



HUNTER WATER CORPORATION

**WATER AND SEWER
DESIGN MANUAL**

**SECTION 6
ALTERNATIVE SEWER SYSTEMS**

AMENDMENT HISTORY

Date	Clause	Amendment
July 2007	All	New document
July 2008	Appendix 6A	Added references to Appendix 1A for electricity cost.
May 2010	6.5.1	Clause amended
May 2010	6.5.2.3	Valve spacing details added
May 2010	6.5.2.3	Clause amended – isolation valve details added
May 2010	6.5.3	Approved multi-stage centrifugal pumps permitted
May 2010	6.5.4.1	Storage requirements amended to comply with Plumbing Code
May 2010	6.5.4.2	All pumps and collection tanks must be approved for use by HWC.
May 2010	6.5.4.8	Duty point wording amended
May 2010	6.5.4.10	Additional control methods included
May 2010	6.5.4.16	Testing methods from WSA01 for PE pipe or WS03 for other pressure pipe
May 2010	6.5.4.11	Emergency contact details to be included in control panel
May 2010	6.5.4.13	Boundary kit requirements changed:
May 2010	6.5.4.21	Further details included
May 2010	6.5.7.2	Submission requirements amended.
May 2010	6.5.7.3	Submission requirements amended
May 2010	Appendix 6A	Appendix amended

TABLE OF CONTENTS

6.1	TERMINOLOGY	4
6.2	INTRODUCTION	6
6.3	APPROVED ALTERNATIVE SYSTEMS	6
6.4	DESIGN PROCESS	7
6.4.1	PRELIMINARY STAGE.....	7
6.4.2	SERVICING STRATEGY, INVESTIGATION PHASE	7
6.4.3	CONCEPT/DETAIL DESIGN.....	8
6.4.4	DETAIL DESIGN.....	9
6.4.5	ODOUR CONTROL	9
6.5	PRESSURE SEWER SYSTEMS	10
6.5.1	PRESSURE SEWER SYSTEM COMPONENTS.....	10
6.5.2	DESIGN LAYOUT	12
6.5.3	DESIGN FLOWS AND SIZING	15
6.5.4	PUMP STATION DESIGN.....	17
6.5.5	FLUSHING POINTS.....	25
6.5.6	RETICULATION MAINS.....	25
6.5.7	INFORMATION TO BE SUBMITTED TO HUNTER WATER.....	26
6.5.8	NON-STANDARD CONNECTIONS	27

APPENDIX 6A – COSTS

Alternative sewer systems, as set out in this section of the Design Manual are those systems specifically designed to be a reticulated sewer system, other than gravity, using equipment that has been specifically designed for this purpose.

6.1 TERMINOLOGY

- **Accredited Designer-** A designer who has met Hunter Water's design requirements and has been accredited to undertake designs for Hunter Water, as specified by Hunter Water.
- **Alarm/Control Panel** – Small box that houses either or both the electrical controls for the pressure sewer pumping unit, and the alarm control system for the pumping unit. Composition of what this box includes can vary from Equipment Supplier to Equipment Supplier.
- **Alarm Volume** – This is the volume that is stored in the on-property storage vessel, between the TWL and the alarm level.
- **Boundary Valve Kit** – This is a valve box at the property boundary, incorporating an isolating valve, flow directional valve and an inspection tee-piece.
- **Drainage Line** – This refers to the household sewer drainage pipework to the pumping unit.
- **Emergency Volume-** This is the volume, which is stored in the pump unit; from just above the alarm activation level to just before the invert of the overflow relief gully, when an overflow occurs.
- **Equipment Supplier** – This is the company that supplies the pumping units. This company may be the manufacturer of the equipment, or an appointed agent of the manufacturer.
- **Flushing Point** – This is a formal point to which a large supply of water can be connected to the pressure sewer reticulation system to flush out the reticulation pipelines, or alternatively, where sewage can be removed from the system by vacuuming it into a truck.
- **High Level Alarm** – This is both an audio and visual alarm system, activated when the level of the sewage stored in the on-property pressure sewer storage vessel reaches the alarm volume level
- **Low Pressure Sewerage Scheme** – This is a different name used to describe Pressure Sewerage System.
- **On-property Works** – These are the total works to be carried out on the residential property, and include any excavation, installation, compaction and restoration associated with the following:
 - The pumping unit
 - The property delivery pressure line and boundary kit.
 - Wiring of the pumping unit to the property power board
 - Connection of property sewer lines to pumping stations from the house.
- **Off-property Works** – These are the total works to be carried outside the residential property including the boundary kit and pressure reticulation system.

- **Overflow Relief Gully (ORG)** – Controlled overflow device to prevent overflows occurring inside the dwellings on the property by ensuring that overflows occur outside of the dwelling. Its arrangements and dimensions are contained in the NSW Plumbing Code.
- **Pipe layer** – This is the company/ individual(s) responsible for constructing the off-property works, such as the reticulation mains or the pressure main.
- **Pressure Line** – This is the continuation of the property delivery line from the boundary kit to the reticulation system pipeline, and includes any road crossings (where applicable).
- **Pressure Sewer Reticulation System** – the series of pipelines laid in the streets connecting the properties to either a treatment plant, or some designated discharge point in an existing sewer system.
- **Pressure Sewer Systems (PSS)**– The properties sewage is discharged to an on-property pumping station. This dedicated pumping unit incorporates a grinder pump to reduce the sewage to a watery slurry. The pumping station then discharges through a small diameter polyethylene pipeline laid at minimum depth into Hunter Water's sewerage system.
- **Pressure Sewer Systems (PSS)**– This is a specialist system, wherein all of the property sewer is connected to an on-property pumping station. This dedicated pumping unit incorporates a grinder pump to reduce the sewage to a watery slurry in the first instance. The pumping station then discharges through small diameter pipelines laid at minimum depth. The pressure reticulation main relies on the pressure generated by the pump to move sewage from the property to discharge point in a gravity reticulation network.
- **Property Delivery Pressure Line** – The pipeline that connects the on-property pumping station to the boundary valve kit and the pressure reticulation main.
- **Pressure Zone** – This is a collection of properties that are capable of being isolated from upstream and downstream areas and are clearly marked on the reticulation drawings. These zones are used to allow one area to become operational whilst the upstream areas' reticulation mains are isolated for both operational and construction purposes.
- **Pumping Units (or Station)** – This includes the pumps, storage vessel, alarm system, pump pressure switches, etc that is installed on the private property.
- **Service Provider** – This is the company/individual responsible for provision of commissioning and fault rectification service and for installation of all of the on-property works under a contract with Hunter Water.
- **Storage Vessel** – This is the watertight container in which the on-property pump is located, and is typically made from plastic compounds or fibreglass.
- **Total Dynamic Head (TDH)**- The Total Dynamic Head acting on the pump comprises of the total static head, the total friction losses, the velocity head and the entrance and exit losses experienced during the normal operation of the system.
- **TWL**- Top Water Level, the point at which the pump on switch is normally set.

6.2 INTRODUCTION

Hunter Water Corporation as the water and wastewater service provider develops and also approves the local strategies for how to service new areas. This approval takes into account Hunter Water regulatory requirements under the Hunter Water Act 1991 and its operating licence. In approving a local servicing strategy, Hunter Water also approves the types of systems and equipment to be used, based on the effective and efficient ongoing operation of its sewer network both now and into the future, as is set out in the following section. Hunter Water also considers the overall regional strategy for the area being developed when considering the approval of a local servicing strategy.

