DISTRICT OF LAKE COUNTRY

OYAMA WATER SYSTEM

CAPITAL WORKS PROGRAM

1998-2008

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Kelowna, BC

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- 1998 - 2008 -

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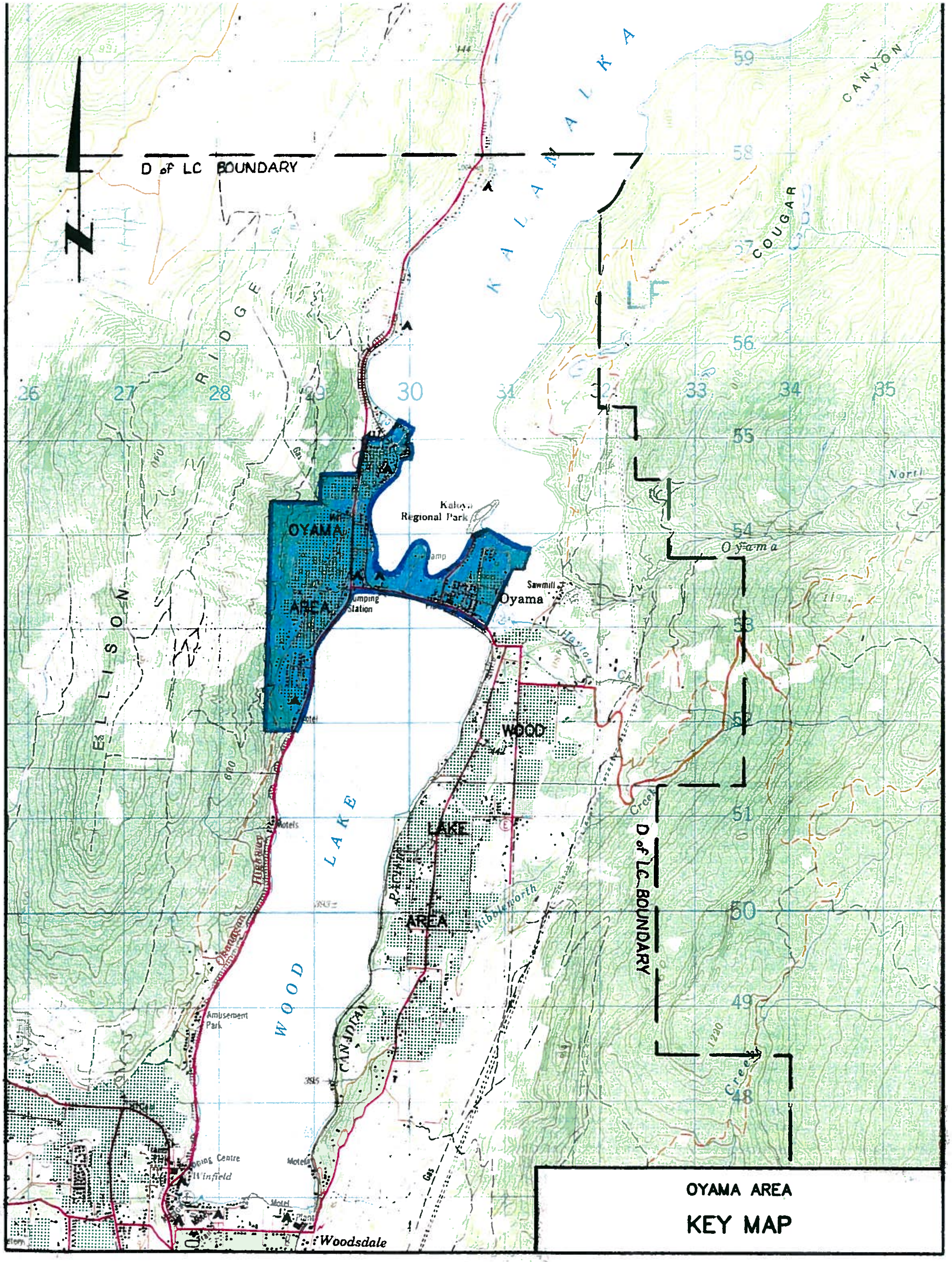


OYAMA AREA

KEY MAP

Oyama Water System

CAPITAL WORKS PLAN 1998- 2008

I. INTRODUCTION

This report is intended to provide a ten year Capital Works Program for the Oyama Water System, an irrigation and domestic water system owned and operated by the District of Lake Country. It will also provide the technical basis for new Development Cost Charge and Capital Expenditure Authorization Bylaws.

