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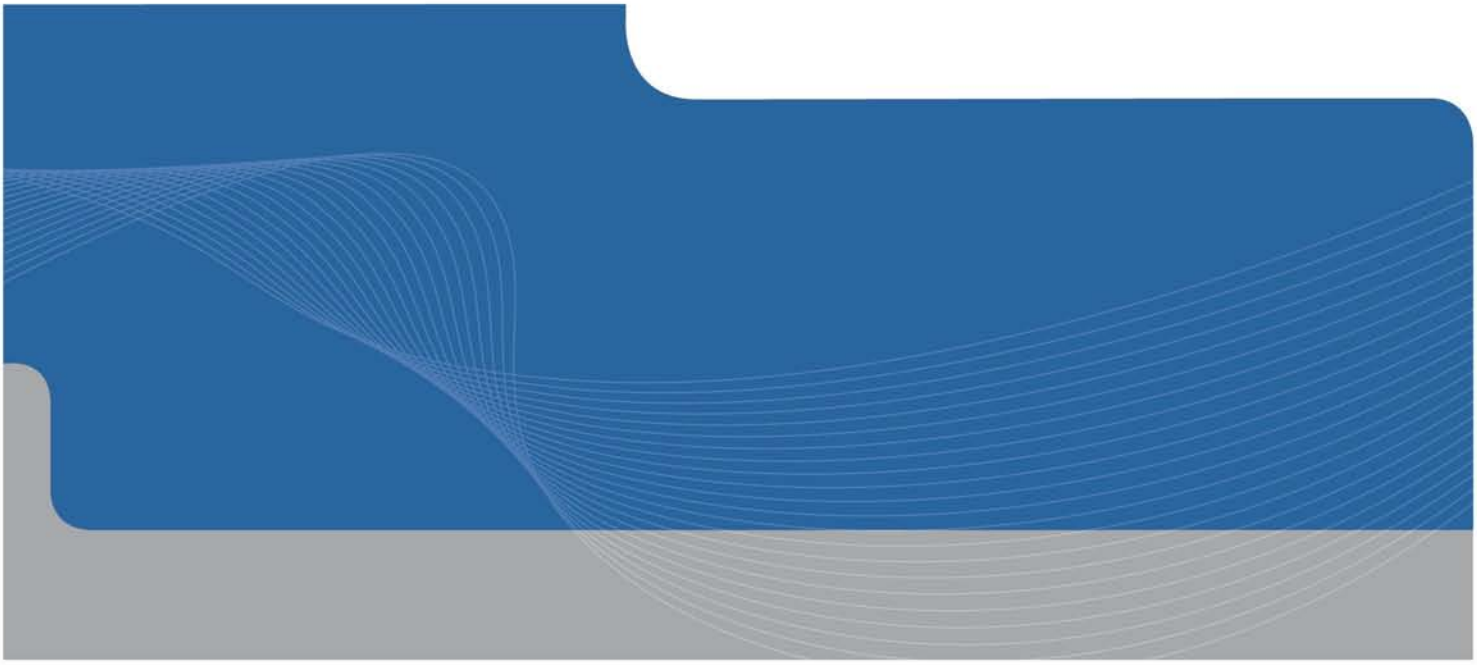
Miriam Vale Shire Council

Report for 1770 Sewerage Scheme

Pressure Sewerage System

December 2005



INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Background

Miriam Vale Shire Council is currently considering sewerage options for unsewered residences in the Town of Seventeen Seventy (1770). As part of the design process, others have prepared a design for a conventional sewerage system to service those lots. Council is concerned with the cost and impact of conventional sewerage construction, which requires the proclamation of easements. In addition, the conventional sewerage design has been met with objection from property owners over sewer construction and the associated clearing required.

GHD Pty Ltd has been commissioned by Miriam Vale Shire Council to review sewerage options for the Town of Seventeen Seventy to determine the most appropriate method of sewering the township. This review will be based on information provided by Council, and a site inspection conducted by GHD on Friday 4 November 2005.

The location of the alltoments to be serviced is shown in Figure 1 in Appendix C.

1.2 Project Objectives and Scope

The objectives of this report are to:

- Review the conventional sewerage system as provided by Miriam Vale Shire Council.
- Review alternate sewerage methods and their application to 1770.
- Compare the different sewerage methods to determine the most appropriate sewerage method for 1770

2. Design Criteria

2.1 Population

Based on the report “Seventeen Seventy Sewerage Scheme Proposed Seventeen Seventy to Agnes Water Link” provided by Miriam Vale Shire Council, the ultimate population is shown in Table 1.

Table 1 Ultimate Population for 1770

Connection Type	Equivalent Population
Commercial	
Captain Cook Holiday village	243.2 EP
Marina	32.0 EP
Toilet Blocks proposed near the marina	12.8 EP
Proposed Volunteer Marine Rescue Building	9.6 EP
QPWS office	6.4 EP
Shop and Proposed Restaurant	106.2 EP
Existing Toilet Blocks	12.8 EP
MVSC Caravan Park	291.2 EP
Proposed NR&M Motel	89.6 EP
Total Commercial	***803.8 EP***
Residential	
Allotments 130 x (3.2 + 2.4)	***728.0 EP***
Total Design Population	**1531.8 EP**

2.2 Flows

The average per capita flows have been calculated using an average dry weather flow of 225 L/EP/day and a peak flow of 1125 L/EP/day as listed in Natural Resources and Mines Guidelines. The resulting populations and flows are summarized in Table 2.

Table 2 Ultimate Design Flows for 1770

Development	Lots	Persons/Lot	Population	ADWF (KL/day)	Sewerage system to connect to
Commercial					
Captain Cook Holiday village	1	243.2	243.2	54.7	Outside area considered in this report
Marina	1	32.0	32.0	7.2	New system
Toilet Block near marina	1	12.8	12.8	2.89	New system
Proposed Volunteer Marine Rescue Building	1	9.6	9.6	2.2	New system
QPWS office	1	6.4	6.4	1.4	New system
Shop and proposed restaurant	1	106.2	106.2	23.9	New system
Existing Toilet Blocks	1	12.8	12.8	2.9	New system
MVSC Caravan Park	1	291.2	291.2	65.5	Existing sewers
Proposed NR&M Motel	1	89.6	89.6	20.2	Existing sewers
Total Commercial			***803.8***	180.9	
Residential					
Allotments	130	*5.6*	***728.0***	163.8	Combination
Total Design Population		**1531.8**	**1531.8**	344.7	

The flows presented in Table 2 are used in the design of conventional gravity systems. For the design of the pressure system, the actual design flows are dependent on the number of pumps operating simultaneously, and are given in Appendix D.

