



AGNES WATER & TOWN OF 1770 WATER INTEGRATED WATER MANAGEMENT STRATEGY

MIRIAM VALE SHIRE COUNCIL

FINAL REPORT

REVISION 2

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1.0 EXECUTIVE SUMMARY

The aim of this report is to outline an overall water resource management strategy which has the follows objectives in relation to providing the towns of Agnes Water and 1770 with water and sewerage services.

- To provide the towns of Agnes Water and 1770 with a safe, reliable potable water supply able to meet the long term requirements of the towns;
- To ensure all water resource able to contribute to the water cycle within the environs of the towns are managed in a sustainable manner;
- To maximise the reuse of the towns limited water resources; and
- To ensure that a lack of water resources is not a constraint on development of the towns.

This report summarises the headworks infrastructure required to service Agnes Water and the Town of 1770 from year 2006 to 2086 when it is expected that the population of the towns will increase from some 1,800 persons to 26,500 persons. The report also summarises the works required to meet the immediate needs of the Town of 1770 in terms of water reticulation and sewerage.

The information presented in this report is based on a number of more detailed reports and these are listed as References.

A fundamental need for the conurbation to progress is a reliable potable water supply. Without this facility the conurbation will not be able to be developed further. Investigations undertaken indicate that the most appropriate means of providing a reliable water supply is to construct a desalination plant. The financing of such a plant is beyond the means of Miriam Vale Shire Council without the benefit of a substantial subsidy from State and Commonwealth Governments.

The overall capital cost of the infrastructure required to service the towns in the next twenty years is $30.233m. Of this amount $25.8m is required by year 2008.

Operation, maintenance and depreciation costs per kilolitre for potable and recycled water will be $4.76 and $2.74 respectively reducing to $2.29 and $2.48 respectively by year 2026. Approximately 50% of these costs relate to depreciation.

It is recommended that Council:

1. adopt this report as an overall water management strategy for the towns of Agnes Water and 1770; and
2. prepare and submit applications for financial assistance for all projects.

2.0 INTRODUCTION

The towns of Agnes Water and 1770 current have a combined population of some 1,800 persons, which represents about 40 percent of the total Miriam Vale Shire population. It is anticipated that the population of the towns will increase to 26,500 persons within 80 years.

Agnes Water and the Town of 1770 are located some 50 kilometres by road from Miriam Vale. A locality plan showing both towns is provided as Figure 1.

It is expected that Agnes Water will experience a rapid population increase in the next few years of a least 4.5 percent per annum such that the population of Agnes Water and the Town of 1770 will be at least 7,000 within 20 years.

The region surrounding Agnes Water and the Town of 1770 is not well endowed with water resources that could be used to meet the urban requirements of Agnes Water and the Town of 1770. Historically, difficulties have been experienced in securing a satisfactory water supply able to meet the mid to long term needs of the towns. To a considerable extent this lack of a satisfactory water supply has impeded development of the towns and it has now become imperative that in overall water resource management strategy be formulated for the conurbation.

The existing water supply sources available to service the towns of Agnes Water and 1770 comprise groundwater supplies located within the environs of the towns. These supplies are accessed by a number of bores which currently feed the Agnes Water's distribution system and some residents at the Town of 1770.

Currently, Agnes Water is provided with a sewerage system and Miriam Vale Shire Council has plans to sewer the Town of 1770. Treatment of sewage is achieved by a series of lagoons located about 7 to 8km south of Agnes Waters. Treatment is limited to secondary standard with effluent from the plant irrigating areas of silviculture.

This report presents details of an overall water resource management strategy for Agnes Water and the Town of 1770.

The objectives of the water resource management strategy are as follows.

- To provide the towns of Agnes Water and 1770 with a safe, reliable potable water supply able to meet the long term requirements of the towns;
- To ensure all water resource able to contribute to the water cycle within the environs of the towns are managed in a sustainable manner;
- To maximise the reuse of the towns limited water resources; and
- To ensure that a lack of water resources is not a constraint on development of the towns.

3.0 POPULATION PROJECTIONS

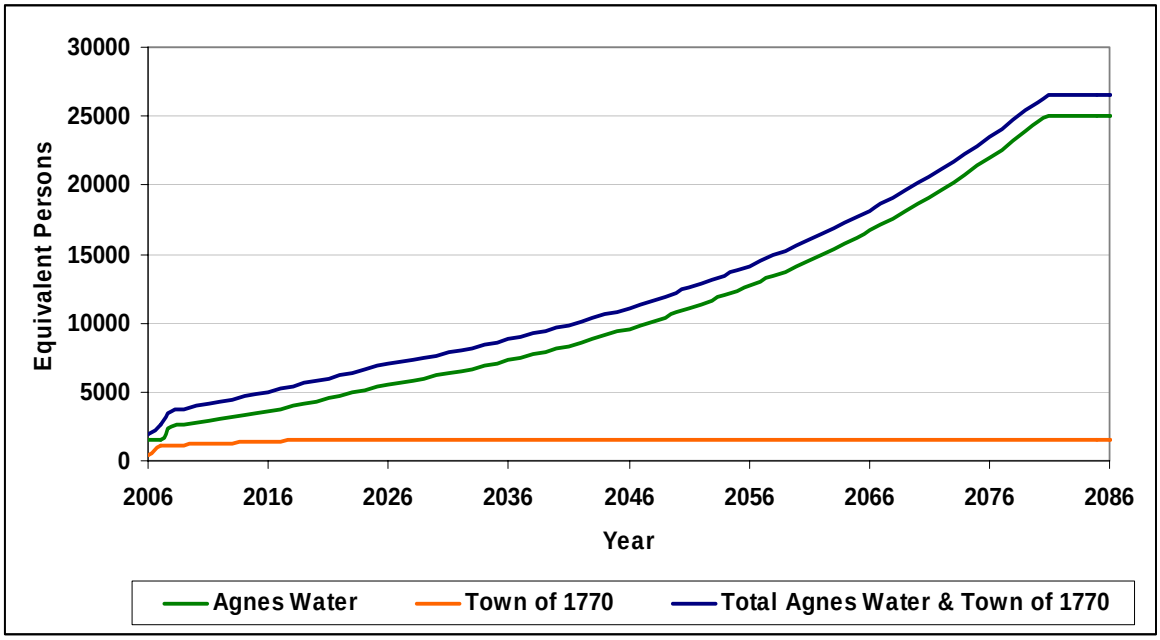
The current equivalent person (EP) populations located within the existing defined water supply area of Agnes Water and the Town of 1770 are estimated to be 1,421 and 381 respectively.

In recent years population increases at Agnes Water have approached 13% per annum while population increases at the Town of 1770 have generally not exceeded 2%.