The District and its predecessor, the Oyama Irrigation District, have received a number of applications for water servicing but have been unable to approve the requests because of water licence restrictions and concern over supply and distribution system limitations. District officials can consider servicing more land as the situation has now changed with the Ministry of Environment granting the District a water reserve on Kalamalka Lake and the completion of a major rehabilitation program in 1996.

The water source prior to the rehabilitation program, a joint project between the Provincial and Federal governments and the landowners, was groundwater which had a high iron content. As a result, the pumping system and pipelines were lined with scale and iron bacteria and had very poor friction factors. The construction of a pump station on Kalamalka Lake and a new reservoir has improved the system as well as the use of Oyama Creek water through the pipelines over the winter periods of 1996 and 1997 which has removed considerable amounts of build-up. The evidence available suggests that removal of build-up is continuing and it is assumed for purposes of this report that the removal is or will be complete. This recent upgrading has resulted in a system that is generally in good condition and capable of supplying the existing 119 hectares of irrigated land and 330 domestic services with some spare capacity.

There are still a few system deficiencies which are discussed as well as the works needed to supply the new development expected over the next ten years. The cost of the new works and the revenues needed to fund the facilities required have been calculated.

In accordance with the general trend, Metric units have been used throughout this report.
A conversion table and a list of abbreviations used are contained on the following page to assist those who may not be familiar with the terminology.

1.2 Units/Conversions

Measurement used throughout are in metric with some exceptions. Conversions from metric to imperial units are as follows:

1m	=	3.28 ft
1 L/s	=	15.87 USgpm
1 ha	=	2.47 ac
1 da-m^3	=	0.8107 ac-ft
1 litre	=	0.264 US gallons
1 L/s/ha	=	6.424 USgpm per acre
1 L/s/ha	=	5.353 Igpm per acre
1 psi	=	0.703 metres of head
1 psi	=	6.89 kiloPascals

1.3 Abbreviations

D of LC	District of Lake Country	Com.	Commercial
OWS	Oyama Water System	SF	Single-family
WLWS	Wood Lake Water System	MF	Multi-family
WLID	Wood Lake Improvement District	Ind.	Industrial
DCC	Development Cost Charge	psi	pounds per inch
MELP	Ministry Of Environment	m	metres, length
PRV	Pressure reducing valve	ac-ft	acre feet
mps	metres per second	OCP	Official Community Plan
m^3/s	cubic metres per second		
lps	Litres per second		
da-m^3	cubic decametre (1000m^3)		