Hunter Water requires that all new developments be serviced by conventional gravity sewer systems. Only in circumstances as outlined below, where Hunter Water's approval is given, will this requirement be deviated from. A Hunter Water approved alternative system may be investigated for a specific development under the following framework, provided that Hunter Water's approval to investigate is granted:

- Only rural residential zonings will be considered, or lots over 1 acre.
- Only developments that cannot drain under gravity to an adjacent system may be investigated for the use of an alternative system.
- Up to a maximum cluster of 50 lots discharging to a gravity connection and no more than 100 lots within the total development, where no further development beyond the alternative system is possible. Discussion with Council will be required to ensure potential development areas outside the LEP are considered.
- In new subdivisions, where the use of the alternative systems will not disadvantage servicing of surrounding developments or future connections.
- To service individual properties, or small clusters of properties adjacent to serviced areas, that cannot be economically serviced by the existing sewer system in that area.
- Where there are particular environmental constraints in the area to be sewered, which requires the construction of alternative equipment. Examples are rocky terrain, highly volatile soil conditions or high water tables/flood conditions.
- Whole of life cost estimates for the proposed alternative system are more cost effective on a total community cost basis than a conventional gravity sewer system.

The Developer will be required to demonstrate to Hunter Water whether their proposed alternative sewer system will meet the above requirements, as well as what the impacts are of the strategy, considering the points following, which Hunter Water will consider in approving an alternative sewerage system.

- Potential environmental impacts,
- Compatibility with Hunter Water regional servicing strategy(s),
- The compatibility of the proposed wastewater infrastructure, with adjacent land areas surrounding land zoning and the general development profile for the area.
- Access to the system for installation and future operational and maintenance needs.

6.3 APPROVED ALTERNATIVE SYSTEMS

Alternative sewer systems approved by Hunter Water Corporation include:

- Pressure Sewer Systems (PSS)
- A combination of PSS and gravity systems

6.4 DESIGN PROCESS

The developer and their design consultant, selected from the Hunter Water accredited designer's list, are required to participate in a process of ongoing liaison, and follow a specific sequence of design activities, in consultation with Hunter Water. This is aimed at facilitating an understanding of the expectations of each party and what the realistic outcome is going to be, such that the requirements of Hunter Water for the comparison, assessment and design of the alternative sewer system are met.

Aspects that require design include the reticulation main, the appropriate selection of the wet well, the facilities to which the system discharges and odour control systems.

The following sequence outlines Hunter Water's requirements at each stage of the process; additional information may be required at the time of application, based on changing legislation and experience in operating alternative systems.

6.4.1 PRELIMINARY STAGE

All developers who are considering serving a development with an alternative sewer system are required to initially meet with representatives of Hunter Water so that agreement can be reached on the key study parameters.

At the initial meeting with Hunter Water, the developer and/or the developer's representative/designer are required to bring:

- A preliminary site layout drawing, showing the proposed gravity layout and alternative system if developed.
- Adjoining land zonings and Local Environment Plan.
- Topographic considerations, including catchment boundaries and contour information.
- Past and future development profiles, including land release projections, etc.
- Likely study area description.
- Any other information that may be pertinent to the proposed development and future surrounding developments.

Following the initial meeting Hunter Water will advise in writing if the alternative system can be pursued in the development, in conjunction with gravity or any other approved alternative sewer system. This is only an approval to allow the investigations to commence; it is not a commitment that the alternative system will be approved for the development.

6.4.2 SERVICING STRATEGY, INVESTIGATION PHASE

Based on the scope of works provided the developer will be required to engage a Hunter Water accredited designer who shall prepare a local servicing strategy report and submit it to Hunter Water for assessment. The objectives of the report shall be the identification of loadings, concept layout for a range of infrastructure options, and the technical and economic assessment of such options, including all factors to be considered that are listed in Hunter Water Design Manual – Section 1.

The report shall identify and detail all sewerage servicing options (e.g., gravity, PSS, combined gravity /PSS), loadings and projections, and provide comprehensive schedules of all capital works, including sizes, lengths, unit and total costs etc. For each option the associated whole of life cycle costs shall also be identified utilising figures provided by Hunter Water. The resultant NPV analysis shall be included in the report. All assumptions made in the NPV process need to

be outlined, including allowances made for the community, developer and Hunter Water's costs. Only where PSS is the lowest NPV will the investigation be approved to proceed to concept design.

Details of the flows likely to be discharged into Hunter Water's sewer system for all of the stages of the development must be included. Included within this report should be the Designer's preliminary notes and assumptions.

In conjunction with the assessment of operation and maintenance costs the designer is required to seek independent written expert advice on whether odour control facilities are required and if so, what type and their likely capital and associated ongoing costs (or equivalent annual lease payment) for the proposed system. Such expert advice shall include details on the qualifications and experience of the expert, the type of dosing device(s), the proposed location, chemical consumables, nature of operation and assessment of environmental impact from accidental chemical spills and methods to contain such spills, as well as any Dangerous Good requirements. The designer shall present such expert advice as part of the servicing strategy report.

Hunter Water approval of the strategy is required prior to proceeding to the concept design.

6.4.3 CONCEPT/DETAIL DESIGN

The designer will be required to present a concept design in accordance with the Hunter Water Design Manual. Only after Hunter Water provides approval of the concept design shall the accredited designer commence on the detail design.

The final approval to use the alternative sewer system for the proposed development will be conditional upon submission of, and review and acceptance by Hunter Water, of the following documents:

- A concept and subsequent detail design that meets the design requirements as set out within this Hunter Water Design Manual and any other Hunter Water criteria provided by Hunter Water or their representatives in negotiating the provision of sewer services to a specific development. The concept design will be about 80% of the detail design for the development and aims to identify any fatal flaws in the design.
- A computer model of the proposed system which identifies and confirms pipe sizes and details the anticipated pressures at the differing contour points for the development. The pump unit/zone with the highest static head shall be identified and considered throughout the design process.
- A report that provides a recommendation on whether odour control will be required based on the advice from the concept design, for early stages and for when the development is complete.
- NPV assessment including allowance for maintenance costs including spare pumps, pump replacement, stator replacement, odour control and community costs. Costs for the supply, installation, operation and maintenance costs for the alternative sewer system will be provided by Hunter Water.
- Confirmation of the pumping units to be used in the development, and the number of spare units being provided. The details of the make and model of the units should be obtained from Hunter Water.
- Plans showing the location of the units including set backs from property boundaries, considering access to the unit for installation and maintenance. PSS units shall be no more than 2 metres from the edge of a driveway to facilitate access for maintenance.

- A Review of Environment Factors (REF) for works that are not approved under the development application, or are outside the approved development area.
- Details of how the remainder of the subdivision is to be serviced, if the application is for part of the development.
- Details of flushing points and the preparation of a flushing program during the growth of the development, if required. The frequency of this flushing shall be documented for the development, considering the staging of growth, etc.
- Details of pipes, valves and fittings.
- Details and calculations used to determine anti-buoyancy requirements.

6.4.4 DETAIL DESIGN

Detail design is the finalisation of the design for the development, including all approvals, consultation with residents, all details for how the system will operate, the location of the infrastructure and provision of all details as required by Hunter Water.

6.4.4.1 System Cost Evaluation

The economic evaluation of all proposed systems shall be completed on a total whole-of-life cost basis, taking into consideration all costs to the developer, the community and to Hunter Water over the operational life of the system. A Net Present Value (NPV) analysis over a 30-year period shall be undertaken for all proposed systems, using a 7% discount. Alternative systems will only be considered for approval by Hunter Water as an appropriate strategy if it can be shown that the proposed system is clearly the least costly solution (in NPV terms), when compared to a conventional gravity sewer system and meets the criteria set out in the Hunter Water Design Manual.

Reference should be made to the operation and maintenance costs that are attributable to conventional gravity and alternative sewer systems, as detailed in Section 6.4.6. Costs may need to be indexed by CPI to the time of the proposed application.