The rate of future population increases is difficult to predict for a number of reasons including the low base number, the need to upgrade services and the increasing popularity of coastal areas. However, it is clear that with the provision of appropriate services Agnes Water and the Town of 1770 can expect to achieve the high rates which have already been experienced in other, similar coastal areas. This position is supported by the area's tourism potential and the extent of interest that developers have expressed in the area.

Graph 3.1 shows the rate of population increase expected over the next 80 years. An eighty year timeframe is an exceptionally long period over which to assess a town's future growth with any degree of confidence. However, it does provide a fundamental basis on which planning can be undertaken and a strategy formulated. Inevitably the strategy will need some modification as time passes. A particular benefit of a management strategy is that it provides all involved with a common basis on which change can be implemented.

Graph 3.1 shows details of the anticipated increase in equivalent persons from year 2006 to year 2086. The graph shows that the Town of 1770 will reach its ultimate capacity of 1,500EP and by the year 2019 and that Agnes Water will reach its ultimate capacity of 25,000EP by the year 2081.



Graph 3.1 Equivalent Person Population Projection

4.0 WATER RESOURCES

Potential water resources of the Agnes Water and Town of 1770 region are as follows.

- Groundwater;
- Surface Water Runoff;
- Sea Water; and
- Recycled Water.

4.1 Groundwater

Historical groundwater extracted from the foreshore dunal systems has been the main source of water supply for the Town of Agnes Water and to a lesser extent the Town of 1770.

The groundwater supply has been accessed by open trenching and by means of bores. The existing groundwater supplies serving Agnes Water and the Town of 1770 are as follows.

- the Agnes Water trench (ie. surface water);
- the Agnes Water Spring Road Bores;
- the Trench Bore;
- the Caravan Park Bore; and
- the Red Sand Pit Bore.

Agnes Water draws raw water supplies from a series of bores on the western side of Spring Road and, if required, from an open trench. Colour is a major impediment to the use of the trench surface water. Treatment of the water from these sources is achieved at a package treatment plant located between the trench system and Spring Road. Treatment is dependent on the raw water quality and includes pH correction using soda ash, flocculation comprising polyaluminium chloride and/or polymer, clarification comprising lamella plates, filtration in a multimedia bed and disinfection with sodium hypochlorite.

The package treatment plant has a capacity to treat a flow rate of 7.5L/s, but has been configured to operate at 4L/s due to the high levels of colour in the water extracted from the trench. The current flow rate from the existing Spring Road Bores is limited to 4.5L/s.

The existing water supply to the Town of 1770 is provided from the Trench Bore, Caravan Park Bore and Red Sand Pit Bore. Currently the only treatment involves disinfection. The water quality from these bores is not totally satisfactory. Problems are low pH and negative Langelier Saturation Index associated with the Trench Bore and a problem with iron associated with the Red Sand Pit Bore.

The open trench near the Trench Bore which was once used as raw water source has been abandoned.

In an effort to identify additional groundwater supplies Miriam Vale Shire Council has conducted extensive aerial geomagnetic surveys. These surveys have not indicated the presence of unexploited groundwater in the vicinity of the conurbation which could be developed without adverse environmental impact.

In summary the existing groundwater supply is considered to have a capacity to reliably supply 130ML/a and possibly a maximum yearly supply of 200ML/a.

4.2 Surface Water Runoff

There are three potential sources of surface water runoff. These are:

- Rainwater Tankage;
- Small to Medium Sized Rural Catchments; and
- Major Regional Dam.

4.2.1 Rainwater Tankage

The performance of rainwater tanks is dependent on the level of reliability required of accepted. For instance, if a reliability of 100% is required (ie. no failure of the system) then the yield (ie. performance) that can be gained from rainwater tanks located in Central Queensland is not high. This is primarily because rainfall during the period from August to November is normally low. However, if a reliability of 99% or 98% (ie. failure of 1 day in 100 days or 2 days in 100 days respectively) is accepted then the yield is increased appreciably.

Analysis of the area's rainfall records indicates that a dwelling having 120m^2 of roof area and a 20kL tank would be able to provide about 135 litres per day with a reasonably high degree of reliability of 99% provided that the system is carefully managed and water use is carefully control.

While 140 litres per day is significant given the area's low water usage it must be recognised that this yield can not be regarded as a safe, no failure yield (ie. a reliability of 100%) and hence this supply of 140 litres must be discounted to some degree when determining the safe, no failure total needs of an isolated urban community such as Agnes Water and the Town of 1770. This is not only necessary because of the increased reliability but also because individual property owners will not manage the supply in a way consistent with the theoretical analysis of yield and will not maximise the system yield.

In terms of overall water supply requirements to Agnes Water and the Town of 1770 it is considered that a supply of only 130 litres per day per residence should be considered as being provided from mandated rainwater tanks of 20kL. However when assessing the total safe yields from available sources even this supply can be expected to fail once in every 100 days on average. For the purposes of planning future water needs this equates to 40 litres per capita per day.

It is possible that some residents will maximise the yield from their particular rainwater tankage system and this could result in an average day yield approaching 50 litres per day (ie. assuming a reliability of 99%).

In summary, rainwater tanks can be expected to make a valuable contribution to the overall water requirements of Agnes Water and the Town of 1770. However, it must be recognised that if the tanks are not carefully managed the supply from the tanks will fail and it will be necessary for either supplementary water to be obtained or reliance fall solely on the reticulated supply. In order to accomplish this Miriam Vale Council has introduced a policy which requires that rain water tanks be plumbed to garden taps, toilets and laundry taps.

4.2.2 Small to Medium Rural Catchments

There are a number of small to medium rural catchments within the environs of Agnes Water and the Town of 1770 which could be developed to capture surface runoff.

Over the years Miriam Vale Shire Council has undertaken a number of investigations aimed at supplementing existing raw water supplies with runoff from small and medium sized rural catchments. These include:

1. Construction of a small weir on Baffle Creek, treatment plant and pipeline to Agnes Water;
2. Worthing Creek Dam, treatment plant and pipeline to Agnes Water;
3. Oyster Creek Dam, treatment plant and pipeline to Agnes Water;
4. Gorge Creek Dam, treatment plant and pipeline to Agnes Water; and
5. Reedy Creek Dam including associated treatment plant and pipeline to Agnes Water; and

In all cases the yield from these schemes has proved to be inadequate and as Agnes Water and the Town of 1770 will need to supplement the existing groundwater supplies with a source able to fully meet the needs of all future development these sources are not worthy considered of development given the relatively high development costs involved.

In summary none of these potential supplies are expected to contribute to the future needs of Agnes Water and the Town of 1770.

4.2.3 Major Regional Dams

There to potential source of surface water runoff having a potential to service the towns of Agnes Water and 1770. These are:

- A Baffle Creek Dam; and
- Awonga Dam

The Baffle Creek catchment is of sufficient size to allow the construction of a dam having a capacity to supply the region including the towns of Agnes Water and 1770. However in order to be constructed any dam on Baffle Creek would need to overcome significant environmental constraints and be able to service a water requirement significantly greater than that of Agnes Water and the Town of 1770. Currently no such water demand exists.