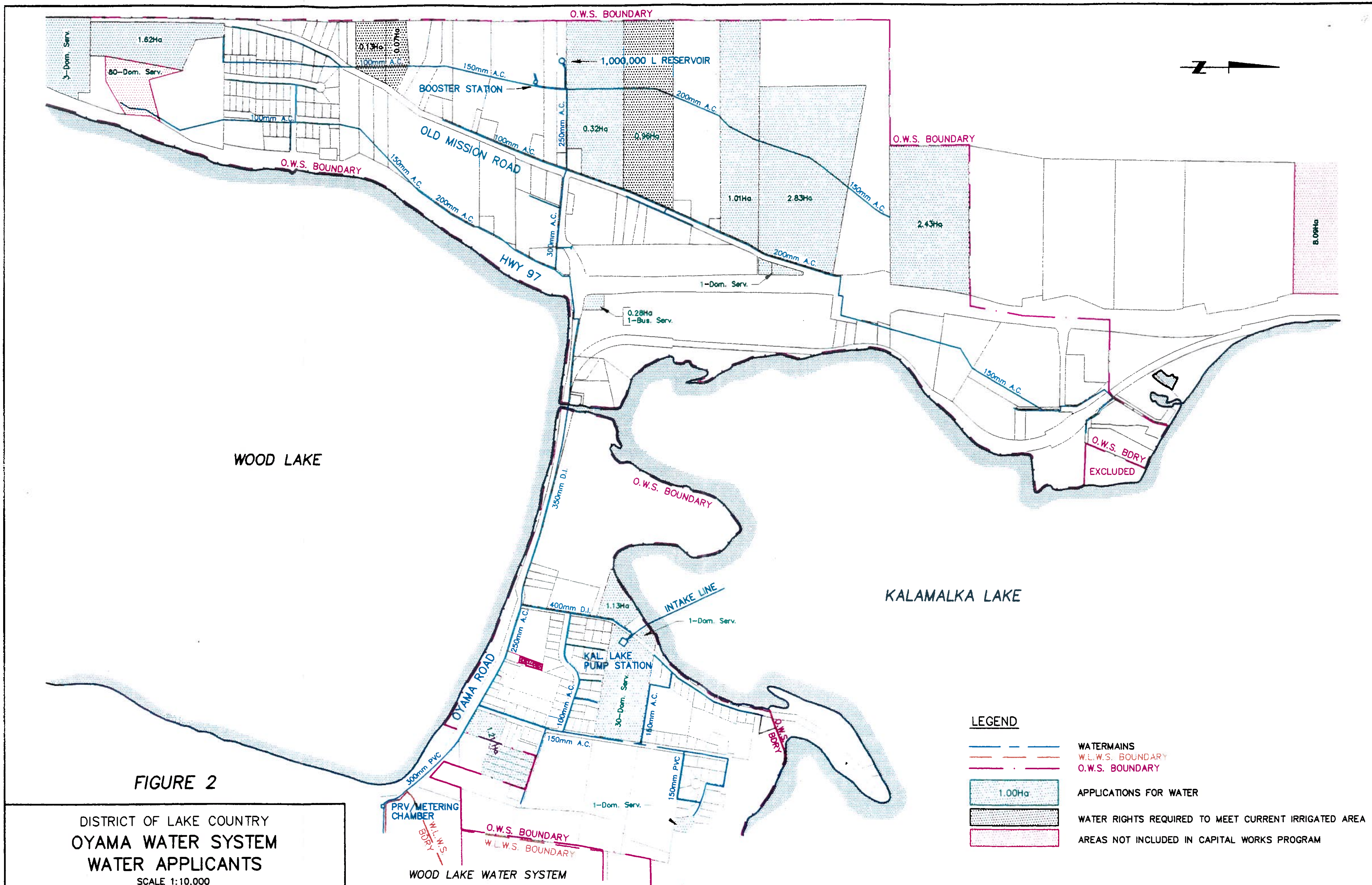


FIGURE 2

DISTRICT OF LAKE COUNTRY

OYAMA WATER SYSTEM

WATER APPLICANTS

SCALE 1:10,000

2. Land Use and Development Projections

Predicting the type and amount of development that may occur in areas like Oyama is a risky proposition at best, however the planning process requires that estimates of growth be made in order to project the water supply facilities that will be needed and the revenues required. In addition to the normal increases for new development there are other considerations to increased water use in the system. Firstly, there is a list of applicants for water dating back to 1986. The District has not been approving new water servicing since that time. Secondly, a recent survey of the irrigated lands within the upper pressure zone revealed that several users were irrigating more land than is shown on the assessment roll. It is assumed users will continue to irrigate these lands and will pay the Development Cost Charges on the additional irrigated areas.

A list of the applicants for water is contained in Annex 2 and Figure 2 opposite shows the location of the properties along with the amount requested, whether it be for domestic or irrigation purposes. Two of the applicants on the list, shown on the drawing in red, were not considered in this capital works program. The application by Teddy Bear Lodge for 80 multi-family residential units was not included since the District of Lake Country OCP does not provide for multi-family developments in this area. The OCP states that a sewer system must be in place for multi-family units which is not likely to happen before the year 2008. Inclusion of a development of this size would have a major effect on projected revenues and expenditures and may distort the figures for other applicants so the request has been deleted from calculations. Also, the application from C. & C. Schmidt for water to irrigate 8.09 hectares of land on the NW¼ Tp 14, ODYD, has not been included in the calculations because the cost of installing a pipeline to supply this lot will make the servicing costs prohibitive. Both applications can be re-evaluated on an individual basis should the landowners still want to consider water servicing.