6.4.4.2 Hunter Water Operation and Maintenance Costs

The accredited designer must include in the NPV assessment Hunter Water's estimates for the operation and maintenance costs for the proposed system, which may take into account site specific conditions. Hunter Water will assess if higher operation and administration costs will result in implementing the proposed system over a typical conventional gravity system. If the proposed system is demonstrated to have higher operating and maintenance costs, then Hunter Water will seek the costs from the developer over and above the cost of a conventional gravity system. The accredited designer is to obtain from Hunter Water whether there is an additional operation and administration cost to be included in the NPV for the system and whether Hunter Water will obtain fees from the developer for this additional cost per property over a 30 year period.

The designer must include in the NPV assessment the ongoing operation and maintenance costs associated with odour control requirements for the proposed system, if required, based on independent expert advice.

6.4.5 ODOUR CONTROL

The design of the alternative system shall mitigate the need for odour suppression measures. However, for all proposals the Designer shall submit an independent expert odour control report outlining the detention time in the total system, considering the up and downstream

infrastructure and any odour control arrangement to be used and how odours will be managed whilst the development is being built out. The report shall identify any chemicals to be used and the quantities to be consumed annually, which must be included in the operational costs of these odour control measures in the NPV analysis. The report shall also identify operating procedures to be adopted in the interim period during which only a small proportion of the development has connected to the system.

Downstream impacts of chemical dosing, such as the impact of chemical reaction with concrete, corrosion of metal fittings and pump impellers shall also be considered. The written expert advice shall be presented to the Corporation for assessment, as part of the servicing strategy report, if no servicing strategy is to be undertaken, then it must be resolved within the concept design. Hunter Water's approval of the report is required along with the concept design.

As a general rule odour control must be by means of septicity control. The level of dissolved sulphides in the effluent discharged from a system shall be less than 1 mg/L for the effluent to be considered treated. Turbulent discharge of the effluent from the system into the downstream sewer system is to be avoided by continuing the discharge pipe work down into the manhole or pump station. For a system that discharges to a pump station, the incoming main should continue below the bottom water level. For a system that discharges to a gravity reticulation system manhole, the manhole lid is to be sealed by means of a gatic cover (or approved equivalent) and the discharge pipe work general arrangement shall be as per the rising main connection details outlined in the Hunter Water Design Manual. Protection of the receiving manhole from corrosive gases is to be achieved by lining of the manhole with an approved lining or coating system.

Septicity control can prevent the release of odorous gases to the atmosphere by retaining sulphides in solution. Where in-line chemical dosing is provided it is to be done such that the effluent from all properties is treated. The length of pipe required between the dosing point and the discharge point will vary depending on the system. Accredited designers will need to consult with suppliers of such facilities to ensure that an adequate mixing length is available. Council consent/approval may be required for the installation of the chemical dosing facilities. It is the responsibility of the designer to obtain approval from the appropriate authorities on this matter.

6.5 PRESSURE SEWER SYSTEMS

6.5.1 PRESSURE SEWER SYSTEM COMPONENTS

The Pressure Sewer System (PSS) moves sewage from a pumping unit located on the property through a series of pressure reticulated mains to a designated discharge point. The system can be effectively divided into three distinct parts, these being:

- Private property works.
- PSS unit & works.
- Reticulation works.

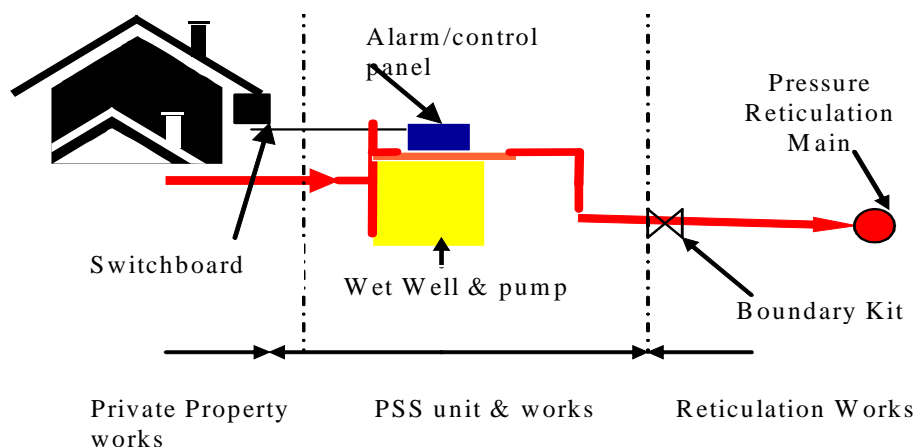


Figure 3.7.1- Responsibility for Works

Private Property Works is defined as the part of the system between the house and the PSS unit, with connection to the stub pipe on the inlet (dwelling side) of the pumping unit. These works are the responsibility of the owner and include:

- The supply and installation of the household sewer drains to the stub on the Pressure Sewer unit.
- Provision of a switchboard compliant with current Australian Standards, for Hunter Water connection to. Switchboard particular requirements can be obtained from Hunter Water for the system that is to be installed.
- Consultation and consideration of earth leakage and consideration in provision of power for a PSS to operate for 45m head for 40 minutes.
- The private property connection comprises of:
- The supply and installation of the property drains between the house and the PSS unit, connecting at the tank pipe stub, precast with the tank.
- Flexible joint between the property lines and the PSS unit, to allow for settling of the unit.
- Pressure testing of the property delivery lines.

The PSS Unit & Works are defined as that part of the system that is upstream of the boundary kit, including the pumping unit, to the stub pipe on the inlet (dwelling side) of the pumping unit and is the responsibility of the Developer or their nominated installer, unless otherwise agreed by Hunter Water. These works comprise:

- The supply and installation of an individual pumping unit that has been approved for the purpose by Hunter Water.
- The supply and installation of the control panel.
- The connection of the pumping unit to the property power board, including supply and installation of a new circuit breaker for the PSS.
- Connection of the boundary kit to the pump unit.
- The pumping unit comprises of the following key elements:
- A single dedicated sewer grinder pump, to reduce all of the incoming sewage to slurry capable of being passed through small diameter pipelines.
- Pump and motor protection devices, to protect against overheating, overpressure and no-flow conditions.
- A leak proof storage vessel that is round in shape and made of lightweight materials.

- Anti-buoyancy measures to prevent the tank floating out of the ground. This is typically some form of concrete ring beam. The calculations used to size the anti-buoyancy ring must be supplied to Hunter Water with the detail design.
- An alarm system that warns by both an audible and visual alarm that the storage volume in the pumping unit is increasing, indicating a pump/ system failure.
- Valves, to ensure the station can be isolated and to prevent siphoning.

The reticulation works is defined as the mains from the discharge point in the gravity network, to and including the boundary kit on the property. These works are the responsibility of the developer for the supply and installation, with ownership passing to Hunter Water after Practical Completion or any performance proving requirements. The works include:

- The supply and installation of the reticulation mains, in the designated allocation.
- The supply and installation of reticulation, isolating and air valves in the reticulation mains, to facilitate the ongoing operation of these mains.
- The supply and installation of the Boundary kits, located as approved with Hunter Water and the property owner.
- The supply and installation of flushing points in the reticulation mains.
- The marking of the lines with tracers with the tracer ends located in valves boxes, to allow future identification.
- The supply and installation of odour suppression equipment (where required) by Hunter Water.
- Protection of the discharge location where required by Hunter Water, such as epoxy lining of the Manhole.
- The connection to the discharge point within the gravity main. This connect will require venting.

The PSS shall be discharged to a point where the receiving system has sufficient capacity to receive the discharges from the PSS, and transport it to the sewage treatment plant. Hunter Water will advise of suitable connection points for the proposed development at the local servicing strategy phase and of any works required to receive the PSS flows.