The Gladstone Area Water Board has indicated that water is available from Awonga Dam should Miriam Vale Shire Council wish to construct a pipeline to Agnes Water. This pipeline would need to be some 105km in overall length and would involve a number of pump stations.

4.3 Sea Water

Sea water desalination has the capacity to provide Agnes Water and the Town of 1770 with all the potable water required. Sea water drawn from off-shore, pretreated and desalinated using reverse osmosis followed by the discharge of brine off-shore has the potential to fully meet the needs of the conurbation.

4.4 Recycled Water

The beneficial use of recycled water has the potential to contribute significantly either as a source of water for garden irrigation and toilet use or as a source of aquifer recharge water.

In the short term the most appropriate means of producing treated water suitable for recycling would be the installation of a sewer mining and treatment facility utilising reverse osmosis.

5.0 EXISTING INFRASTRUCTURE

5.1 Water Supply

The town of Agnes Water is provided with a reticulated potable water supply derived from bores. This supply is extracted from the Spring Road bores and can be supplemented from bores in the Red Sand Pit area. The supply is treated prior to distribution.

Part of the Town of 1770 is also provided with a reticulated water supply drawn from bores. Miriam Vale Shire Council currently has plans to reticulate water to the rest of the Town of 1770 and will connect the system to the existing Agnes Water scheme.

The existing bores have limited production and are not able to be further developed. An alternative source of supply is urgently needed in order to meet the needs of both towns.

In addition to the reticulated supplies a number of property owners supplement their water requirements with rainwater tankage and private bores.

The existing water supply has a capacity to reliably supply 130ML/a. The maximum supply able to be drawn from groundwater is probably only about 200ML/a.

The existing system is only able to meet the requirements of some 2,000 persons.

5.2 Sewerage

Agnes Water is sewered whereas the Town of 1770 is currently unsewered. Miriam Vale Shire Council has plans to sewer the Town of 1770 in the near future.

Sewage from Agnes Water is pumped from the town via a 200mm dia rising main some 8kms to a sewage treatment plant. The sewage treatment plant has a capacity to treat sewage from a population of some 2,100 persons. Treatment to secondary standard is achieved in a series of lagoons prior to the effluent being irrigated to a area of silviculture.

5.3 Infrastructure Augmentation

To enable further development it is essential that the following infrastructure augmentation occur.

- An alternative reliable water source be developed;
- The Town of 1770 be sewered;
- The Town of 1770 be provided with a reticulated water supply of appropriate standard; and
- The capacity to treat sewage be upgraded.

To allow the forgoing infrastructure to be provided it is necessary that a comprehensive water resource management strategy be formulated for the conurbation.

6.0 LEVELS OF SERVICE

Agnes Water and the Town of 1770 have historically experienced low overall water consumption. This is primarily because of the limited available supply and careful demand management policies of Miriam Vale Shire Council.

Residents of Agnes Water and the Town of 1770 currently rely of the following water sources.

- Groundwater supplied through the distribution system;
- Rainwater tanks; and
- Individual bores.

Future water supplies to the towns will depend on the sources of water available and in this regard there are a number of options as summarised in Table 5.1.

Table 5.1
Water Supply Options and Levels of Service

Option	Source of Supply		Level of Service
A	Internal Potable including Toilets	Groundwater & Desalinated Seawater	200L/EP/d
	External	Rainwater Tanks	140L/ET/d
		Individual Bores	200L/ET/d
B	Internal Potable	Groundwater & Desalinated Seawater	200L/EP/d
	Toilets	Recycled Water	20L/EP/d
	External	Recycled Water	120L/EP/d
		Rainwater Tanks	140L/ET/d
		Bores	200L/EP/d
C	Internal and External	Groundwater & Desalinated Seawater	200L/EP/d
	External	Rainwater Tanks	140L/ET/d
		Individual Bores	200L/ET/d

Note :- EP denotes 'Equivalent Person'
ET denotes 'Equivalent Tenement'

Daily potable water consumption variation are as follows.

Mean Day Maximum Month/Average Day = 1.5
Maximum Day/Average Day = 2.3
Maximum Hour/Maximum Day = 2.0

Under maximum hour demands residual pressures at all locations shall be 22m minimum.

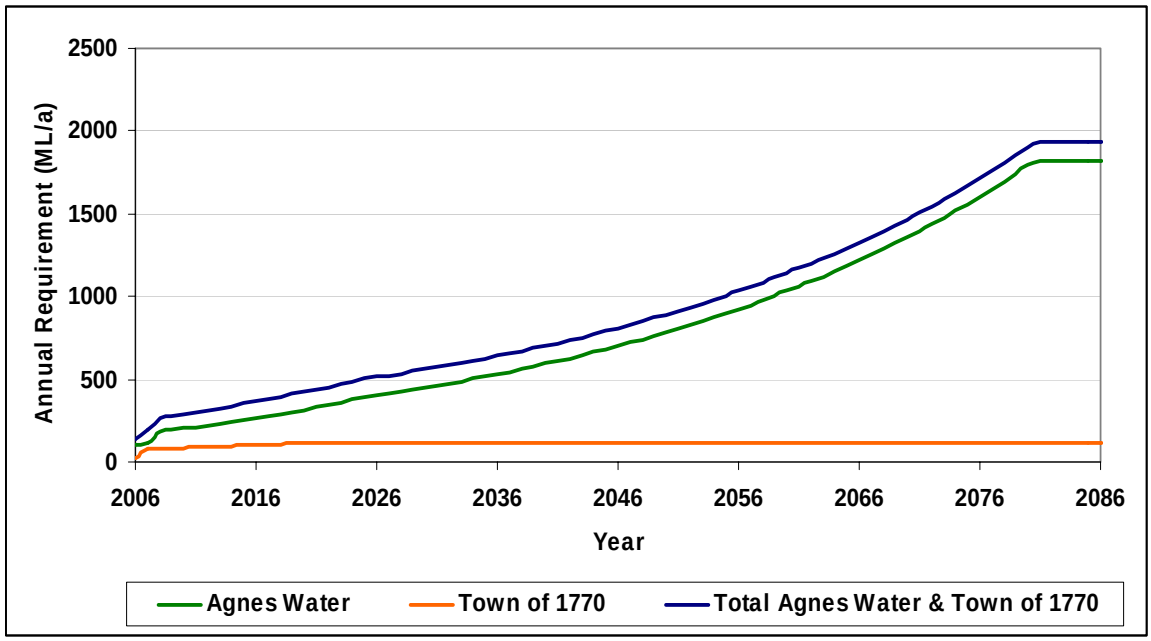
Fire flows - Residential Zones = 15L/s with a minimum pressure of 12m;
- Commercial Zones = 30L/s with a minimum pressure of 12m.