3. Existing Sewerage System

Approximately 32 allotments in 1770 are serviced by a conventional gravity sewerage system and pumped to a nearby treatment plant by a 100 mm diameter pressure main. The remainder of 1770 residents currently use on–site sewerage systems such as septic tanks.

4. Sewerage Collection System

4.1 General

There are a number of possible sewerage collection/reticulation systems that could feasibly be implemented at 1770. Each collection system has its own specific advantages and disadvantages that enable it, under certain conditions and site constraints, to be the most effective system. The potential collection systems that have been considered for the purposes of this report are:

- Conventional Gravity Reticulation
- Common Effluent Drainage
- Vacuum Sewerage Reticulation
- Pressure Sewerage System

The site constraints and conditions that are considered in the assessment of the above options include:

- Capital cost;
- Likely operation and maintenance costs;
- Suitability for hilly areas;
- Clearing and Easements required

4.2 Conventional Gravity Collection System

A conventional gravity collection system for 1770 was designed by others. However, Council has expressed some concern about the cost and environmental and social impacts of conventional sewerage construction. The conventional sewerage system designed by others requires easements for sewer construction and landowners are objecting to sewer construction and associated clearing. Also, the conventional sewage system is unable to provide a minimum 6 hour storage capacity during power outages as required by Council, due to the limited storage capacity available within the steeply graded reticulation system.

4.3 Common Effluent Drainage System

A common effluent drainage (CED) system is a reticulated system that collects the effluent from the existing septic tanks and conveys it to a sewage treatment plant. The reticulation of a common effluent drainage system is similar to that of a conventional gravity sewer system, however some requirements are relaxed due to the flow attenuation and solids reduction that occurs through the septic tanks before entering the collection system.

A common effluent drainage system may generally utilise a smaller sewer pipe, a shallower grade and larger spacing of the sewer manholes. These advantages are typically offset by the need to maintain and operate the existing septic tanks, the additional cost of installation of a septic tank for future development, the need to continue the sludge pump out and disposal services on a regular basis and the further potential requirement to upgrade the septic system to meet the conditions of the On-Site Sewerage Code.

Common effluent systems offer little advantage over conventional sewerage and do not address the landowners' concerns with the impacts of a gravity collection system associated with clearing for construction. Hence, this option will not be considered further.

4.4 Vacuum Sewerage Collection System

A vacuum sewerage system gravitates sewage from 2 to 4 properties to a vacuum collection pit adjacent to the properties. From there the sewage is introduced automatically to the vacuum system through a vacuum valve which, based on liquid level in the pit, will drain the pit and allow a controlled quantity of air to enter the vacuum main as a mixed column of air and sewage. The sewage is transported to the main pump station under a partial vacuum as a mixed air water column. Typically a saw tooth profiling of the vacuum main is used to ensure resuspension of the sewage in the column throughout the system. The vacuum mains discharge the sewage to the pressure vessel at the vacuum pump station. The pressure vessel is where the air and sewage are separated by settling and removed from the vessel respectively by the vacuum pumps and the sewage discharge pumps which would deliver the sewage to the treatment plant via a sewage pressure main.

Vacuum sewerage is not considered to be feasible for 1770, due to the site conditions. Vacuum sewerage systems require a gravity system to collect the sewage into the collections pits. Due to the topography of the site, these sewers would need to run in the alignment used in the conventional gravity system design. As a result, Vacuum sewerage collection systems would only partly address the landowners' concerns with the impacts of the construction of gravity sewers and will not be considered further.

4.5 Pressure Sewerage System

Pressure sewerage systems have been used extensively throughout the USA and Europe for about 30 years. These systems are now being installed in many locations in Australia, including Melbourne, Sydney and Wagga Wagga. The systems are a cost effective solution for small areas and where conventional systems are impractical such as rocky, hilly, flat and/or water charged terrain. This system requires only shallow trenches and relatively smaller (40 mm to 200 mm) diameter piping, within both the property boundary and street. The system can be installed at any site, regardless of the terrain, subject to the head limits of the pumping equipment (typically 45 m).

At the heart of the system is a prefabricated plastic pit that provides wastewater storage, grinding and pumping in a single self-contained unit at the location of each property. The grinder pump in the pit discharges wastewater from the property by a 32 mm inside diameter polyethylene pipeline to common pressure mains in the streets. The combined pressure mains discharge to a conventional submersible pump station for pumping to a treatment plant. However, because all incoming sewage is pumped, the pump station may not require as deep a wet well that is normally required to accommodate gravity sewers.

It would be proposed that Miriam Vale Shire Council would own and operate the household pump unit and the pipework between the pump and the pressure reticulation mains. The unit is wired to the household power supply, and the property owner is responsible for the power costs involved. Installation of this type of system significantly reduces disruption to the surrounding landscape. Pressure sewerage mains can be located along ridges on road reserves, servicing properties on either side of the road.

4.6 Preferred sewerage collection system option

As Council is proposing to provide water reticulation, opportunity exists for construction of water and pressure sewerage mains in a common trench. The pressure main system has been designed with the proposed water reticulation layout in mind. Layout plans of the proposed pressure sewage system are provided in Figures 1 to 5 in Appendix C.

The proposed pressure sewage system includes pumping the sewage along the pipeline route to the reservoir site. This route is marginal in terms of pump heads, but options exist through minor main relocation to minimise the pump duties, or a minor pump station could be implemented if necessary, with some associated saving in pipe sizing. These matters can be addressed at the detail design stage.

4.6.1 Pump Units

The pump units used in pressure sewer systems comprising a grinder type pump, pump well and associated electrics and controls, were originally designed in the US and are available from a limited number of suppliers in Australia. Pump units are supplied either with single pumpsets (simplex) or two pumpsets (duplex).

The grinder pumps are suitable to reduce particle sizes in domestic sewage to allow it to be discharged through the 32 mm inside diameter pressure mains.

The pressure sewerage system as proposed in this report is based on pump wells with a minimum 1,500L storage capacity. This is equivalent to two days storage for a typical residence. Thus no overflow should occur from these systems for less than two days normal usage. This would allow for provision of emergency pump out of the systems by connection of portable generators to the pumping units. A connection point for emergency power supply is normally provided at the pump control units for this purpose. The precise sizing of the proposed pump wells would be required to be determined in consultation with Council at the detail design stage.

4.6.2 Pump Unit Selection

Domestic Connections

Single pump units are specifically designed to accommodate the flows from a typical domestic house, with a typical discharge capacity of 0.5 to 0.8 L/s against a head of 40 to 45 metres. This includes a holiday house which may be subject to increased occupancy compared with a permanently occupied house. It does not however provide for large additional flows such as backwash water from swimming pools. However, an increased storage tank could be supplied to accommodate such flows.

