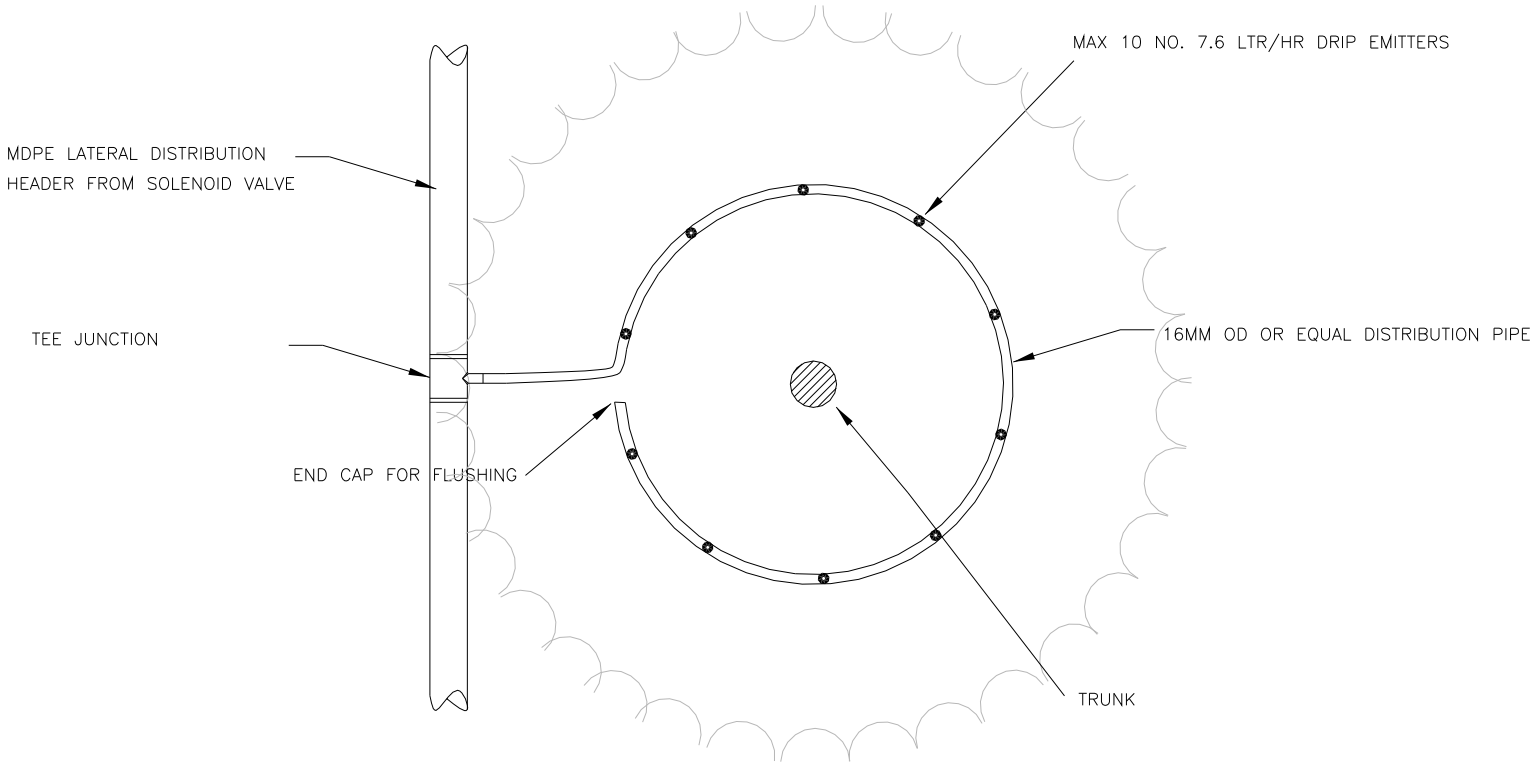
Indicative List of Materials
(not binding - contractor to design & build)

1. Incoming MDPE Pipe (size as per specification - preformed bend)
2. Male Adaptor
3. 90° Galvanised Elbow
4. Isolation Valve
5. Nipple
6. RBY Filter
7. Solenoid Valve
8. Pressure Regulating Valve
9. Hydrant Chamber
10. Suitable Support for Chamber
11. Geotextile Membrane Underlay
12. Gravel



Schematic Solenoid Valve Assembly Arrangement
¾" Valve With Filter & Pressure Regulator