Daily recycled water consumption variation between average day and maximum day requirements = 3.5.

7.0 WATER REQUIREMENTS

7.1 Potable Water

The potable water requirements of Agnes Water and the Town of 1770 based on a per equivalent person level of service of 200L/d in shown in Graph 6.1.



Graph 6.1 Annual Potable Water Requirement

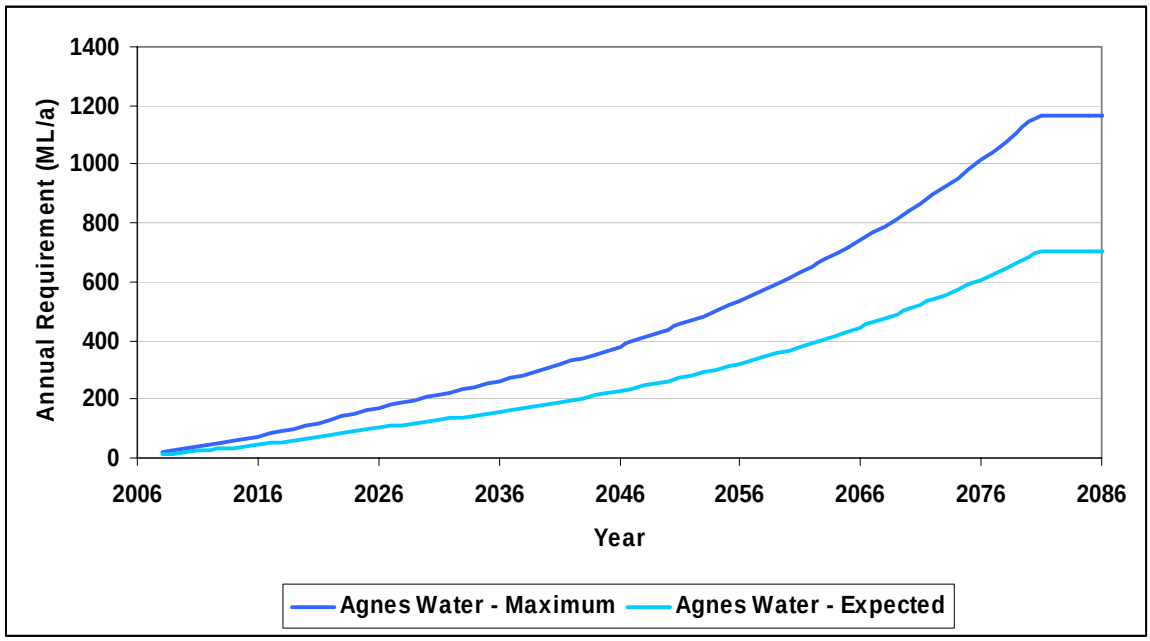
Daily potable water requirements are summarised in Table 6.1.

Table 6.1
Daily Water Requirements

Year	Average Day (kL)	MDMM (20hrs) (kL)	Maximum Day (kL)
2006	375	563	864
2011	823	1,234	1,893
2016	1,004	1,506	2,310
2021	1,201	1,802	2,763
2026	1,405	2,107	3,231
2031	1,569	2,353	3,608
2036	1,756	2,635	4,040
2046	2,220	3,329	5,105
2056	2,830	4,245	6,509
2066	3,635	5,452	8,360
2076	4,695	7,043	10,800
2086	5,300	7,950	12,190

7.2 Recycled Water

On the basis that recycled water can be used to water gardens and for toilet flushing Graph 6.2 provides details of the future maximum recycled water requirements of Agnes Water and the expected likely maximum requirement.



Graph 6.2 Maximum Annual Recycled Water Requirement

It is not envisaged that recycled water will be distributed to the Town of 1770.

The expected daily recycled water requirements are summarised in Table 6.2.

Table 6.2
Daily Water Requirements

Year	Average Day (kL)	Maximum Day (kL)
2006	0	0
2011	63	220
2016	123	430
2021	198	692
2026	283	991
2031	352	1,232
2036	431	1,508
2046	625	2,189
2056	882	3,086
2066	1,220	4,269
2076	1,665	5,828
2086	1,919	6,717

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8.0 POTABLE WATER SUPPLY OPTIONS

There are only two realistic options able to meet the medium and long term needs of Agnes Water and the Town of 1770 in terms of a potable water supply. These options are:

- Construction of a pipeline from the Gladstone Area Water Board's Awonga Dam scheme to convey treated water to the conurbation; and
- Construction of a desalination plant to provide high quality water to the conurbation.

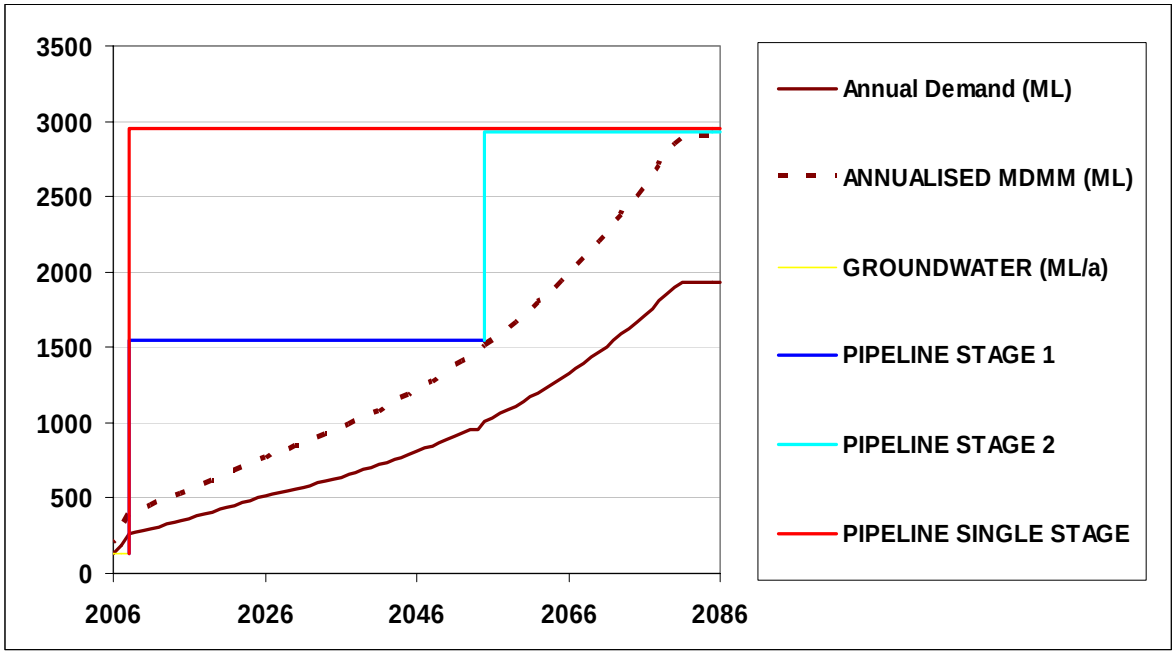
Miriam Vale Shire Council has examined both there options.