Accordingly, each domestic house connected to the pressure system will be via a single pump (simplex) unit.

Major Customer Pump Unit Selection

As shown in Table 2, the flow high flow rates are expected in the system from the proposed restaurant and shops. The shop and restaurant is expected to produce a Peak Wet Weather Flow (PWWF) of 1.4 L/s, which is too large for a single pump (simplex) unit. Accordingly, the connection of the restaurant and shops to the pressure system would be via two dual pump (duplex) units. In each duplex unit, both operational pumps would operate in parallel at a nominal pump rate of 0.8 L/s and must be capable of continuous operation when “called” to pump. Larger storage wells would also be incorporated into such locations.

4.6.3 Grinder Pump Operation

As all pump units servicing connections to the pressure sewer network have a pump well providing some balance storage, the actual operation of the pumps will occur on a random basis depending on the levels in each storage well. The supplier of the pump units have modeled this behaviour, and have developed statistical relationships for the number of pumps likely to be operating simultaneously. One of these suppliers, Aquatec Fluid Systems, has developed a design spreadsheet to design pressure systems. This spreadsheet was used for the design of the pressure system, and the results are presented in Appendix D.

However, if multiple simultaneous pump starts occur, then the pressure units are available with an approved high pressure shut off switch and will delay the start of a pump if high pressures in the combined rising main are detected (either from closed valves or multiple simultaneous pump operation). Under these conditions the pump start is delayed until system pressures are reduced, thus protecting the pumps and the combined pressure pipelines. This option would be recommended.

4.6.4 Odour

The average weighted hours to discharge as calculated for the system in Appendix D indicates that the sewage in the pressure system will be relatively fresh. However, by their nature, detention times in pressure sewerage systems are generally higher than for conventional gravity systems, with increased potential for sulphide generation. The impact on odour generation will also be dependent to some degree on the effects of dilution by sewage from other sources (ie existing sewered areas). Chemical dosage into the system has the potential to reduce or minimise, but not eliminate, sulphide generation, as well as consideration of pressure main configuration at the detail design stage. These issues will be required to be addressed at the time of detail design.

5. Comparison of Reticulation Options

5.1 Capital Cost Estimates

Preliminary estimates of capital cost have been assessed for collection system options for comparative purposes only, based on indicative location and sizing of reticulation systems, typical rates for similar systems elsewhere and indicative sewerage rates derived in consultation with Council Officers.

The comparative cost estimates are detailed in Appendices A and B and summarized in Table 3.

Table 3 Sewerage Reticulation Costs

Sewerage System	Estimated Capital Cost	Annual Operational and Maintenance Cost
Conventional Gravity Collection System	$ 3,564,000*	$ 24,724
Pressure Sewerage System	$ 2,281,000	$ 29,086
Pressure Sewerage System installed in conjunction with water reticulation	$ 1,981,000	$ 29,086

* Based on revised cost estimate of $2,492,000 as supplied by Council plus 10% on-costs and 30% contingencies.

5.2 O & M Cost Estimates

Operation and maintenance cost estimates for the sewerage reticulation options are detailed in Appendix A and summarized in Table 3.

The comparative present value of the strategy options considered have also been assessed, based on discount rates of 4, 6 and 8% and a nominal assessment period of 20 years. The outcome of this assessment is set out in Table 4

Table 4 Comparative Present Value of Sewerage Reticulation Options

Discount Rate	**4%**	**6%**	**8%**
Period of Assessment		20 years	
Conventional Gravity Collection System Comparative Capital Cost	$ 3,564,000	$ 3,564,000	$ 3,564,000
NPV of O&M Costs	$ 336,014	$ 283,588	$ 242,749
Total Comparative Costs	**$ 3,900,014**	**$ 3,847,588**	**$ 3,806,749**
Pressure Sewerage System Comparative Capital Cost	$ 2,281,000	$ 2,281,000	$ 2,281,000
NPV of O&M Costs	$ 395,287	$ 333,613	$ 285,570

Discount Rate	4%	6%	8%
Total Comparative Costs	**$ 2,676,287**	**$ 2,614,613**	**$ 2,566,570**
Pressure Sewerage System installed in conjunction with Water Supply Comparative Capital Cost	$ 1,981,000	$ 1,981,000	$ 1,981,000
NPV of O&M Costs	$ 395,287	$ 333,613	$ 285,570
Total Comparative Costs	**$ 2,376,287**	**$ 2,314,613**	**$ 2,266,570**

For the purpose of comparing the two systems, the electrical costs were not considered as they were assumed to be approximately equal for the two systems. Since the capital cost has such a large impact on the NPV, the electrical cost for the pressure system would have to be twice that of the conventional system, which is not the case, for the conventional system to have a lower NPV.

5.3 Preferred Reticulation Option

Based on the capital and annual cost assessment undertaken above, the pressure sewerage system is the most cost effective.

The pressure sewerage system can be installed in the same trenches as the proposed water reticulation system with appropriate markings and separated to distinguish between the two systems. This will result in the least impact to the area during the construction of the sewerage system and will eliminate the need for easements through landholder boundaries and should result in slightly lower overall construction costs due to reduced excavation and reinstatement. The pressure sewerage system is subject to ongoing operation of the pressure pump units by the individual householders (typically of the order of $25 per unit annually) and maintenance of the units by the Council.

The conventional sewerage system will require a larger outlay to install the system, and will result in higher net present value costs for Council even though operation and maintenance costs are marginally lower than the pressure system. The clearing required to install this system will have a greater environmental and social impact on the region than the installation of a pressure system. Also, a minimum storage capacity of 6 hours under power failure conditions cannot be readily achieved for a conventional sewerage system.

The preferred option for the Town of 1770 is the pressure sewerage system.

6. Recommendations

It is recommended that Council adopt a pressure sewerage system as the most appropriate collection system option for 1770.

Appendix A

Cost Estimates

Pressure Sewerage System Cost Estimate

Operation and Maintenance Cost Estimate

Net Present Value Analysis

Miriam Vale Shire Council

Seventeen Seventy Sewerage Scheme
Order of Cost Estimate (105 lots)
Pressure Sewage Collection System

(All amounts exclusive of GST)

Item	Description	Qty	Unit	Rate $	Amount $
1	**Pressure Main**				
1.1	50 mm diameter PN12 PE80	877	m	75	65 775
1.2	63 mm diameter PN12 PE80	782	m	75	58 650
1.3	75 mm diameter PN12 PE80	207	m	95	19 665
1.4	90 mm diameter PN12 PE80	1258	m	105	132 090
1.5	Miscellaneous fittings, air valves, valves, scours		Item		30 000
2	**Pressure House Pumps**				
2.1	Single pump installations complete	104	No.	9 500	988 000
2.2	Double pump installations complete	2	No.	15 500	31 000
2.3	Allotment connection	105	No.	750	78 750
	SUB TOTAL				**1 403 930**
4	**Miscellaneous Works**				
4.1	Road restoration, relocation of services, etc.		15%		210 590
4.2	Engineering, Survey, Council Oncosts		10%		140 393
4.3	Contingencies		30%		526 474
	SUB TOTAL				**877 456**
	TOTAL				**$2,281,000**

* Note: Based on recent pricing for similar scheme at Whitsunday Shire.