6.5.2 DESIGN LAYOUT

6.5.2.1 Design Criteria

The overall design of the PSS must achieve the following requirements:

- It must meet the minimum velocity for self-cleaning of 0.6m/s at peak flow conditions.
- It must ensure that the TDH for the pumps (i.e. the static head plus friction losses and velocity losses) does not exceed the duty head of the pump, which is nominally 45m
- It must ensure all pumps are able to pump into the reticulation system after a failure scenario prior to an overflow occurring on property.
- It must ensure that the sewage detention time in the PSS is evaluated for the potential odour and septicity requirements.
- It must prevent siphoning of the system, where there is a localised high point prior to the discharge location.
- It must prevent the entry and build up of air into the system that can cause the system to suffer from airlocks and prevent the movement of liquid.

- It must ensure sufficient velocities to ensure the system is capable of being scoured clean, particularly during the growth periods of the development. Flushing points should also be provided to facilitate cleansing of the lines and for emptying of the lines.
- Include a PSS approved computer model showing the ultimate loading proposed for the development and the proposed stages. The model shall demonstrate that the system will cater for failure scenarios, such as power failure and provide normal operating details. This model will be developed by the approved designer.
- It must ensure that the pump with the highest TDH is capable of operating in a failure scenario, prior to an overflow occurring.

6.5.2.2 On-Property Design Criteria

In the case of existing dwellings, a preliminary audit of the dwelling's electrical and plumbing systems will be required before design work can commence. This audit is to identify what work is required to bring these systems up to the relevant standards before the pressure sewer system can be installed, with the cost to be borne by the home owner. This will require investigation into the ingress of rainwater into the house sewer mains, by use of smoke testing, water testing and possibly dye testing.

Where there is a vacant lot, the location of the boundary kit is to be agreed with the property owner or developer and approved by Hunter Water and positioned close to the front and side boundary. All valves, both stop and reflux valves and connections must be located within a single valve pit. Include in the valve pit a tee with a stop valve to allow for testing of the system external to the tank and to also allow for emptying of the tank.

The PSS pump design is to be carried out in consultation with the property owner/s, or their nominated representative. Where possible, the reasonable needs of the property owners are to be accommodated in the design, and typically, these might include modifying the pipeline route to avoid structures, buried pets, prized gardens, or locating the line to avoid future proposed property extensions, etc.

Key considerations in the initial design are as per Figure 4.3.2, and as follows:

- All pipelines are to be laid a minimum distance of 1.5m from the side and or rear property boundaries, and their route is to run parallel to that boundary.
- Where the properties are large and this requirement is unreasonable, the property delivery line will be laid essentially perpendicular to the reticulation mains, but should essentially be a straight line. It will be laid in a position sympathetic with the current property usage.
- The pump station must be installed within a direct line of sight of the pressure sewer alarm/control panel and at the front of the property.
- The pump station must be located at the front boundary for ease of installation and to provide for future vehicular access, or must provide vehicular access by other means, such as a laneway, or in the case of a corner block, via a side gate entry.
- One pump station, with a single tank per property is to be used.

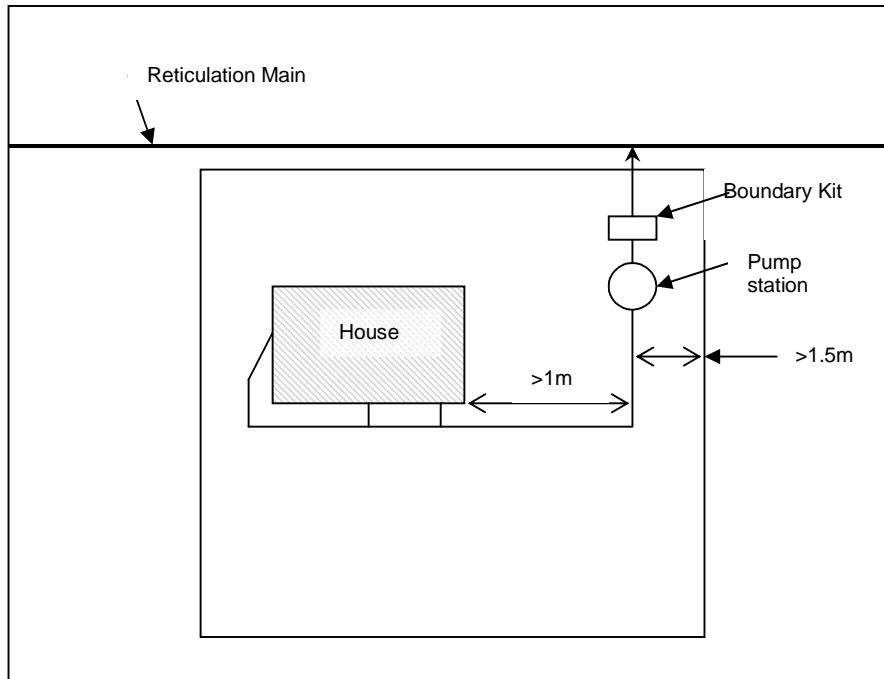


Figure 4.3.2- Property Layout

6.5.2.3 Reticulation Design

The determination of peak loads, the maximum flow likely to be operating at any one time in the reticulation system can be assessed using the Rational Method, the Probability Method, or another method if approved by Hunter Water. The proposed method needs to be approved by Hunter Water for the particular development, and agreed at the initial meeting as set out in Section 6.2.

The reticulation mains are to include a number of flushing points, to allow the mains to be kept clean particularly during the construction phase and development of the subdivision. These should be located to provide access to assist with cleaning the lines, and minimising odour generation. The cost of including these fittings also needs to be included within the NPV assessment.

The reticulation system must incorporate a number of designated isolating valves, at defined zones, to enable isolation of discrete zones of the PSS, to allow for fault rectification work or for downstream works/faults. Unless otherwise specified valves shall be located:

- at intervals of not greater than 500m or 30 service connections, which ever is lesser;
- at both ends of bridge crossings; and
- at both sides of areas of unstable ground.

An isolation valve shall also be provided on the branch (riser) of each tee immediately adjacent to an air release and vacuum break valve for maintenance purposes. All isolating valves shall be capable of being locked in the open and closed position

Isolation valves are required at the sewer lateral tapping connection to the reticulation main.

Design calculations, showing the friction losses and the estimated static head, shall be included in any submission to Hunter Water on the proposed installation of pressure sewer systems. Hunter Water may require that some reticulation main sizes be increased, if it considered that the heads on the pumps are too high. This will need to be evaluated in light of any flow constraints.

The reticulation drawing shall include a plan view and longitudinal profile including depths and ground level. The design shall ensure that siphoning is prevented, low spots in the design are minimised and the optimal transfer arrangement is provided.

The reticulation pipework shall be laid at minimum depth, with rising grade to the discharge point to prevent siphoning and the potential for air locks at high points, with smaller diameter pipework than conventional systems.