Two pipeline schemes have been examined. These are:

1) Construction of an initial main of 200mm dia and length of 105km followed at a later stage of a further 200mm dia main;
2) Construction of a 300mm dia main able to met the ultimate requirements of the conurbation.

In relation to the desalination plant it is proposed to construct this installation in a series of modules each having a capacity to supply 525ML/a. Seawater will be drawn from deep water some 600m off-shore from the existing Agnes Water water treatment plant

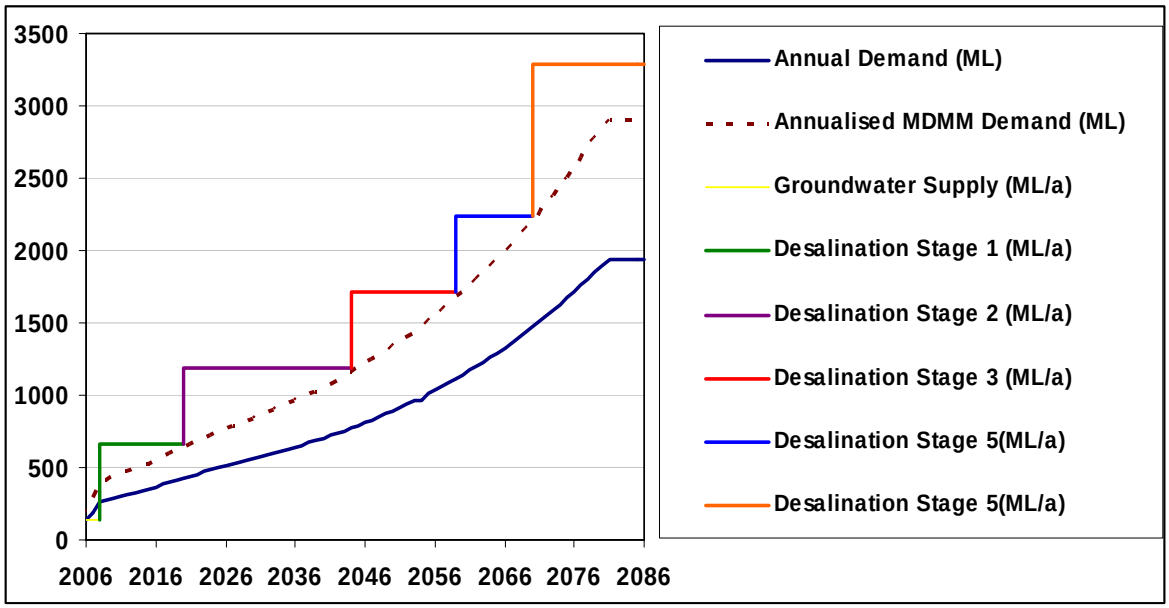
Graph 8.1 shows the staging requirements of each pipeline option.



Graph 8.1 Pipeline Staging (ML/A)

Graph 8.2 shows the staging associated with construction of the desalination plant. In all some six stages will be constructed to meet the long term needs of the conurbation.

Figures 2 and 3 show the location proposed for the desalination plant and preliminary details of the layout of the plant respectively.



Graph 8.2 Desalination Plant Staging (ML/a)

Detailed costings of these options in terms of capital, operation, maintenance and replacement followed by economic analyses over an 80 year period has indicated that the desalination plant option is the least cost option.

Table 8.1 presents the results of the economic analysis are based on a discount rate of 5%.

Table 8.1
Net Present Value Comparison over 80 Years

Option	NPV
Pipeline 2/200mm dia	$52,963,000
Pipeline 300mm dia	$59,432,000
Desalination	$37,805,000

Based on the detailed costings 'Burns Bridge Transactions (BBT)' undertook a 'risk free' net present cost analysis of the options over an initial 20 year period. The analysis included the following costs.

- NPC CAPAEX – Capital cost incurred and adjusted for building index;
- NPC OPEX – Operations cost in real dollars and adjusted for CPI; and
- NPC – Terminal Value. As the asset life for the options are not the real value of the asset at termination of the comparison (20 years) is added as a positive cost. The value is significant for the pipeline based on an 80 year asset life compared to a 25 year asset life for the desalination option.

The results of the analysis are given in Table 8.1.

Table 8.1
Risk Free Net Present Cost Analysis of Options

Costs	Awonga Pipeline		Desalination
	200mm dia	300mm dia	
NPC CAPEX	$41,286,000	$41,276,000	$24,061,000
NPC OPEX	$11,172,000	$9,835,000	$7,987,000
NPV Terminal	-$16,396,000	-$16,656,000	-$1,706,000
Total NPC	$36,062,000	$34,455,000	$30,342,000

In assessing this analysis BBT state that under the 'risk free' analysis the Awonga pipeline options represent a higher whole of life position than the desalination option. The difference of 13% is significant given the detailed costing undertaken in producing the data. However the difference is still below the level of accuracy of the source data.

A Monte Carlo risk analysis and affordability analysis have also been undertaken by BBT. With respect to the affordability analysis the following cases were analysed.

- 20 year annual cash flow;
- 5 year budget position.

The detailed results of these analyses are presented in the ***draft*** report entitled 'Review of Water Supply Options' July 2006 by Burns Bridge Transactions.

The results of these analysis has been summarised by BBT in their ***draft*** report as follows.

"Overall the current budget and analysis of future options indicate that the water supply to 1770/Agnes Water is not sustainable with out some form of significant CSO (Community Service Obligation). The water charge, connection fee and debt servicing costs are based on 4 key costs associated with the additional infrastructure being:

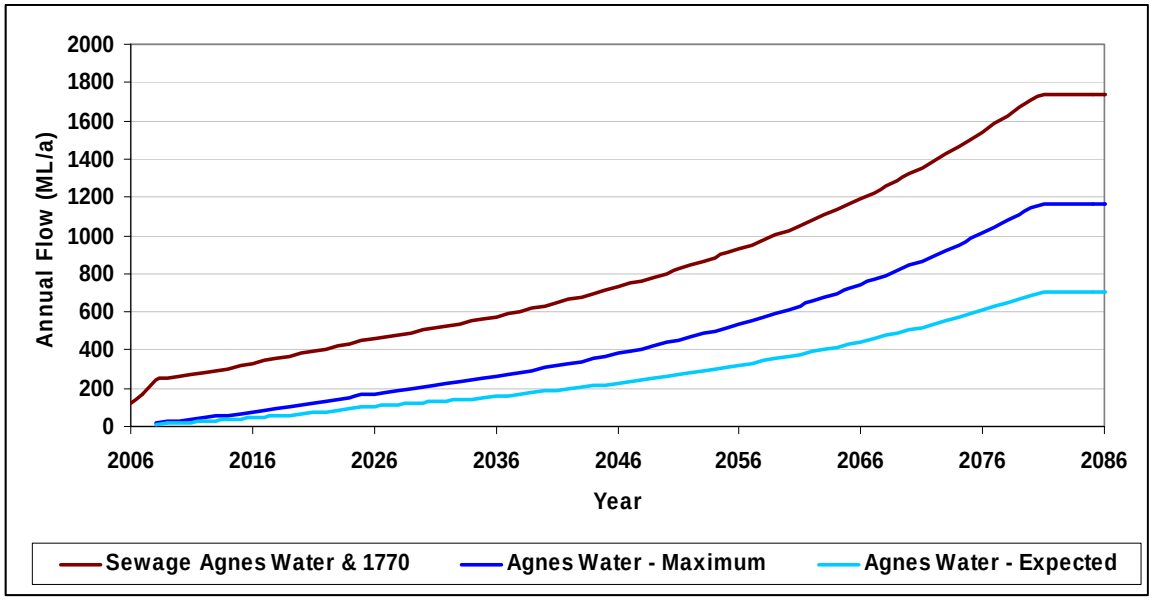
- Depreciation;
- Debt Servicing;
- Operational Costs; and
- Corporate Services Costs.

9.0 SEWAGE TREATMENT AND RECYCLING OPTIONS

The beneficial reuse of treated effluent from sewage is a resource which must be maximised.

Unfortunately the existing sewage treatment plant is located too far from where recycled water is required and accordingly it is proposed to overcome this problem by providing a sewer mining facility adjacent to the existing water treatment plant and to eventually augment the existing sewage treatment plant with the construction of a new sewage treatment plant. The new sewage treatment facility will be constructed next to the proposed sewer mining plant.

Graph 9.1 shows the total sewage load expected to be generated from the towns of Agnes Water and 1770 for the period until year 2086, the maximum recycled water volume likely to be used and the expected annual volume actually used. The volumes given in Table 9.1 are based on a sewage load of 180L/EP/d and recycling only applying to new development at Agnes Water.



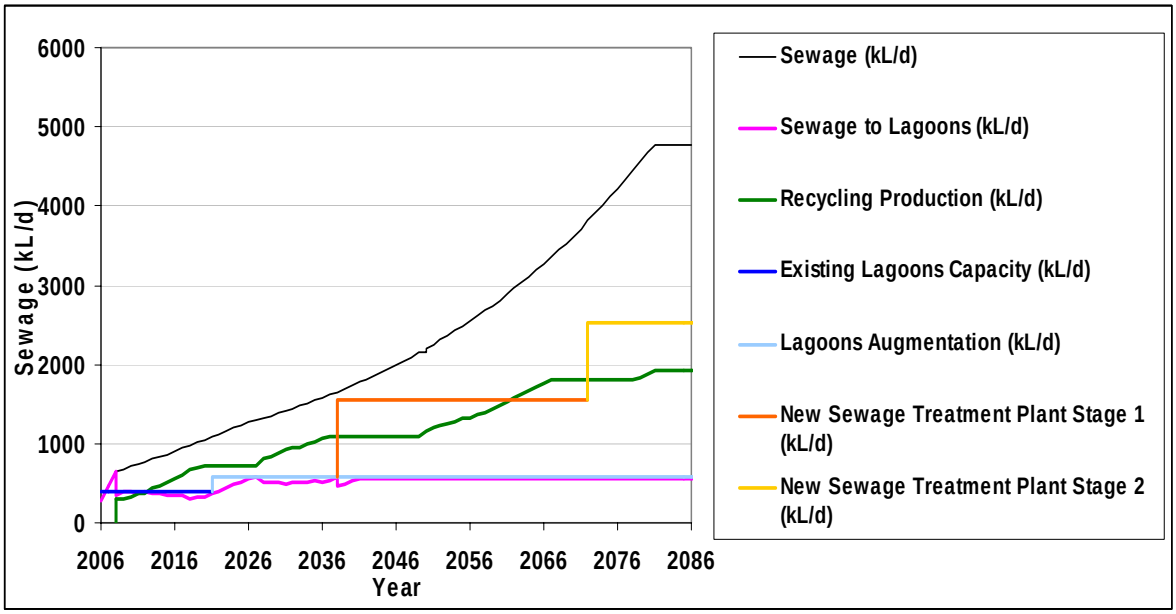
Graph 9.1 Sewage Load and Recycled Water Requirement

To meet the future sewage treatment and recycling it is proposed to undertake the following works.

- Construct a sewer mining facility with initial capacity of 720kL/d increasing to a maximum capacity of 1,920kL/d;
- Increase the capacity of the existing sewage treatment lagoons by 50%;
- Construct a new sewage treatment plant in two stages of 970kL/d each.

The timing of associated with the construction of these facilities is shown on Graph 9.2.

The facilities proposed will eventually be able to supply Agnes Water with a recycled water supply of some 700ML/a which is expected to be the demand in year 2086.



Graph 9.2 Sewage Treatment and Recycling

Table 9.1 summarises the capacity and timing associated with provision of the recycling and sewage treatment facilities.

Table 9.1
Sewage Treatment and Recycling Facilities

Existing Sewage Treatment Plant		Sewer Mining and Recycling Plant		New Sewage Treatment Plant	
Year	Total Capacity (kL/d)	Year	Total Capacity (kL/d)	Year	Total Capacity (kL/d)
2021	580	2008	720	2038	970
		2027	1,080	2072	1,940
		2049	1,800		
		2079	1,920		

Essentially the above assumes that some 40% of the sewage flow will be recycled for external garden use and toilet flushing. In addition it is proposed that portion of the recycled sewage will be used to augment groundwater aquifers.

Figure 4 shows overall details of the proposed location of the sewer mining installation.

In addition to the recycled water available from the sewer mining facility treated sewage will be available from the new sewage treatment facility. It is presumed that this water will also be treated to a high standard and used for to supplement the sewer mining flows, if necessary, and to irrigate sporting field and other public lands.

The overall capital costs of these installations are summarised in Table 9.2.