Miriam Vale Shire Council

Seventeen Seventy Sewerage Scheme
Order of Cost Estimate (105 lots)

Pressure Sewage Collection System
Installed in conjunction with the water supply system.

(All amounts exclusive of GST)

Item	Description	Qty	Unit	Rate $	Amount $
1	**Pressure Main**				
1.1	50 mm diameter PN12 PE80 constructed with water main	827	m	23	18 608
1.2	50 mm diameter PN12 PE80	50	m	75	3 750
1.3	63 mm diameter PN12 PE80 constructed with water main	782	m	23	17 595
1.4	75 mm diameter PN12 PE80 constructed with water main	207	m	29	5 900
1.5	90 mm diameter PN12 PE80 constructed with water main	1178	m	32	37 107
1.6	90 mm diameter PN12 PE80	80	m	105	8 400
1.7	Miscellaneous fittings, air valves, valves, scours		Item		30 000
2	**Pressure House Pumps**				
2.1	Single pump installations complete	104	No.	9 500	988 000
2.2	Double pump installations complete	2	No.	15 500	31 000
2.3	Allotment connection	105	No.	750	78 750
	SUB TOTAL				**1 219 109**
4	**Miscellaneous Works**				
4.1	Road restoration, relocation of services, etc.		15%		182 866
4.2	Engineering, Survey, Council Oncosts		10%		121 911
4.3	Contingencies		30%		457 166
	SUB TOTAL				**761 943**
	TOTAL				**$1,981,000**

* Note: Based on recent pricing for similar scheme at Whitsunday Shire.

Miriam Vale Shire Council

Seventeen Seventy Sewerage Scheme
Sewerage Systems
Operation and Maintenance Cost Estimate

(All amounts exclusive of GST)

Item	Description	Qty	Unit	Rate $	Amount $
	CONVENTIONAL GRAVITY COLLECTION SYSTEM				
1	**Maintenance**				
1.1	Civil Works	1 638 441		0.50%	8 192
1.2	Pump Station	657 917		1.00%	6 579
1.3	Pump Equipment	165 104		3.00%	4 953
2	**Operation**				
	Contingency (25%)				5 000
	TOTAL				**24 724**
	PRESSURE SEWERAGE SYSTEM				
1	**Maintenance**				
1.1	Civil Works	276 180		0.50%	1 381
1.2	Pump Wells	548 875		1.00%	5 489
1.3	Pump Equipment	548 875		3.00%	16 466
2	**Operation**				
	Contingency (25%)				5 750
	TOTAL				**29 086**

Client:	Miriam Vale	**Job No.:**	42 13675	**Sheet:**	1 of	1
Project:	1770 sewerage	**Calcs by:**	BVG	**Date:**	21/11/2005	
Subject:	NVP Analysis	**Checked by:**		**Date:**		

	Conventional Gravity System			Pressure System			Pressure System constructed in conjunction with Water Supply		
Infrastructure Costs	$ 3,564,000	$ 3,564,000	$ 3,564,000	$ 2,281,000	$ 2,281,000	$ 2,281,000	$ 1,981,000	$ 1,981,000	$ 1,981,000
Operation and Maintenance p.a	$ 24,724	$ 24,724	$ 24,724	$ 29,086	$ 29,086	$ 29,086	$ 29,086	$ 29,086	$ 29,086
Rate of inflation/ interest rate	4%	6%	8%	4%	6%	8%	4%	6%	8%
Operational Period	20	20	20	20	20	20	20	20	20
NPV for Operational Period	$ 3,900,014	$ 3,847,588	$ 3,806,749	$ 2,676,287	$ 2,614,613	$ 2,566,570	$ 2,376,287	$ 2,314,613	$ 2,266,570
NPF of Operation & Maintenance	$ 336,014	$ 283,588	$ 242,749	$ 395,287	$ 333,613	$ 285,570	$ 395,287	$ 333,613	$ 285,570

Appendix B

Cost Estimate for Conventional Sewerage System

Miriam Vale Shire Council

Seventeen Seventy Sewerage Scheme
Order of Cost Estimate (105 lots)
Gravity Collection System

(All amounts exclusive of GST)

Item	Description	Qty	Unit	Rate $	Amount $
1	**Revised Cost Estimate**		Item		2 492 000
2	**Miscellaneous Works**				
2.1	Engineering, Survey, Council Oncosts		10%		249 200
2.2	Contingencies		30%		822 360
	TOTAL				**$3,564,000**