It is common practise in making projections of future growth to use historic growth patterns as one of the principal indicators. In the Oyama situation, historic patterns are valueless because growth has been restricted by water availability. Future development in Oyama will be influenced to a very large extent by the amount of land available. Much of the Oyama area is within the Provincial Agricultural Land Reserve as shown on Figure 3 opposite which will severely limit any land use other than agriculture. The agricultural land within the service area is mostly irrigated now and there are only small areas where a supply of irrigation water would be beneficial. A copy of the assessment roll showing the lots that have irrigation rights and the design flow for each lot is contained in Annex 1. Outside the service area are some lands with development capability but the economics of water supply make it prohibitive to expand the water system very far beyond the current boundaries.

The estimates and calculations used in this report assume that only two-thirds of the applicants on the waiting list will actually want water within one year and for the balance of the ten year planning period an estimated annual increase of one hectare of irrigated land and three residential services will occur. There will be some new commercial/ institutional users but they will be small in number and are included in the residential component. Table 1 shown below summarizes the anticipated increases in serviced land over the next ten years.

Table 1 - Growth Projections

Category	1998	1998-2008	Total
Irrigated Land (hectares)	8	9	17
Single Family Residential Units on Dry Land	5	18	23
Single Family Residential Units on Grade 'A' Land	1	9	10

The predictions of growth rates are very speculative and it will be important to monitor increases in water use on a regular basis to ensure that water system improvements are being made to reflect actual conditions.

3. Water Demand Projections

Theoretical demands for water on a system that services agricultural land is based on the soil types, or soil duties, recommended by the Ministry of Agriculture. Most of the Oyama area has a soil duty of 0.94 lps/ha (6.0 USgpm/ac). The experience of other Districts indicates that the recommended or theoretical demands are never reached in practise and actual Peak Day demands are usually only about 80% of theoretical demands. Flow records for the Oyama system indicate that the highest water use day is only 95 lps, or 70% of theoretical. This 70% figure is lower than other Districts and may be due to the build-up of scale in the pipelines which has restricted the ability of the system to deliver water. Peak water use will likely increase with the new system and as the pipeline encrustations are removed. For purposes of this report, peak water use estimates for irrigation purposes have been taken as 80% of theoretical demand, the same as used in other Districts. The estimated peak water use for the existing system and projections to the end of the ten year planning period are summarized as follows:

.1	**Existing System**				
	.1	*Peak Day*			
		Irrigation:	119 hectares @ 0.94 lps x 80%	=	90 lps
		Domestic:	330 services @ 0.189 lps x 80%	=	50 lps
		Total:		=	**140 lps**
	.2	*Annual*			
		Irrigation:	119 hectares @ 7.62 da-m³ (2.5 ac-ft/ac)	=	905 da-m³
		Domestic:	330 services @ 0.92 da-m³	=	305 da-m³
		Total:		=	**1210 da-m³**
.2	**Demands @ End of 10 Year Period**				
	.1	*Peak Day*			
		Irrigation:	136 hectares @ 0.94 lps x 80%	=	102 lps
		Domestic:	363 services @ 0.189 lps x 80%	=	55 lps
		Total:		=	**157 lps**
	.2	*Annual*			
		Irrigation:	136 hectares @ 7.62 da-m³	=	1036 da-m³
		Domestic:	363 services @ 0.92 da-m³	=	334 da-m³
		Total:		=	**1370 da-m³**

The calculations for the amount of irrigated land are made using the Grade 'A' area listed in the assessment roll less 0.1 of a hectare (0.25 of an acre) for each domestic service.

4. Water Supply

The main water supply for the OWS is Kalamalka Lake with a pump station located on Trask Road. The system is also inter-connected with and can receive a limited supply of water from the Wood Lake Water System. This latter source is particulary useful for emergency situations or during major fires.

.1 Water Licensing

The District is authorized to divert and use water from Kalamalka Lake under the following water licences.