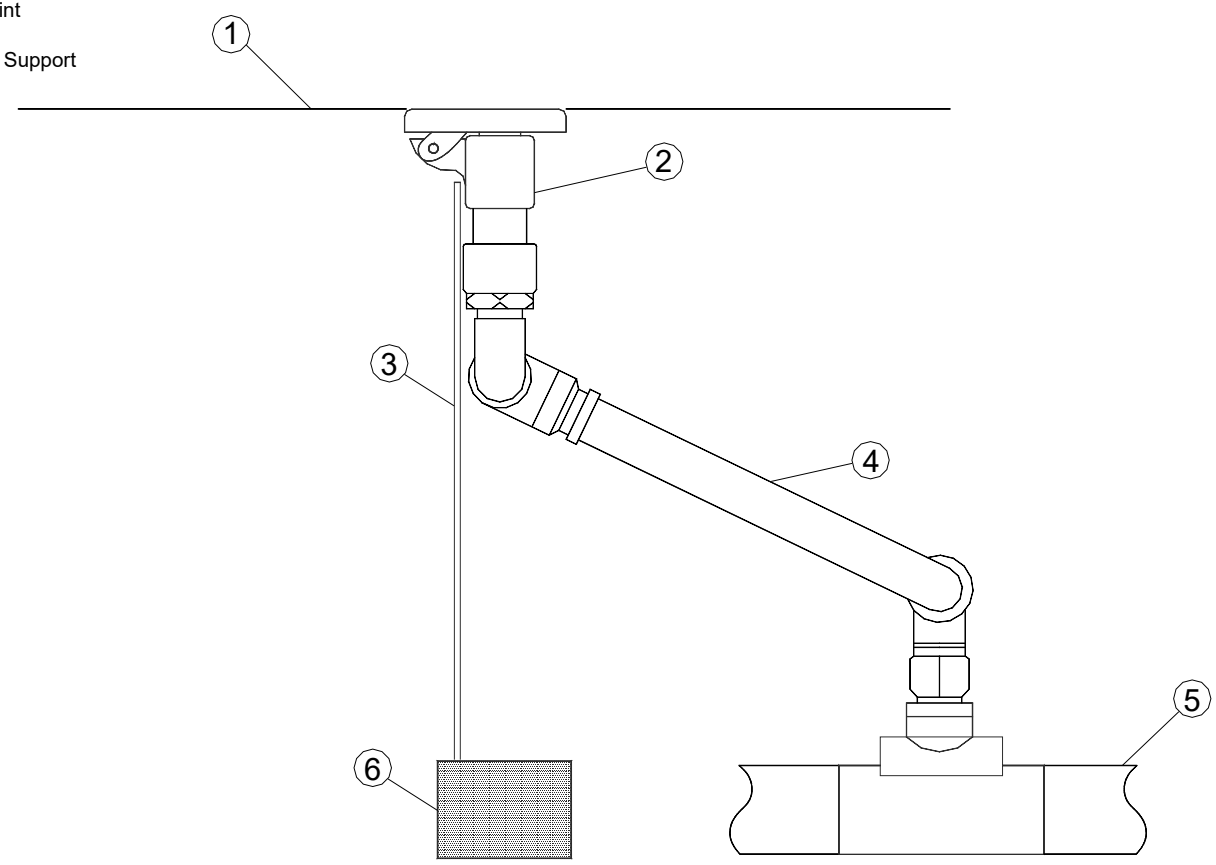
Schematic Tree Drip Arrangement



Do Not Scale - Schematic Only

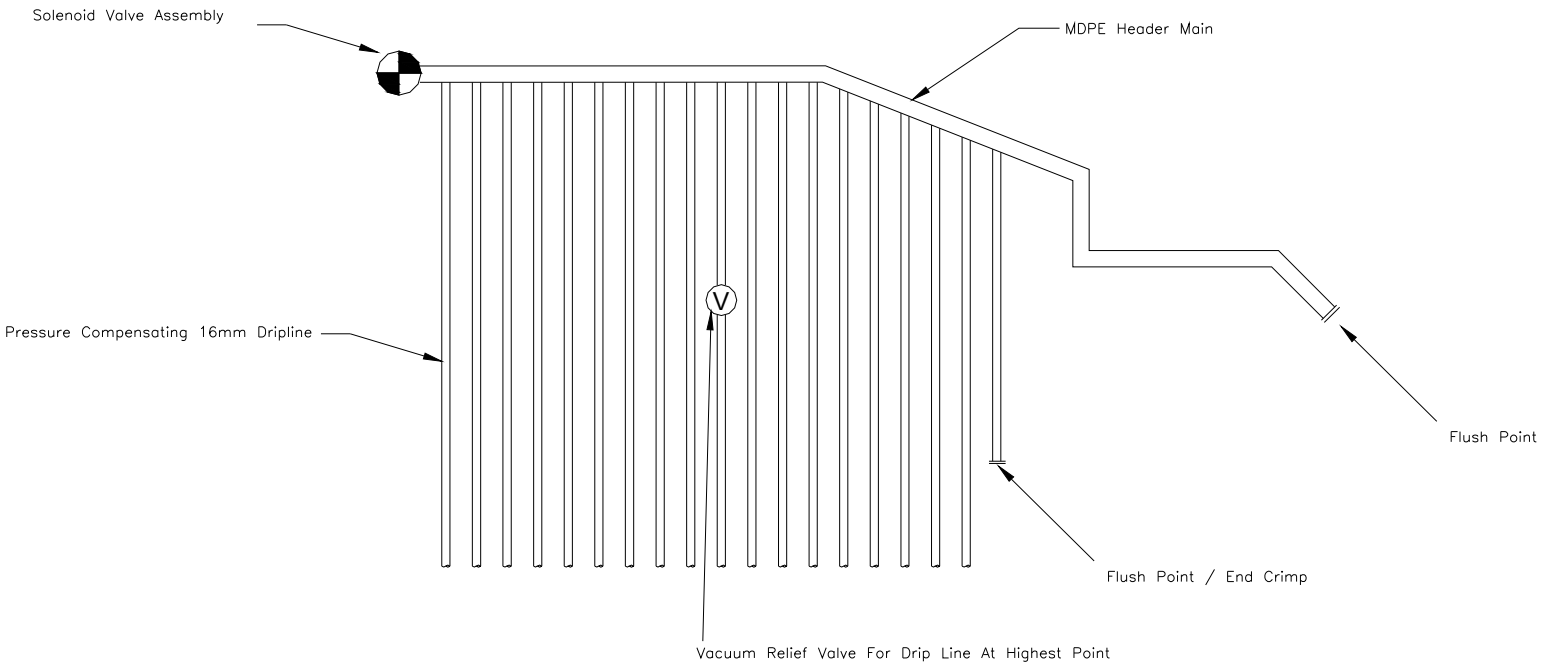
Indicative List of Materials
(not binding - contractor to design & build)

1. Ground Level
2. QCV Connected To Stainless Steel Riser
3. Stainless Steel Riser