* Note: Revised cost estimate provided by Council

Appendix C

Figures

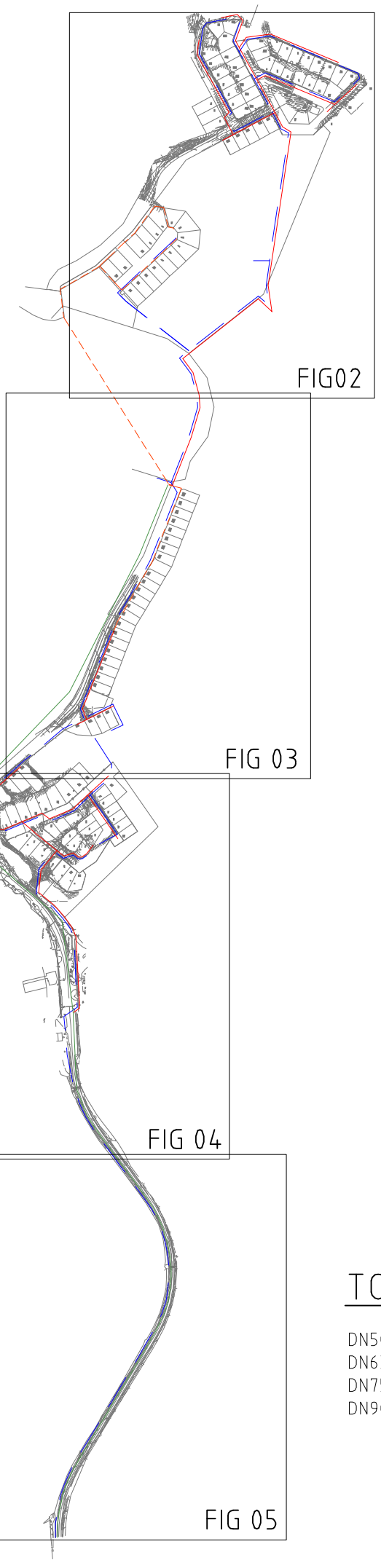
LEGEND

PROPOSED LOW PRESSURE SEWER NETWORK

PROPOSED WATER MAIN

EXISTING GRAVITY MAIN

EXISTING RISING MAIN



TOTAL PIPE LENGTHS

DN50 - 876.569m
DN63 - 781.088m
DN75 - 206.895m
DN90 - 1257.108m

0 100 200 300 400 500m

SCALE 1:10000 AT ORIGINAL SIZE

GHD MANAGEMENT ENGINEERING ENVIRONMENT

FILE : 42-13675-FIG001.dwg PRINTED : 28/11/2005

MIRIAM VALE SHIRE COUNCIL

REVIEW OF SEWERAGE SCHEME OPTIONS FOR 1770 PRESSURE SEWERAGE SYSTEM

COMPILATION PLAN

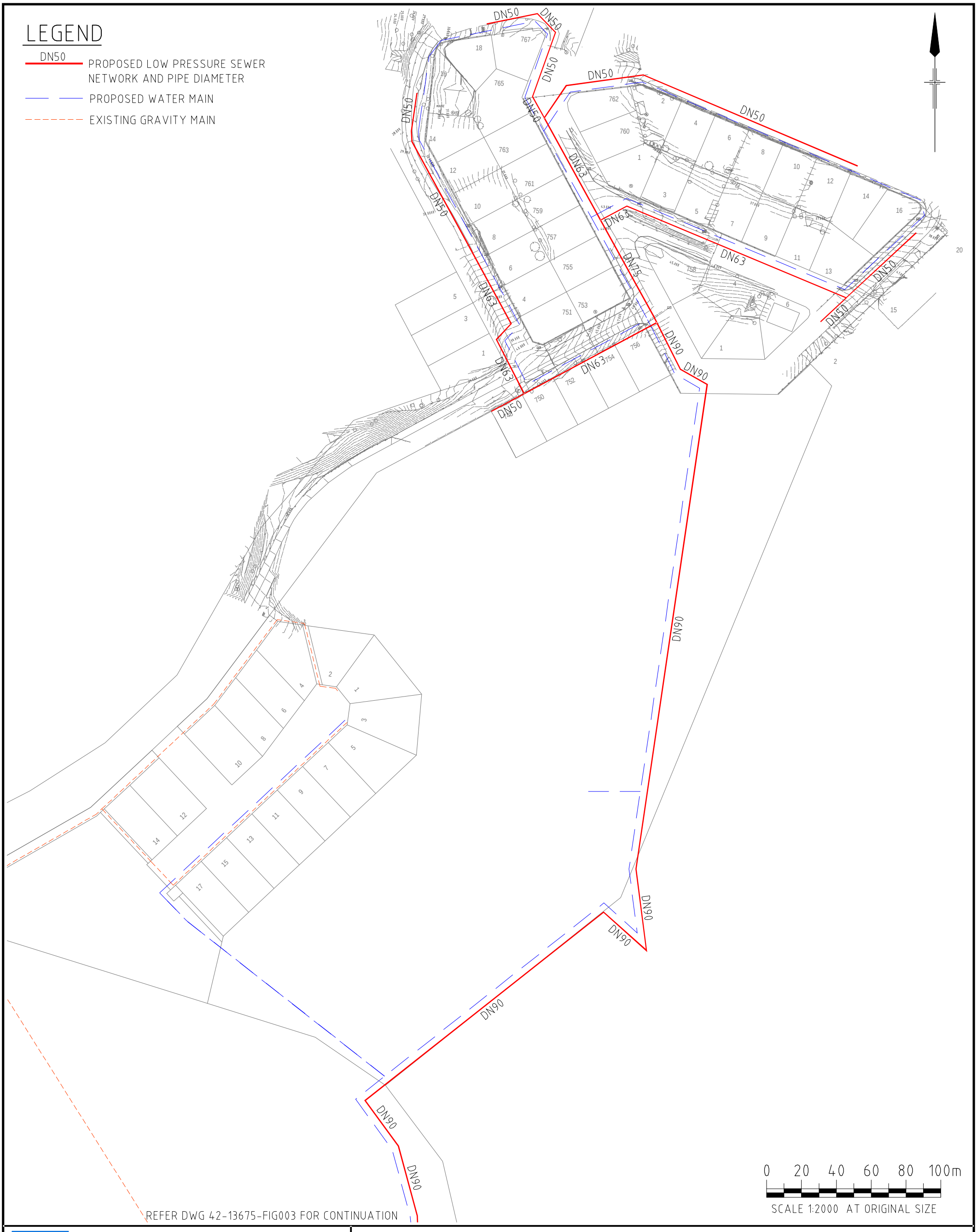
FIGURE 01

LEGEND

DN50 — PROPOSED LOW PRESSURE SEWER NETWORK AND PIPE DIAMETER

PROPOSED WATER MAIN

EXISTING GRAVITY MAIN



GHD MANAGEMENT ENGINEERING ENVIRONMENT

FILE : 42-13675-FIG002.dwg PRINTED : 28/11/2005

MIRIAM VALE SHIRE COUNCIL

REVIEW OF SEWERAGE SCHEME OPTIONS FOR 1770 PRESSURE SEWERAGE LAYOUT

SHEET 1 of 4

FIGURE 02

LEGEND

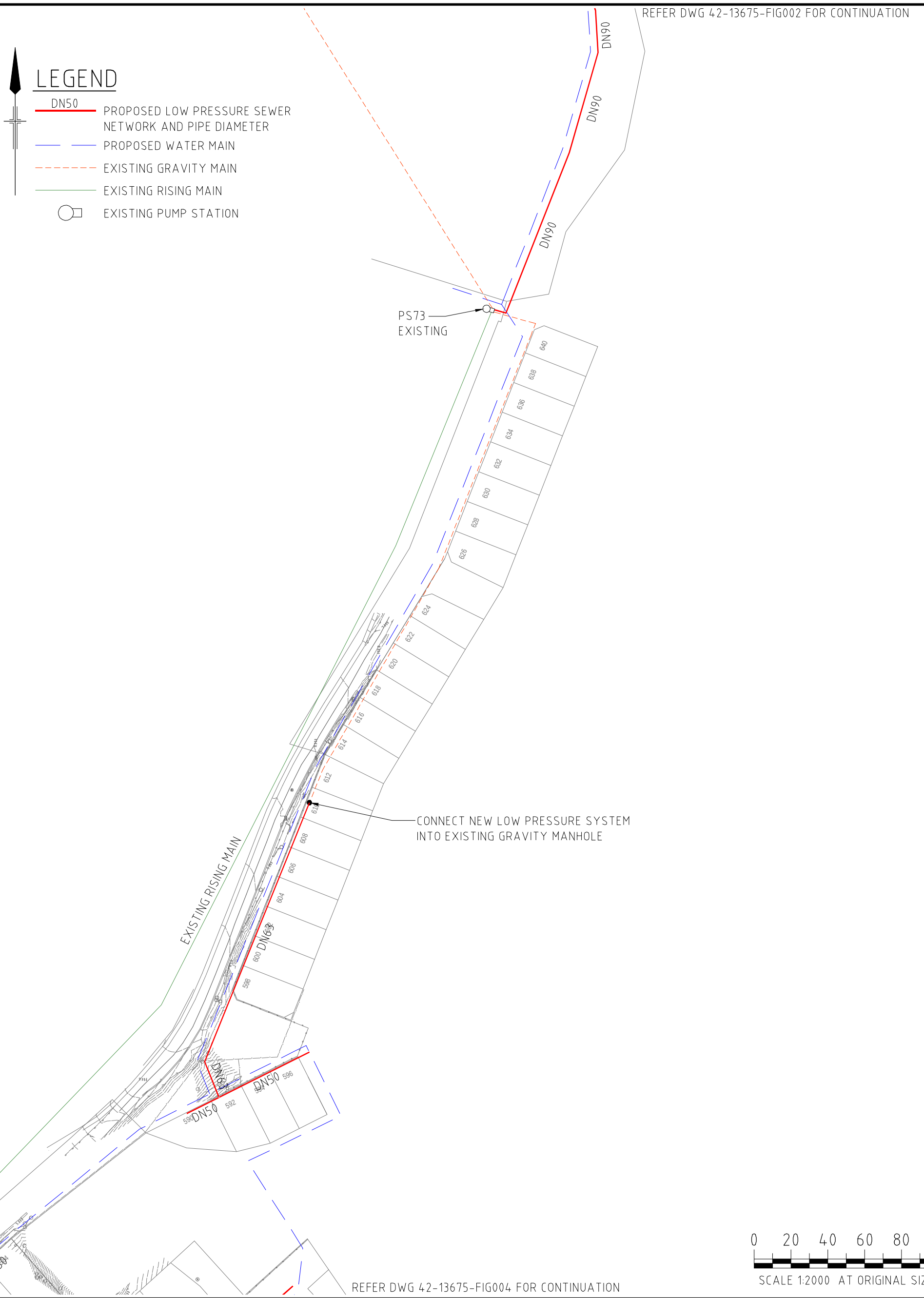
DN50 — PROPOSED LOW PRESSURE SEWER NETWORK AND PIPE DIAMETER

PROPOSED WATER MAIN

EXISTING GRAVITY MAIN

EXISTING RISING MAIN

EXISTING PUMP STATION



0 20 40 60 80 100m

SCALE 1:2000 AT ORIGINAL SIZE

GHD MANAGEMENT ENGINEERING ENVIRONMENT

FILE : 42-13675-FIG003.dwg PRINTED : 28/11/2005

MIRIAM VALE SHIRE COUNCIL

REVIEW OF SEWERAGE SCHEME OPTIONS FOR 1770 PRESSURE SEWERAGE LAYOUT

SHEET 2 of 4

FIGURE 03

REFER DWG 42-13675-FIG003 FOR CONTINUATION

LEGEND

- DN50 — PROPOSED LOW PRESSURE SEWER NETWORK AND PIPE DIAMETER
- PROPOSED WATER MAIN
- EXISTING RISING MAIN

0 20 40 60 80 100m

SCALE 1:2000 AT ORIGINAL SIZE

REFER DWG 42-13675-FIG005 FOR CONTINUATION

GHD MANAGEMENT ENGINEERING ENVIRONMENT

FILE : 42-13675-FIG004.dwg PRINTED : 28/11/2005

MIRIAM VALE SHIRE COUNCIL

REVIEW OF SEWERAGE SCHEME OPTIONS FOR 1770 PRESSURE SEWERAGE LAYOUT