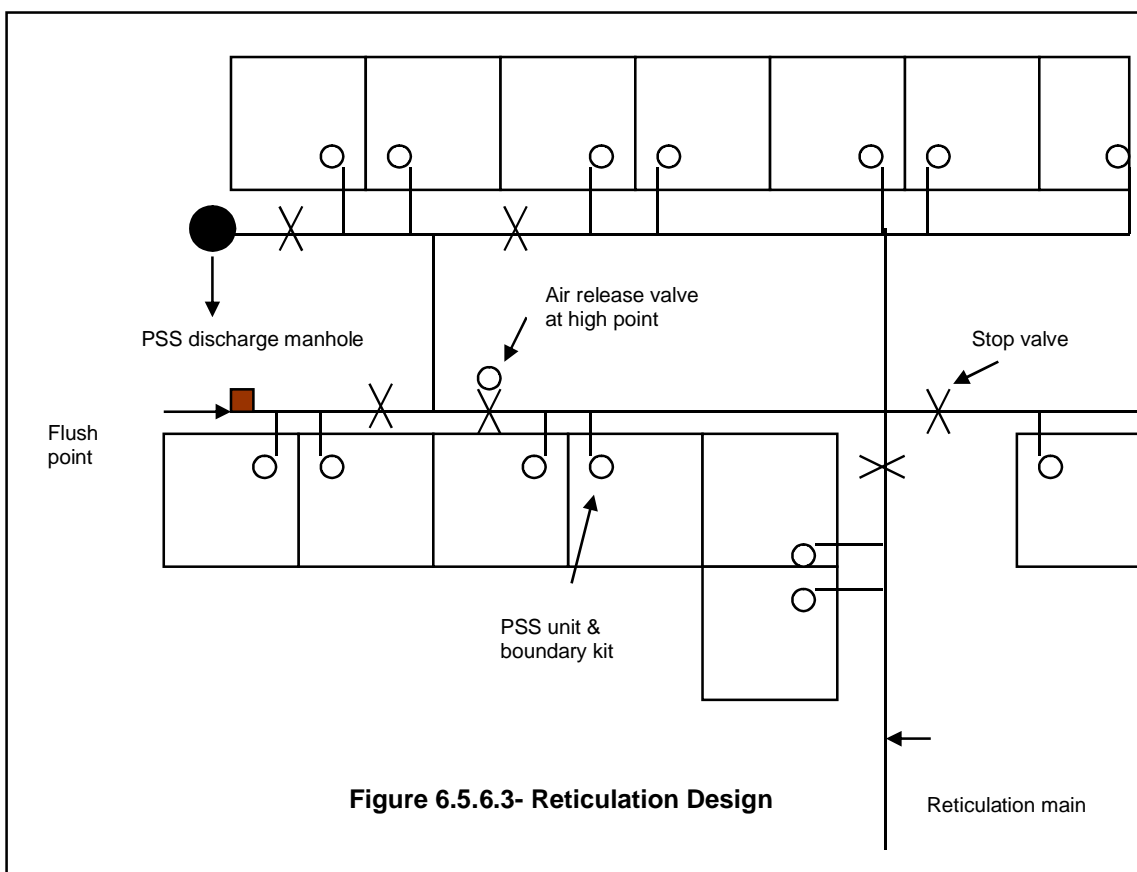


Figure 6.5.6.3- Reticulation Design

6.5.3 DESIGN FLOWS AND SIZING

PSS design should be based on ADWF and PDWF as per the Hunter Water Design Manual. The inflow into the wet well should be as per the Hunter Water diurnal curve, allowing for PDWF and off peak flows. The system should be designed based on the diurnal curve into the tank and the pump operation to cater for the flows throughout the day. PSS pumps may be semi-positive displacement pumps or multi-stage centrifugal pumps. All pumps must be approved for use within Hunter Water Networks.

The designer should check for the impact on the operation of the system of storm allowances entering the tank to ensure the system can handle wet weather as the system deteriorates. The

allowance should be based on 0.5 of the storm allowance outlined in the Hunter Water Design Manual.

Given that the pump's life will be ultimately governed by its duty head as well as the mechanical aspects of the pump, there shall be no alterations to reticulation pipe sizes (as shown on the design layout), without a full certification of the changes by the system designer. Pipe designs are to be based upon commercially available pipe sizes that are approved by Hunter Water, no field amendments during the construction phase will be entertained by Hunter Water, for altering any pipe sizes.

6.5.3.1 Rational Method

The rational method is a conservative method for estimating the flows in the sewer main from the proposed sewer system and has the following flow equation:

$$Q \text{ (L/sec)} = a (ET + b) \times \frac{3.785}{60}$$

$$a = 0.5, b = 20$$

ET = Equivalent Tenements

The rational method allows no diversity factor or 'r' factor as used by Hunter Water within the Design Manual for gravity systems. This means flow balancing or attenuation, as the number of ET connected increases is not considered for the system. This means that flows can be underestimated for the lower number of connections and over estimated for the higher number of connections.

6.5.3.2 Instantaneous (Probability) Method

The instantaneous method is based on the maximum number of pumps operating at any one time and hence the total flow into the system and the Total Dynamic Head (TDH). This methodology has been developed by the different equipment suppliers and as such is proprietary information and hence the methodology cannot be specifically documented within this manual. Generally the assumption is, that say for 50 pump units a maximum of three units would operate concurrently, contributing a maximum total flow of say $3 \times 1.0 = 3.0\text{L/sec}$. For this methodology the equipment supplier under contract with Hunter Water should be contacted and consulted on the methodology.

6.5.3.3 Modelling Criteria

Each development proposed for PSS must provide a model demonstrating the operation of the PSS at ultimate loads and interim loads and also considering potential inflow infiltration to the system from house drainage lines, based on the pumps operating at the contributing flow of 1L/s.

The model should be used to verify flows initially ascertained using the rational, instantaneous or other method as approved by Hunter Water. The following criteria should be followed to develop a model of the proposed PSS for any development:

- Every pump unit is to be modelled separately up until 50 units. Over 50 units pumps can be clustered with no more than 5 units per cluster. The positioning of the clusters shall be at the most remote location and lowest point within the cluster, to reflect the operation of the worst system. The height distance between clusters should be no more than 1metre.
- Only properties with the same land zones shall be clustered.

- It should be assumed that the number of units clustered multiplies the total storage volume.
- Flows into the system shall be modelled as diurnal curves.
- Pump flows shall use the actual pump curve, showing head and flow curve, from 0 m head and 0 L/s flow.
- The wet well parameters can be supplied by Hunter Water. This modelling should be undertaken specifically for the units proposed to be installed at the development. The units will be supplied by Hunter Water using the developer contributions.
- As a guide, no pump shall operate for more than 35 minutes in one day, in normal operation. Where pump operation deviates from the 35 minutes, approval from Hunter Water must be sought.
- As a guide, no pump should operate continuously at TDH above 45m head for more than 40 minutes after a failure scenario. Where pump operation deviates from the 40minutes, notification and approval from Hunter Water must be sought, with the implications of the longer run times documented for Hunter Water review.
- Pipe roughness for the model should be applied as 1.5mm in conjunction with the Colebrook-White formula. Where a design proposes a lower pipe roughness, submit a compliant design to the 1.5mm and a non-compliant design, providing commentary on the implications to the system of using the lower pipe roughness. Hunter Water will assess the implication of the reduced pipe roughness and make a determination based on the potential risk to the operation of the system and the potential for increased pipe roughness over time.
- The system outlet should be assumed to be at Ground Level (GL), unless a specific distance from GL is supplied by Hunter Water. The designer should check with Hunter Water on the requirements for this.

The model shall be operated under the following criteria to verify the applicability of PSS for the proposed development and any constraints that may exist for the system. Model the system with all tanks at TWL/Alarm and run for at least 30 days until the system has reached equilibrium and the operation of the units becomes cyclic.

- Pipe sizing should be determined based on the cyclic operation of the PSS, not the size required after a failure scenario.
- The selected pipe sizing for normal operation of the system should be modelled for a failure scenario, with all tanks 100mm off the overflow level in the tank.
- The system should be operated with and without the storm allowance.

The outcome of the above checks on the operation of the PSS should be reported, noting any alterations made to the operating parameters and to the proposed pipe sizing. The effects of running the model with and without the storm allowance should also be documented.

6.5.4 PUMP STATION DESIGN

The complete details in respect to the pumping station are set out below. Hunter Water will have a supply arrangement for the provision of the pump station for new developments; hence Hunter Water should be contacted for the operating parameters to be used within the design.