Table 9.2
Capital Cost of Sewage Treatment and Recycling Facilities

Facility	Stage Capacity	Capital Cost
Sewer Mining – Stage 1	720kL/d	$4,966,000
Augmentation of Existing Sewage Treatment Plant	200kL/d	$650,000
Sewer Mining – Stage 2	360kL/d	$1,530,000
New Sewage Treatment Plant – Stage 1	970kL/d	$6,250,000
Sewer Mining – Stage 3	720kL/d	$3,400,000
New Sewage Treatment Plant – Stage 1	970kL/d	$5,900,000
Sewer Mining – Stage 4	120kL/d	$650,000
Total	4,060kL/d	$23,346,000

Within the first twenty years it will only be necessary to construct the first stage of the sewer mining facility and the augmentation of the existing sewage treatment plant. The capital cost of these works are estimated at $5.62m.

Analysis of the sewer mining facility also indicates that the project is not sustainable with out some form of significant CSO (Community Service Obligation).

10.0 CONCLUSIONS

10.1 Environmental Benefits

The primary aim of Miriam Vale Shire Council is to provide the community with a safe, reliable water supply which promotes the economy of the coastal community and the Shire in an environmentally sustainable way. This can be achieved by the provision of an integrated water supply management strategy based on construction of the following facilities.

- A desalination plant to supply potable water; and
- A sewer mining plant to maximise the benefits of delivering recycled water for groundwater supplementation, external household use and community use.

The Agnes Water – Town of 1770 conurbation's population is expected to eventually reach 26,500. To meet the water supply needs of the conurbation it is essential that the readily available sources of water, namely seawater and sewage, be utilised. All other options in terms of potable water supply and treatment require similar power requirements and similar, substantial investment. In addition continuation of the existing practice of lagoon treatment of sewage and release of effluent to land is not sustainable in the long term and in no way benefits the community.

10.2 Capital Costs

The overall costs of all the works considered in this report and required to meet the water management needs of Agnes Water and the Town of 1770 for the next twenty years are summarised in Table 10.1.

Table 10.1
Capital Cost Summary – Year 2006 to Tear 2026

No.	Description	Amount
1	Desalination Plant – Stage 1	$20.805m
2	Desalination Plant – Stage 2	$3.812m
3	Sewer Mining Facility – Stage 1	$4.966m
4	Augmentation of Existing Sewage Treatment Plant	$0.650m
	Total	$30.233m

Of the facilities listed in Table 10.1 Stage 1 of the Desalination Plant and the Stage 1 of the Sewer Mining Facility are required to be constructed prior to year 2008. Stage 2 of the Desalination Plant will be required by year 2019 and Augmentation of the Existing Sewage Treatment Plant by year 2021.

10.3 Operation. Maintenance and Depreciation Costs

Operation, maintenance and depreciation costs have been determined for both the desalination scheme and the sewer mining schemes. Table 10.2 summarises the cost of both the sources of water derived from these schemes excluding the capital cost of the schemes.

Table 10.3
Cost of Water Supply

Year	Potable Supply		Recycled Water	
	Volume Produced (kL/a)	Cost per kilolitre	Volume Produced (kL/a)	Cost per kilolitre
2009	132,000	$4.76	110,000	$2.74
2026	553,000	$2.29	263,000	$2.48

Of the costs given in Table 10.3 depreciation represents about 55% of the desalination scheme costs and 45% of the sewer mining scheme costs.

11.0 RECOMMENDATIONS

It is recommended that Council:

1. adopt this report as an overall water management strategy for the towns of Agnes Water and 1770; and

2. prepare and submit applications for financial assistance for all projects

REFERENCES

1. 'Agnes Water Water Supply Final Report' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, June 1995.

2. 'Agnes Water Water Supply – Financial Analysis' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, October 1995.

3. 'Agnes Water Water Supply – Springs Road Bores Planning Report' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, December 1997.

4. 'Agnes Water Water Supply – Springs Road Bores Planning Report' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, December 1997.

5. 'Agnes Water Water Supply – Springs Road Bores Planning Report' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, December 1997.

6. 'EIS Agnes Water Sewerage' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, March 1999.

7. 'Agnes Water Sewerage Scheme Planning Report with Addendum 1 & 2' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, May 2003.

8. 'Agnes Water and Town of 1770 Desalination Feasibility Investigation' prepared for Miriam Vale Shire Council by Parsons Brinckerhoff, May 2005.

9. 'Review of Environmental Factors for the Proposed Agnes Water Desalination Project' prepared for Miriam Vale Shire Council by Parsons Brinckerhoff, May 2005.

10. 'Water Supply Strategy for Agnes Water and 1770' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, June 2005.

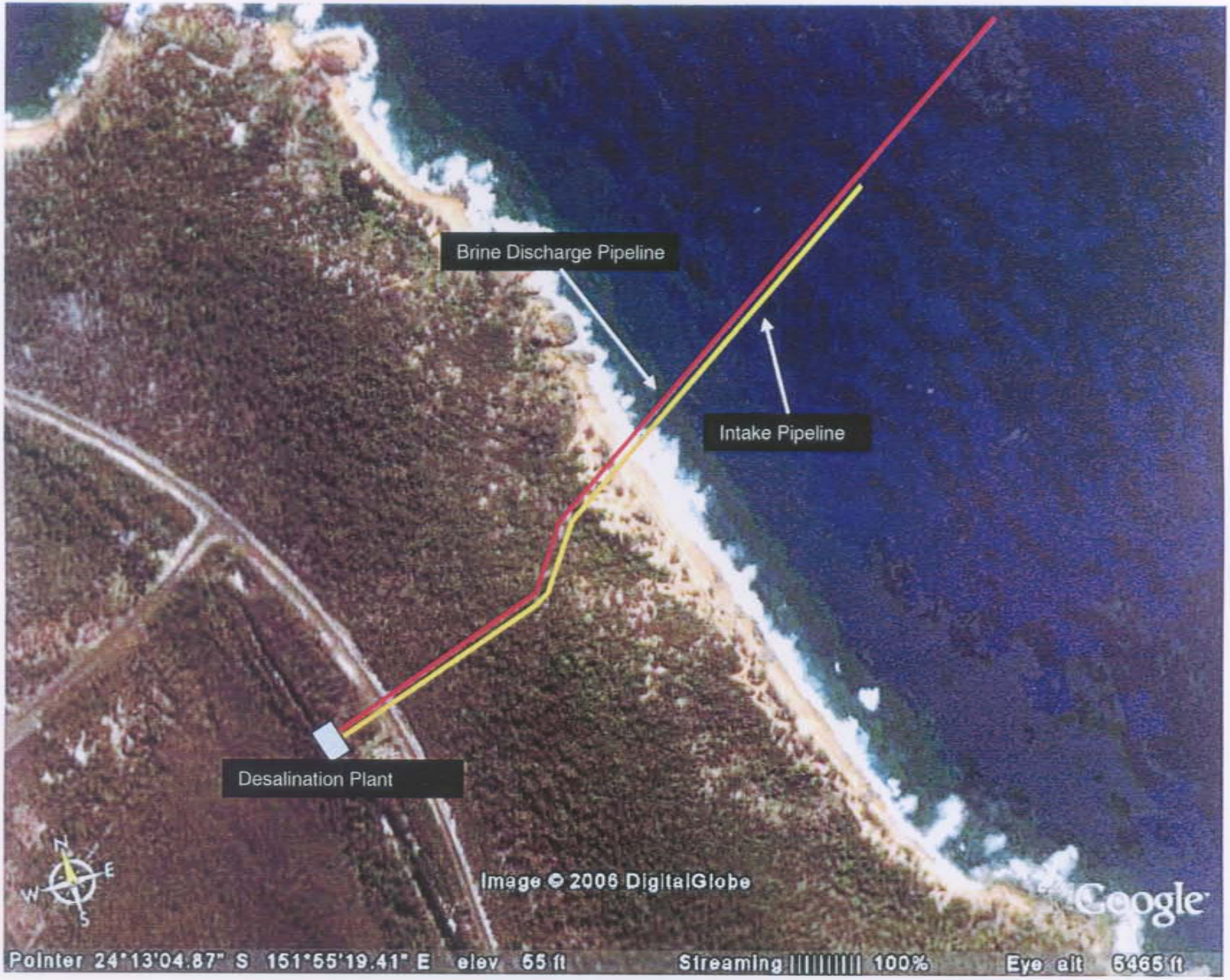
11. 'Agnes Water Water Supply – Financial Analysis' prepared for Miriam Vale Shire Council by Coleridge Water Engineers, October 1995.