SHEET 3 of 4

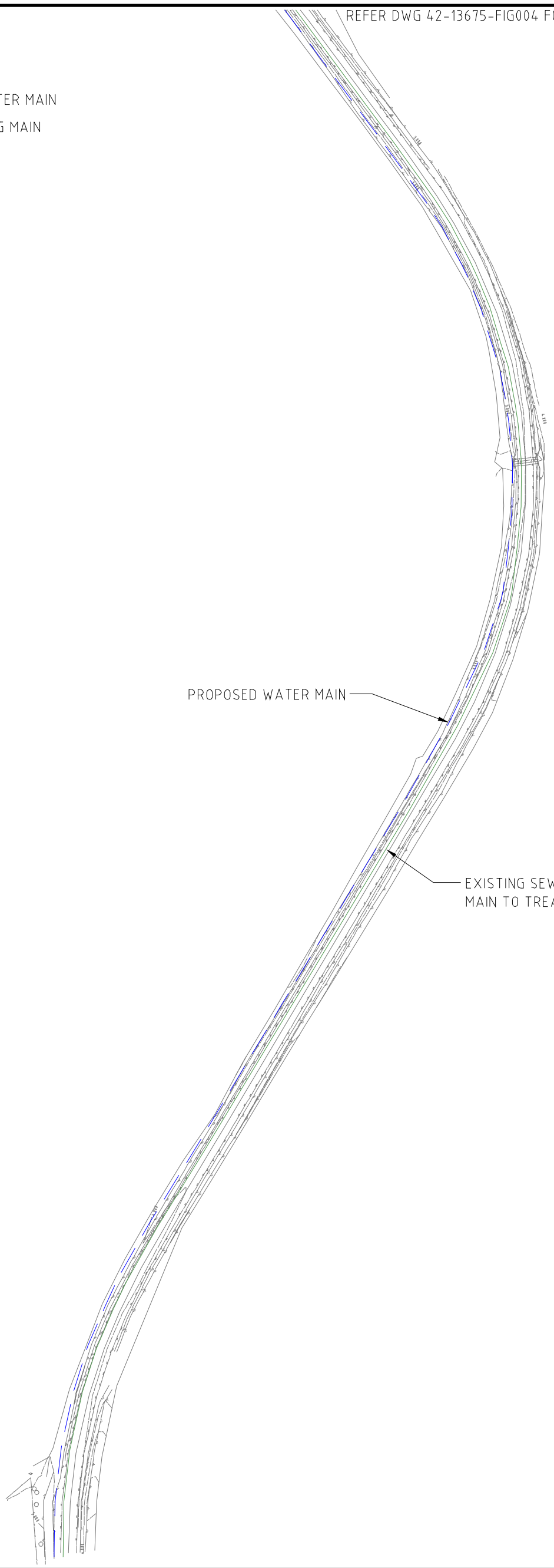
FIGURE 04

REFER DWG 42-13675-FIG004 FOR CONTINUATION

LEGEND

PROPOSED WATER MAIN

EXISTING RISING MAIN



0 20 40 60 80 100m

SCALE 1:2000 AT ORIGINAL SIZE

MANAGEMENT
ENGINEERING
ENVIRONMENT

FILE : 42-13675-FIG005.dwg PRINTED : 28/11/2005

MIRIAM VALE SHIRE COUNCIL

REVIEW OF SEWERAGE SCHEME OPTIONS FOR 1770 PRESSURE SEWERAGE LAYOUT

SHEET 4 of 4

FIGURE 05

Appendix D

Aquatec design spreadsheet

1 2 3 4 6 7 8 9 10 11 12 13 14 16 17 18 20

CALCULATION SHEET

PRELIMINARY SIZING ONLY
NOT FOR CONSTRUCTION

1. This Design Aid has been prepared for the development of preliminary pipe sizing only.
2. Designers should satisfy themselves as to the adequacy & application of results from use of this Design Aid
3. Aquatec Fluid Systems does not represent that this Design Aid contains sufficient analysis for the preparation of Designs for Construction of works.

PIPE CLASS & MATERIAL - PN12.5 PE80

AQUATEC FLUID SYSTEMS

Project Location: 1770 - Stage 2
Project Name: Low Pressure Sewerage System for 1770

PIPING SUMMARY DATA	
(Excludes laterals)	
Pipe Size	Total Length (m)
16	0
20	0
25	0
32	0
40	0
50	76
63	164
75	0
90	0
110	0
125	0
140	0
160	0
180	0
200	0
225	0
250	0
280	0
315	0
355	0

Haz W Const: 130.0

Data Input Cells
Optional Data Input Cells
Data Reference from Data Sheet

SIMPLIFIED METHOD: AN + B = Q
A = 0.05250
B = 0.80
Litres/Tenement/Day = 1512

Weighted Average HRS to Discharge = 0.28

PIPE SEGMENT NUMBER	FLOWS INTO SEGMENT	NUMBER OF (ET)	ACCUM ET CONNECTED	LOW PUMP or U/S in Segment	CONTROL DATUM of Segment	PIPE LENGTH (METRE)	DESIGN FLOW (L/S)	PIPE SIZE (Nom. Bore)	PIPE ID (MM)	DESIGN VELOCITY (M/S)	FRICTION FACTOR (M/100M)	FR LOSS THIS PIPE (METRE)	DS HGL (METRE)	US HGL (METRE)	PUMP HEAD (METRE)	PIPE SEGMENT NUMBER	SEGMENT RETENTION TIME	Max HRS TO DISCHARGE