4. Swing Joint
5. Mainline
6. Concrete Support



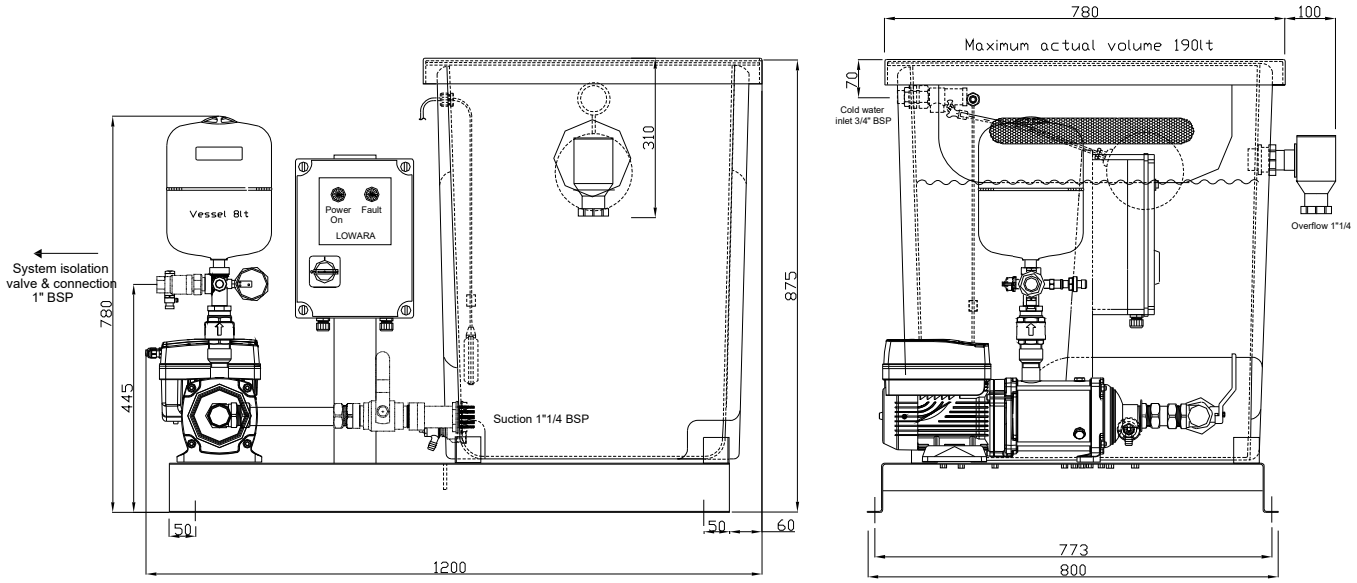
Schematic QCV Arrangement

Typical Schematic Dripline Arrangement



NOTE: DO NOT EXCEED MANUFACTURERS ADVISED LONGEST RUN FOR DRIPLINE

Typical Pump Arrangement



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