12. 'Miriam Vale Shire Council Integrate Water Management 1770/Agnes Water – Business Development Plan, Draft' prepared for Miriam Shire Council by Burns Bridge, December 2005.

13. 'Miriam Vale Shire Council Review of Water Supply Options' *Draft Report* prepare for Miriam Shire Council by Burns Bridge Transactions, July 2006

FIGURES

Locality Map **FIGURE 1**



Proposed Desalination Plant

Figure 2

TO AGNES WATERS

SPRINGS ROAD

ACCESS ROAD

LOT 40
FD1100

LOT 6
SP150900

LOT 1
SP150900

EXISTING LAGOON

STAGE 2
RESERVOIR
1.2ML

STAGE 1
RESERVOIR
1.2ML

MBR

STAGE 2
RO PLANT BUILDING

STAGE 1
RO PLANT BUILDING

STAGE 2
POST TREATMENT
& CHLORINATION

STAGE 1
POST TREATMENT
& CHLORINATION

BLOWD
PBARK
HBASH
BANKSIA
WATTLE

REV	BY	DESCRIPTION	DATE

Vertical Datum
Horizontal Datum
PSM No.
RL.

Surveyor: Date:
Designer: Date:
Checked: Date:
Technical Services Manager Date

Works & Development Engineer
Date:
Director of Engineering
Date:

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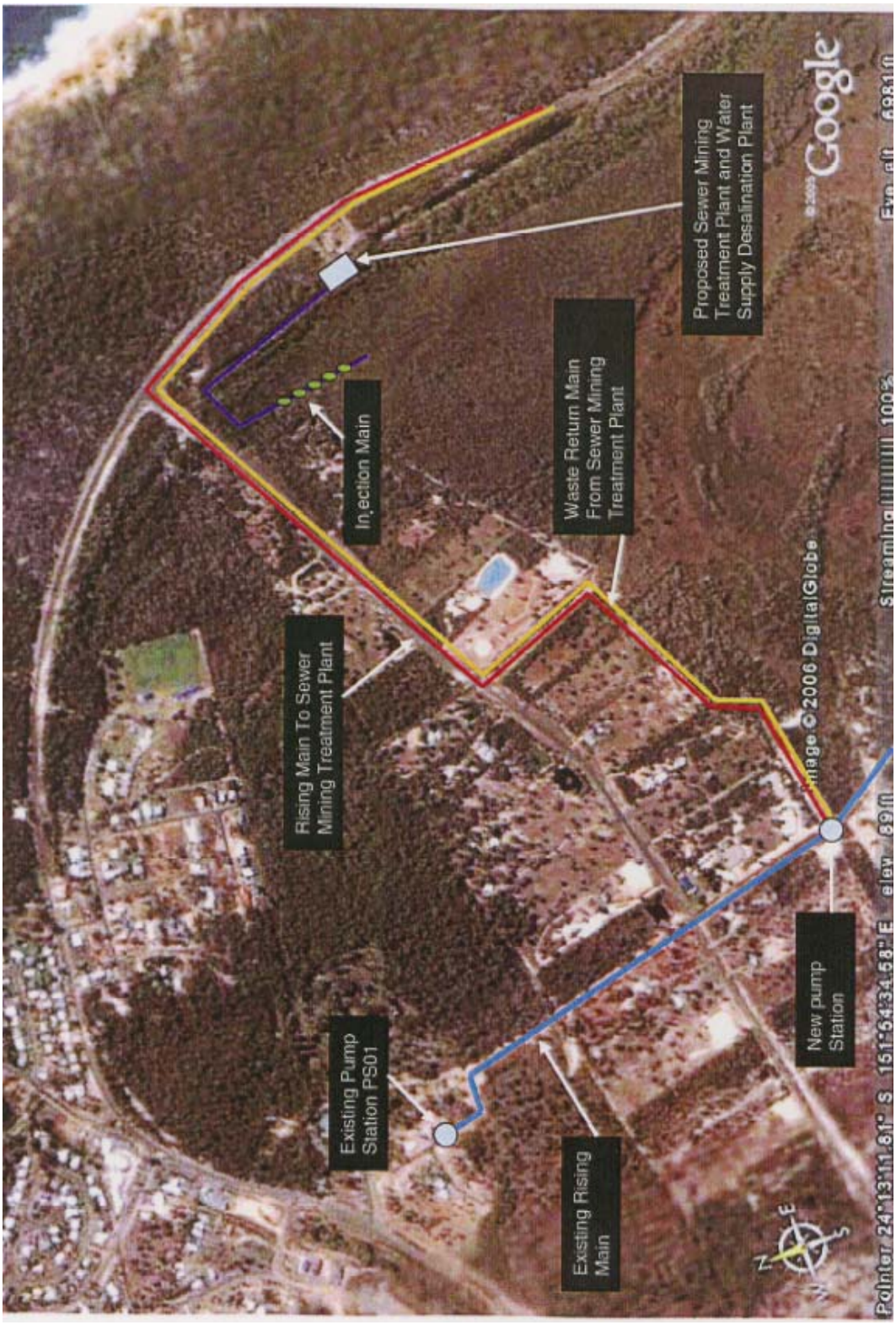
Proposed Desalination Plant Preliminary Site Layout
Figure 3



Overall Details of Sewer Mining Facilities

FIGURE 4