1	2	5	5	18.0	18.0	56.0	1.06	50	40.4	0.83	2.41	1.35	17.98	19.32	1.35	1	0.23	0.62
2	3	4	12	9.3	9.3	104.0	1.43	63	51.0	0.70	1.34	1.40	9.41	10.81	1.53	2	0.28	0.40
3	0	5	17	8.6	8.3	60.0	1.69	63	51.0	0.83	1.83	1.10	8.31	9.41	0.82	3	0.11	0.11
4	2	3	3	17.7	18.0	20.0	0.96	50	40.4	0.75	1.99	0.40	17.98	18.37	0.71	4	0.14	0.53
5	0	0	0	0.0	0.0	0.0												
6	0	0	0	0.0	0.0	0.0												
7	0	0	0	0.0	0.0	0.0												
8	0	0	0	0.0	0.0	0.0												
9	0	0	0	0.0	0.0	0.0												
10	0	0	0	0.0	0.0	0.0												
11	0	0	0	0.0	0.0	0.0												
12	0	0	0	0.0	0.0	0.0												
13	0	0	0	0.0	0.0	0.0												
14	0	0	0	0.0	0.0	0.0												
15	0	0	0	0.0	0.0	0.0												
16	0	0	0	0.0	0.0	0.0												
17	0	0	0	0.0	0.0	0.0												
18	0	0	0	0.0	0.0	0.0												
19	0	0	0	0.0	0.0	0.0												
20	0	0	0	0.0	0.0	0.0												
21	0	0	0	0.0	0.0	0.0												
22	0	0	0	0.0	0.0	0.0												
23	0	0	0	0.0	0.0	0.0												
24	0	0	0	0.0	0.0	0.0												

1 2 3 4 6 7 8 9 10 11 12 13 14 16 17 18 20

CALCULATION SHEET

PRELIMINARY SIZING ONLY
NOT FOR CONSTRUCTION

1. This Design Aid has been prepared for the development of preliminary pipe sizing only.
2. Designers should satisfy themselves as to the adequacy & application of results from use of this Design Aid
3. Aquatec Fluid Systems does not represent that this Design Aid contains sufficient analysis for the preparation of Designs for Construction of works.

PIPE CLASS & MATERIAL - PN12.5 PE80

AQUATEC FLUID SYSTEMS

Project Location: 1770 - Stage 2
Project Name: Low Pressure Sewerage System for 1770

PIPING SUMMARY DATA (Excludes laterals)	
Pipe Size	Total Length (m)
16	0
20	0
25	0
32	0
40	0
50	355
63	210
75	150
90	360
110	0
125	0
140	0
160	0
180	0
200	0
225	0
250	0
280	0
315	0
355	0