6.5.4.1 Minimum Storage Requirements

Each pump unit collection tank must have a minimum storage volume equal to the control volume (volume required to operate under dry weather conditions, see Section 6.5.4.10), plus

an allowance for emergency storage, nominally corresponding to 24 hours ADWF storage for multiple pump arrangements or 48 hours ADWF storage for single pump arrangements.

Emergency storage requirements may be reduced with prior Water Authority approval based on an agreed maintenance and service contract.

For HWC owned and maintained units, emergency storage shall be equivalent 10 hours ADWF storage.

Where power interruptions or environmental constraints or other unique features might require additional storage over and above the set minimal requirements, the pumping station requirements will be determined on a case-by-case basis, and will be marked separately on any design plans for the areas, as well as any associated specifications.

6.5.4.2 Specific Wet Well Requirements

All pumps and collection tanks must be approved for use by HWC. The wet well shall comply with the following minimum criteria:

- NSW Department of Health Approval.
- The wet well shall be made of lightweight materials to facilitate ease of installation.
- The wet well shall be round in shape, with a sloping bottom, to facilitate installation by auger and hence minimal damage to the property and disturbance to the resident(s) living on the property.
- Have a shape, or external mouldings, that assist with any anti-buoyancy provision. Such provisions shall be able to readily bond with the structure, to ensure they will continue to act as an anti-buoyancy device for the life of the pumping station.
- Have the flexible stub for connection to the wet well installed insitu in construction, to ensure the joint is watertight.

6.5.4.3 Wet Well Lid

The lid shall be lockable to minimise the risk of children entering PSS units. The lock shall be Hunter Water approved. The lid shall have a confined space label visible before opening the lid and be water proof.

6.5.4.4 Anti-buoyancy Features

To prevent any potential of the pumping units floating, the following needs to be applied in relation to all pressure sewer pumping unit installations:

- The pumping station is not to be installed in a ground depression where rainfall runoff water could normally pond.
- A concrete ring beam or ballast is to be installed or poured around the base of the storage vessel. The size of the ballast will be in accordance with the Equipment Supplier's requirements and assuming the water level reaches Ground Level.

6.5.4.5 Air Release

High points within the PSS must have air release valves to allow the release of air, to prevent air locks. These air release valves should be manual and should be positioned at distance from private properties to ensure minimal odour issues when venting the pipeline. The impact on the surrounding residents, both existing and new should be considered, with the proposed location to be approved by Hunter Water.

6.5.4.6 Serial Numbers

The pumping station is to have a serial number, which can be recorded in the property installation information and Work-As-Executed drawings. This number should be readily distinguishable, and must be unique to each PSS and obtained from Hunter Water.

6.5.4.7 Pumps and Pump Protection

The complete details (in respect to the pumps) are set out in Hunter Water's Technical Specification, which Hunter Water will use to procure the pump units, but key elements that need to be noted in the design of the system are described in the following sections.

6.5.4.8 Pump Duty Points

Pump duty points shall be determined for each development and all properties within the development shall be serviced by the same or equivalent pump. In addition to ensuring that network performance and design criteria are met, the selection of pumps and duty points shall also take into consideration of the type and availability of replacement pumps, spare parts and alternate manufacturers.

Unless otherwise agree with Hunter Water, pumps for rural residential applications shall have the following duty points:

- Maximum Head (shut off head) – 45m
- Minimum Flowrate – 0.45 L/s.

Typically, the rated or design head should be taken as the maximum head the pump should be designed to accommodate, i.e. the total static head, plus the friction losses that will occur in the designed reticulation system.

A flowrate of 0.45l/s should be taken as the minimum flowrate the pump should be capable of discharging under normal operating requirements. Higher duty points are permissible, and may be approved for some specific applications.

6.5.4.9 Pump Protection

The pump must be provided with protection devices to protect the pump against the following possible scenarios:

- No flow through the pump, due to no inflow into the pumping station or due to a blocked line on the discharge side of the pump, or large numbers of units already pumping.
- Pressure Switch or other form of overpressure motor protection, and one that facilitates the effective and systematic clearing of the system after the system has been subjected to a significant power outage.
- Motor runtime shut out if the pump operates for more than 40 minutes in any one runtime.
- Motor thermal overload, if the pump is not functioning appropriately or something becomes jammed in the pump (and the grinder in particular).

The pump shall also to be protected by at least two non-return valves, to prevent flows from the pressure sewer network flowing back through the pump, or by other means to achieve the same end result.

6.5.4.10 Pump Operating Levels and Controls

The pumping unit shall be controlled by pressure switches; ultrasonic sensors; or conductive level sensors. Float switches are not permitted.

- **Pump off switch**, which should be set as low as possible, i.e. at a level to minimise the volumes of sewage stored in the pumping station after the pump ceases to operate.
- **TWL or Pump on switch**, with the storage volume between “pump off” and “pump on” to be of a limited volume. This is to promote relatively frequent pumping for short durations, and minimise the time the sewage is stored in the storage vessel. The pump should be limited to no more than 10 starts an hour.
- **An alarm switch**, which activates if the “pump on” switch fails to operate. This level should be set such that alarms are not activated when normal high output applications (such as domestic washing machines and the like) discharge into the storage vessel.
- **Redundant switches** should the initial pump on switch fail.

6.5.4.11 Alarms and Controls

The complete details (in respect to the alarms and controls to be provided with the pumping units) are set out in the Hunter Water’s Technical Specification, which Hunter Water will manage for the procurement of the pump units, but key elements that need to be noted in the design of the system are:

- Weatherproof surrounds for the control /alarm panels, that are corrosion resistant to a high degree and compliant with AS3000.
- A Perspex safety shield, to prevent inadvertent contact with live wires when the panel is opened.
- A lock, to prevent unauthorised entry as approved by Hunter Water.
- An audible alarm, with a resident activated kill switch to silence the audible component of the alarm.
- A visual alarm, that can only be switched off by the maintenance authorities accredited service provider.
- Contact details for the nominated emergency contact and maintenance provider.

6.5.4.12 On-Property Installation Procedures

Construction on the property is to occur in accordance with the detailed procedures developed in conjunction with the service provider and approved by Hunter Water, and will occur within defined time limits to minimise the inconvenience to any existing property residents, or to meet occupancy targets in respect to new homes.

Key requirements will be:

- A separate, on-property design will have been drawn up in consultation with the property owner, and the unit is to be installed in accordance with that diagram.
- All testing is to be carried out at the time of the installation, and the pump formally commissioned to facilitate a ‘once on and off the property’ approach to the installation.
- Minimum cover over the property discharge line is to be 450 mm.
- Appropriate notice is to be given to the property resident before entering the property, in accordance with Hunter Water’s consultation requirements.

6.5.4.13 Boundary Kits

The Boundary Kit is to consist of the following in order from the sewer lateral:

- upstream isolation valve;
- maintenance fitting (plugged tee for testing and bypass, positioned vertically);
- non-return valve (suitable for sewage, no spring mechanisms); and
- downstream isolation valve.

Dependant on any other agreements between the customer and Hunter Water, such as Trade Waste Agreements, a sewage flow meter may also be required within the boundary kit.

All fittings shall incorporate mechanical unions to enable complete assembly removal and are to be located within a common valve box. All boundary boxes are to be nominally located 1m from the front boundary in non-trafficable areas. Covers shall Class B – Non-Trafficable and be marked *Pressure Sewer Control Assembly*. Alternate locations subject to Hunter Water Approval.

All fittings shall be selected from Hunter Water's approved Products and Manufacturers Register.

6.5.4.14 Testing And Commissioning Of Pumps

Testing and commissioning of the pumping units is to occur in accordance with the detailed procedures developed by the service provider and approved by Hunter Water, and will occur within defined time limits to minimise the inconvenience to any existing property residents, or to meet occupancy targets in respect to new homes.

Pressure testing needs to be conducted in three specific areas, these being:

- For the pumping unit and property delivery line, i.e. the on-property works.
- For the reticulation system.
- Pressure of the house drainage lines, prior to connection to the pump unit to ensure infiltration is minimised
- Testing may need to be modified, if the area is in water restrictions at the time of the tests being conducted.

6.5.4.15 On-Property Tests

All operational tests are to be conducted using potable water, with the pumping unit only being connected to the sewer system after these tests have been successfully carried out. The tests required for the on-property testing is to include, but not be limited to:

- Leakage Test
- Simulated Power Failure Test
- A time-based operational test
- An alarm test
- A Pump Protection Test
- Visual Inspection

6.5.4.16 Testing of the Reticulation Pipework

The pipelines shall be flushed out prior to testing to ensure the lines are clear and free flowing. The designer shall develop a procedure for how the flushing will be facilitated. If the flushing points are proposed to be connected to potable water, then they must have sufficient pressure and also have an approved backflow prevention device to prevent contamination of the water supply.

Pressure gauges shall be placed on the discharge side of the pumps. The pressures recorded should not exceed the design head for the pump. The pressure test must be carried out at all properties.

PE pressure pipes shall be pressure tested in accordance with procedures detailed WSA01 Polyethylene Code of Australia. All other pressure pipelines shall be pressure tested in accordance with the procedures detailed in Section 19.4 of the WSA03 Water Supply Code of Australia Hunter Water Edition.

6.5.4.17 Commissioning of Pumps

The Equipment Supplier may have their own requirements before they will formally certify the pump is commissioned, and any Installer will need to make themselves aware of these requirements and what is required to gain this Commissioning Certificate.

These certificates shall be furnished to Hunter Water prior to Practical Completion being granted.

6.5.4.18 Residential Connection To Pressure Sewer Systems

The property owner's plumber will be required to connect to the stub pipe on the inlet side of the pump unit. The connection is not to be made until the pump has been commissioned using town water.

In existing homes, property owners will be advised when they can connect, and they will also be required to decommission their existing septic tanks, as per their Local Council requirements. The existing household drainage lines will need to be tested, to ensure elimination of stormwater entering the PSS system, with test certificates to be furnished to Hunter Water prior to connection being permitted.

6.5.4.19 Pipe Materials

Detailed information, in respect to the pipe materials is set out within Hunter Water's Approved Product Listing, but key aspects that need to be factored into the design components are as follows.

Residential Property Delivery Line Materials

The property delivery lines for all applications shall be:

- >32mm diameter polyethylene pipe.
- The pipe will be Class PN 16.
- The pipe should occur in long rolls, such that in most cases the only joints on the property should be to the pumping station and to the boundary kit.

Reticulation Main Materials

The reticulation mains shall be:

- (50mm – 125mm) polyethylene pipes, with a preference for sizes that are easily available, as appropriate. When and if larger sizes become available in longer rolls, these will also be considered if appropriate.
- Class PN 16 pipe (unless otherwise stated in dedicated areas).
- A minimum length of 100 m in the pipe rolls.
- Readily available in the commercial marketplace, so that additional lengths can be purchased for repair or extension purposes.
- Capable of being crimped (if required), to effect repairs.

Pipe Colours

Only black polythene pipe shall be used for pressure sewer systems. Black pipe with a coloured stripe shall not be used under any circumstances. Conduits for pressure mains shall be black polyethylene.

Joining the Pipes

All pipes are to be joined by electro fusion techniques in accordance with the manufacturer's requirements. Those carrying out pipe joining are to be appropriately qualified, capable of demonstrating their experience with this technique, and have the right equipment to affect the welds. Hunter Water may consider butt-welding of the pipes by persons with the appropriate qualifications, equipment and experience.

Marking the Pipes

The location of the pressure sewer pipes are to be laid with tracer tape, so they can be easily found at a later date for maintenance purposes. The ends of the tracer tape must be located in a tracer/valve box, which is marked for easy identification.

Pipe Protection

Subject to Hunter Water approval, the pipe can, in most instances, be backfilled with the excavated material from the trench where a trenching machine has dug the trench, provided that the trench is excavated in clean soil free from rocks, sharp objects, organic matter and other objects larger than 20mm. Should the excavated material be unsuitable provide a minimum of 80mm of sand backfilling on all sides of the pipe. . Where it is difficult to gain the depth (i.e. due to excavation difficulties), then the pipe is to be encased in a minimum of 100mm of concrete. The trench will need to be widened to accommodate this encasement.

Repairs to Mains

Where repairs are required, these will be achieved either through crimping of the pipe or the isolation of a section of the pipe using the various isolating valves (property and reticulation system).

Subsequent Connections

Where subsequent connections into the pipe are required, either of the following procedures can be used, with the technique employed that has the minimum number of existing customers affected by the new connection:

- The use of pipe saddles, generally where live connections are contemplated.
- Isolation of the pipe section and the welding in of a new connection, which will require a temporary shut down of the mains.

6.5.4.20 Valves And Fittings

Only those valves listed by the Hunter Water approved materials list and as being suitable for use with the PSS equipment, can be used.

The valves and fittings to be used on the pipelines need to be compatible with polythene pipe and the class of pipe used. The types of valves should also be readily available in the commercial marketplace, and they also need to comply with the relevant standards for valves and fittings.

6.5.4.21 Public Positive Covenants

Every property owner serviced by a PSS will be required to have a Public Positive Covenant (PPC) on the land, which would be registered prior to the sub-division of the initial lot, or in the case of backlog prior to the connection to the sewerage system.

PPCs are required to identify the lot as being serviced by a non-standard sewerage connection and to detail the type of connection (pressure sewerage), responsibilities of property owners

and Hunter Water in regard to the operation and maintenance of the pressure sewerage system. Easements may also be required dependant on the operation and maintenance requirements agreed and approved by Hunter Water prior to development.

The steps to initially register the PPC over the land are as follows:

- Developer has an 88B Instrument that is used to register easements, rights of carriageway and covenants.
- Hunter Water must lodge the LPI at the Department of Lands with the 88E Instrument (Memorandum), which must include the Developer's consent in writing to the instrument, which is via the 88E and the approved form (Form 13PC). Hunter Water may permit the developer to do this on Hunter Water's behalf.

Effectively, this means Hunter Water Lodges the 88E Instrument (Memorandum and Form), and the developer notes the contents on the 88B Instrument.

6.5.4.22 Customer Consultation

For new properties the 88B Instrument will advise the purchaser that the property is served by a PSS and a brochure with contact numbers will be available to those persons purchasing to better understand what the system is about.

For existing or backlog homes, the key elements of the consultative process are:

1. Initial letter to residents (existing homes), or letter in response to an application (new homes), setting out who is to be the Installer/ Contractor on the project, plus their contact numbers.
(Letter by Hunter Water)
2. Installer to contact the property owner, and meet on-site to discuss the site specific issues, such as pool, grey water systems, etc. (Action Installer)
3. For existing homes, Hunter Water should undertake a site visit prior to the installer to discuss possible locations and also any site constraints. Where the electrical switchboard needs upgrading, Hunter Water must provide this advice to the property owner, providing them with at least 30 days to effect the upgrade prior to connection
4. The results of any property audits are to be provided to the property owner, where after the property owner must be given at least 30 working days notice, unless alternate time frame is agreed with the property owner, to allow them to engage their own tradespeople.
5. Copy of layout/ installers drawing for property owner's signature.
(Action Installer)
6. Prior notification (5 days) to resident before works commence on site.
(Action Installer)
7. Installer to introduce staff to the property resident prior to the commencement of design phase, and also prior to the commencement of work. Property resident provided with 24 hour a day emergency contact numbers, whilst on site works are underway.
(Action Installer)
8. Final inspection of property, with resident invited to participate.
(Action Installer)
9. Hand over a copy of the draft homeowner's manual, as well as discussing (with the resident) the instructions in that document on how to use the system. Homeowners manual will also be available on the Hunter Water website.
10. Emergency contact numbers to be affixed to the Alarm/Control panel.