Haz W Const: 130.0

Data Input Cells
Optional Data Input Cells
Data Reference from Data Sheet

SIMPLIFIED METHOD: AN + B = Q
A = 0.05250
B = 0.80
Litres/Tenement/Day = 1512

Weighted Average HRS to Discharge = 1.01

PIPE SEGMENT NUMBER	FLOWS INTO SEGMENT	NUMBER OF (ET)	ACCUM ET CONNECTED	LOW PUMP or U/S in Segment	CONTROL DATUM of Segment	PIPE LENGTH (METRE)	DESIGN FLOW (L/S)	PIPE SIZE (Nom. Bore)	PIPE ID (MM)	DESIGN VELOCITY (M/S)	FRICTION FACTOR (M/100M)	FR LOSS THIS PIPE (METRE)	DS HGL (METRE)	US HGL (METRE)	PUMP HEAD (METRE)	PIPE SEGMENT NUMBER	SEGMENT RETENTION TIME	Max HRS TO DISCHARGE
1	2	5	5	4.4	4.9	105.0	1.06	50	40.4	0.83	2.41	2.53	22.51	25.03	20.67	1	0.43	1.58
2	3	4	9	4.9	7.8	90.0	1.27	63	51.0	0.62	1.08	0.97	21.53	22.51	17.60	2	0.32	1.15
3	4	5	14	7.8	19.7	120.0	1.54	63	51.0	0.75	1.53	1.84	19.70	21.53	13.77	3	0.28	0.83
4	5	3	37	16.1	16.5	80.0	2.74	90	73.1	0.65	0.78	0.62	16.47	17.09	1.04	4	0.14	0.55
5	6	1	45	5.1	4.0	100.0	3.16	90	73.1	0.75	1.01	1.01	5.13	6.14	1.09	5	0.15	0.40
6	0	2	47	3.2	3.2	180.0	3.27	90	73.1	0.78	1.07	1.93	3.20	5.13	1.93	6	0.26	0.26
7	8	3	3	33.7	41.7	60.0	0.96	50	40.4	0.75	1.99	1.19	41.74	42.93	9.28	7	0.41	1.30
8	4	10	20	19.7	19.7	150.0	1.85	75	60.9	0.64	0.91	1.37	19.70	21.06	1.37	8	0.35	0.89
9	8	7	7	33.8	41.7	90.0	1.17	50	40.4	0.91	2.87	2.58	41.74	44.32	10.52	9	0.26	1.16
10	5	7	7	4.1	16.5	100.0	1.17	50	40.4	0.91	2.87	2.87	16.47	19.33	15.20	10	0.29	0.69
11	0	0	0	0.0	0.0	0.0												
12	0	0	0	0.0	0.0	0.0												
13	0	0	0	0.0	0.0	0.0												
14	0	0	0	0.0	0.0	0.0												
15	0	0	0	0.0	0.0	0.0												
16	0	0	0	0.0	0.0	0.0												
17	0	0	0	0.0	0.0	0.0												
18	0	0	0	0.0	0.0	0.0												
19	0	0	0	0.0	0.0	0.0												
20	0	0	0	0.0	0.0	0.0												
21	0	0	0	0.0	0.0	0.0												
22	0	0	0	0.0	0.0	0.0												
23	0	0	0	0.0	0.0	0.0												
24	0	0	0	0.0	0.0	0.0												

1 2 3 4 6 7 8 9 10 11 12 13 14 16 17 18 20

CALCULATION SHEET

PRELIMINARY SIZING ONLY
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1. This Design Aid has been prepared for the development of preliminary pipe sizing only.
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PIPE CLASS & MATERIAL - PN12.5 PE80

PIPING SUMMARY DATA

(Excludes laterals)

Pipe Size	Total Length (m)
16	0
20	0
25	0
32	0
40	0
50	525
63	393
75	75
90	785
110	0
125	0
140	0
160	0
180	0
200	0
225	0
250	0
280	0
315	0
355	0

Haz W Const: 130.0

Project Location: 1770 - Stage 3
Project Name: Low Pressure Sewerage System for 1770

Data Input Cells
Optional Data Input Cells
Data Reference from Data Sheet

SIMPLIFIED METHOD: AN + B = Q
A = 0.05250
B = 0.80
Litres/Tenement/Day = 1512

Weighted Average HRS to Discharge = 1.33

PIPE SEGMENT NUMBER	FLOWS INTO SEGMENT	NUMBER OF (ET)	ACCUM ET CONNECTED	LOW PUMP or U/S in Segment	CONTROL DATUM of Segment	PIPE LENGTH (METRE)	DESIGN FLOW (L/S)	PIPE SIZE (Nom. Bore)	PIPE ID (MM)	DESIGN VELOCITY (M/S)	FRICTION FACTOR (M/100M)	FR LOSS THIS PIPE (METRE)	DS HGL (METRE)	US HGL (METRE)	PUMP HEAD (METRE)	PIPE SEGMENT NUMBER	SEGMENT RETENTION TIME	Max HRS TO DISCHARGE
1	2	8	8	29.1	34.8	200.0	1.22	50	40.4	0.95	3.11	6.22	83.67	89.89	60.80	1	0.51	1.76
2	3	5	16	32.4	37.7	60.0	1.64	63	51.0	0.80	1.73	1.04	82.63	83.67	51.31	2	0.12	1.26
3	4	3	32	37.7	46.9	75.0	2.48	75	60.9	0.85	1.57	1.18	81.46	82.63	44.96	3	0.11	1.13
4	5	3	51	47.5	77.3	345.0	3.48	90	73.1	0.83	1.21	4.16	77.30	81.46	33.97	4	0.45	1.03
5	0	0	51	7.0	7.0	440.0	3.48	90	73.1	0.83	1.21	5.30	7.00	12.30	5.30	5	0.57	0.57
6	2	3	3	30.3	34.8	110.0	0.96	50	40.4	0.75	1.99	2.18	83.67	85.86	55.55	6	0.75	2.00
7	8	3	3	33.7	44.0	60.0	0.96	50	40.4	0.75	1.99	1.19	84.93	86.12	52.47	7	0.41	1.94
8	3	9	13	35.3	37.7	160.0	1.48	63	51.0	0.73	1.43	2.30	82.63	84.93	49.60	8	0.40	1.53
9	8	1	1	46.3	44.0	25.0	0.85	50	40.4	0.67	1.60	0.40	84.93	85.33	39.03	9	0.51	2.04
10	11	5	5	29.3	30.3	110.0	1.06	50	40.4	0.83	2.41	2.65	84.04	86.69	57.41	10	0.45	1.90
11	12	6	11	31.7	42.2	85.0	1.38	63	51.0	0.67	1.25	1.06	82.98	84.04	52.32	11	0.25	1.45
12	4	4	16	41.0	46.9	88.0	1.64	63	51.0	0.80	1.73	1.52	81.46	82.98	41.96	12	0.18	1.20
13	12	1	1	41.0	42.2	20.0	0.85	50	40.4	0.67	1.60	0.32	82.98	83.30	42.28	13	0.41	1.61
14	0	0	0	0.0	0.0	0.0												
15	0	0	0	0.0	0.0	0.0												
16	0	0	0	0.0	0.0	0.0												
17	0	0	0	0.0	0.0	0.0												
18	0	0	0	0.0	0.0	0.0												
19	0	0	0	0.0	0.0	0.0												
20	0	0	0	0.0	0.0	0.0												
21	0	0	0	0.0	0.0	0.0												
22	0	0	0	0.0	0.0	0.0												
23	0	0	0	0.0	0.0	0.0												
24	0	0	0	0.0	0.0	0.0												

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