Prior to undertaking this consultation process, Hunter Water must be consulted to ensure all updates to this process are considered, as the process is ever evolving based on experience.

6.5.4.23 Access to the Pumping Unit

The pumping station should incorporate provisions for the removal of the pump (and other mechanical devices) without the need to enter the pumping station, the intention is to avoid working in a confined-space environment.

In addition to the above, the nature of the opening to the storage vessel and its lid must be such that a basic lifting device can be easily fitted above the opening, to facilitate the removal of the pump. Vehicular access to the pumping unit is to be provided, and the developer should be indicating this requirement in the property requirements/ Public Positive Covenants to the property owner prior to the transfer of land.

Subdivision layouts should consider how vehicular access will be facilitated, to ensure direct access to the unit and with rear drainage to lots eliminated.

6.5.4.24 Maintenance Arrangements and Fees

Hunter Water has a full homeowner's manual, which sets out (in detail) the fault rectification arrangement. The basic arrangements that need to be factored into the design are as set out below.

- The resident will be responsible for notifying Hunter Water of any failure of the PSS unit.
- Hunter Water will provide fault rectification service, not preventative maintenance.
- For new developments, the developer shall advise the property owner or potential purchasers of the property that PSS is to be provided as their sewer connection and what their responsibility and obligations are.
- The resident will be responsible for the provision of power and payment of the annual power fees.

Where additional costs over and above the costs for operation of a conventional gravity system is demonstrated, Hunter Water will seek to obtain these additional fees from the developer, over a 30 year NPV period.

6.5.5 FLUSHING POINTS

The reticulation will need to contain a number of flushing points, where water can be added or sewage extracted from the system in sufficient volumes to allow the cleaning of the reticulation network, particularly during the construction phases. Typically, this will involve the connection of a mobile tanker to the flushing point to achieve this flushing action. Details of how these flushing points are to work must be submitted as part of any design for a PSS. This procedure must also be included in the Operation and Maintenance manual to be handed to Hunter Water as part of the commissioning process.

The fittings are to have kamlock connections, and should be sufficiently robust in nature to avoid damage through normal operational use and should be listed on Hunter Water's approved material list.

6.5.6 RETICULATION MAINS

The construction of the reticulation mains is to occur in accordance with the detailed procedures set out in the Hunter Water's technical specification, but key factors to be considered in the design and tendering stages are as follows.

6.5.6.1 Depth and Location of Pipework

The pipe will be laid to a depth as per Table 4.5.7.1, with the addition for open drains that where erosion is occurring, the main will need to be backfilled with concrete.

Application	Minimum Cover
Footpath	>450mm
Sealed road	>600mm
Unsealed road	>750mm
Open drain	>600

Table 4.5.7.1- Minimum Cover requirements

Distances from other services will be in accordance with the Hunter Water Design Manual, where there are ambiguities between this section and the other sections of the design manual, it should be assumed that this section takes precedence. Hunter Water should be contacted to clarify the ambiguity.

6.5.6.2 Road Crossings

Where the road is a sealed surface, the pipeline is to be installed using trenchless technology such as under-road (directional) drilling or thrust boring techniques, unless otherwise approved the Local Council. Where trenchless technology is used the pipe shall be installed inside a suitable conduit or casing pipe. For unformed roads, excavation can be by either open trench excavation or under-boring of the road.

6.5.6.3 Property Connections

The property boundary kit is to be connected to the reticulation mains at the same time as the reticulation mains are being installed. Connection will be from the reticulation main to the boundary kit, with the installation of that valve pit forming a part of the reticulation construction work. The location of the boundary kit should be approved by Hunter Water prior to construction.

6.5.7 INFORMATION TO BE SUBMITTED TO HUNTER WATER

It is intended that a file be maintained on each pressure sewerage installations, and thus a significant amount of information will be required in the design of this system. Details of the information to be provided to Hunter Water about the installation of pressure sewer system is set out in the in Hunter Water's Technical Specification, but shall the following. Submission shall include an electronic copy of all information:

6.5.7.1 Reports

- Servicing Strategy
- Concept Report
- Design Report
- Designers Final Report

6.5.7.2 Reticulation Mains

- Work-As-Constructed (WAC) plans, as specified in WSA02 (gravity sewerage components), WSA03 (pressure sewerage components) and STS903.
- Longitudinal profiles will be required to ensure the main is constantly rising to the discharge point.

- The sections of the pipelines that have been directionally drilled.
- Date construction completed for a reticulation zone.
- Date made operational.
- Dates boundary kits installed on the property
- Pressure test results/ verified.
- Date property connection lateral laid.

6.5.7.3 Residential Information

- Property address, owner's name and any special property features.
- Work-As-Constructed (WAC) plans, based upon the property design (highlighting any deviation from original design), undertaken with the property resident. WAC plans should be completed in accordance with WSA02 (gravity sewerage components), WSA03 (pressure sewerage components) and STS903 where applicable. Plans shall included the following details:
 - well location;
 - customer sanitary drain connect location;
 - all pipe, valves and fittings up to the boundary kit;
 - control panel and power and control cable locations;
 - boundary kit location; and
 - tapping point and isolation valve location at the common rising (reticulation) main.
- The date work commenced on the property.
- The date/s the work was completed and that the Installer left the property.
- The date the pump made operational and results of the pressure test on the pump.
- Date and number of the pump-commissioning certificate.
- Manufacturer, serial number, pump curve and warranty information of pump.
- Manufacturer, serial number and warranty information of pump station or collection tank.
- Isolation details for the site.
- Electrical details
- Customer Operation and Maintenance Manual and emergency contact details.

6.5.8 NON-STANDARD CONNECTIONS

Hunter Water does not yet approve the use of PSS for any other development other than a free hold property. Hunter Water may consider the use of PSS as part of a non-standard connection, such as body corporate, industrial or commercial connections, however all design requirements must be met.

APPENDIX 6A COSTS

Capital Cost to Developer

For all new developments, Developers are responsible for the design, supply and construction of all infrastructure required within the pressure sewerage system.

Hunter Water and the Developer may enter into an agreement for Hunter Water to supply and install the pressure sewer units on behalf of the developer at the time of customer connection. Hunter Water will provide to the developer at the initial meeting on pressure sewer systems or shortly thereafter when requested details of estimated capital costs. The costs will be from Hunter Water's supply contract and will be per-property cost figure for the capital cost and installation for the following supply:

- PSS wet well, pump and boundary kit.
- Spare parts; including 1 spare pump per 5% of pumps, minimum of one pump to be supplied. Spare stator based on 10% of the pumps to be supplied, this number may be higher where the system is to be located in coastal areas.
- Generic odour control system; any variation being considered by the designer must be discussed and agreed with by Hunter Water for the costs proposed.

The developer must also include in the NPV assessment the cost of epoxy lining the manhole that is the discharge location for the PSS with this work to be carried out as part of the contract for the reticulation work.

Community Costs (Capital and Operational)

The costs for the community are:

- Electricity usage determined for the system and proposed pump units. Refer to Operating and Maintenance Cost Estimating Guidelines for electricity costs and greenhouse gas abatement costs.
- Maintenance requirements based on 10% of units requiring annual maintenance.
- Pump replacement every 5 years, unless otherwise agreed with Hunter Water.
- Odour control system operation and maintenance costs.
- Network operation and maintenance costs.
- Costs to connect to the sewer system: \$3,000 per property for backlog.
- The costs to ensure their switchboard is capable of providing an interface for the PSS.
- Hunter Water connection cost for the PSS \$350 per property.