.1 C.L. 109392

Irrigation:	1202 da-m³ (975 ac-ft) per annum
Waterworks:	142 m³ per day
Period of Use:	April 1 to September 30

.2 C.L. 109391

Waterworks:	142 m³ per day
Period of Use:	October 1 to March 31

.3 C.L. 109390

Irrigation:	342 da-m³ (277 ac-ft) per annum
Period of Use:	April 1 to September 30

.4 C.L. 109389

Irrigation:	49 da-m³ (40 ac-ft) per annum
Period of Use:	April 1 to September 3

.5 Total Licences:

Irrigation:	1594 da-m³ (1292 ac-ft) per annum
Waterworks:	142 m³ per day (102 da-m³ or 83 ac-ft per annum)

In addition to the licences, the District of Lake Country has a reserve under Section 44 of the Water Act for future use of 617 da-m³ (500 ac-ft) . The reserve does not specify the period of use or purpose so presumably the water can be used at any time for any purpose.

The water use in the year 2008 is projected to be 1036 da-m³ (840 ac-ft) for irrigation use and 334 da-m³ (271 ac-ft) for domestic use. The water licences are more than adequate for irrigation purposes but not for domestic. The District will either have to apply to have irrigation licences converted to domestic licences or apply to use some of the water being held under the reserve.

.2 Pumping Capability

The Kalamalka Lake pump station, which was constructed in 1995, is equipped with one 50 hp and three 125 hp pumps. The design of the water system requires that Peak Day demands be met with one of the largest pumps out of service. The total pumping capacity of the station with three out of four pumps running is:

.1	125 hp pumps, 2 @ 78.9 lps	157.8 lps
.2	50 hp pump, 31.5 lps	31.5 lps
.3	**Total:**	**189.3 lps (3000 USgpm)**

The projected Peak Day demand in the year 2008 is 157 lps (2490 USgpm) so if the projections of growth are reasonably accurate there is enough supply capability to meet the water requirements for at least the next ten years.

The upper pressure zone is supplied by a booster pump station which contains a 60 hp pump and a 1½ hp pump. The small pump is used in the winter to supply in-house residential demands and the large pump is used in the summer to supply residential and irrigation demands. The pump is a new unit and is capable of delivering

57 lps (900 Usgpm) at 60 metres of head. There is no reservoir in the upper zone and pressures are controlled by varying motor speeds with a variable frequency drive.

A more complete discussion of the upper pressure zone and the options to improve the upper zone system are contained in a report entitled *'Upper Pressure Zone Upgrading Options'* prepared in April 1997.

5. Distribution System

.1 Network Analysis

The distribution system was analyzed with the assistance of the *Waterworks* Computer Program. The analysis was made for a variety of conditions of which three were printed; existing system, existing system with regrade applicants, and the proposed system with a fire flow at the south end of Old Mission Road. The printouts are contained in Annex 5 and a plan showing the pipeline and node labelling system is contained in the pocket of this report.

The criteria used for the network analysis include both standard design values and values obtained from experience with other water systems. These criteria are shown in the table below.

Design Criteria - Table 2

1. Peak Day Demand a) Irrigation b) Single Family Domestic c) Multi-Family Domestic	 0.94 lps/ha @ 80% (6.0 USgpm/ac) 0.189 lps/conn @ 80% (3.0 USgpm/conn) 0.101 lps/unit @ 80% (1.6 USgpm/unit)
2. Peak Hour Demand a) Irrigation b) Single Family Domestic c) Multi-Family Domestic	 0.94 lps/ha (6.0 USgpm/ac) 0.189 lps/conn (3.0 USgpm/ac) 0.101 lps/unit (1.6 USgpm/unit)
3. Maximum Pipeline Velocities a) Mainlines b) Distribution System - normal conditions c) Distribution System - fire flows	 2.4 m/s (8 fps) 2.0 m/s (6.5 fps) 4.0 m/s (13 fps)
4. Pipeline Friction Factors a) Asbestos-Cement b) PVC c) Ductile Iron	 C = 120 C = 140 C = 130
5. Minimum Design Pressures a) Irrigation @ highest elevation on lot b) Residential @ service connection c) Fire Flows @ hydrant	 310 kPa (45 psi) 280 kPa (40 psi) 140 kPa (20 psi)
6. Maximum Pressure a) Residential & Irrigation	 860 kPa (125 psi)
7. Minimum Recommended Fire Flows a) Rural Residential b) Urban Residential	 15.1 lps (240 USgpm) 63.1 lps (1000 USgpm)

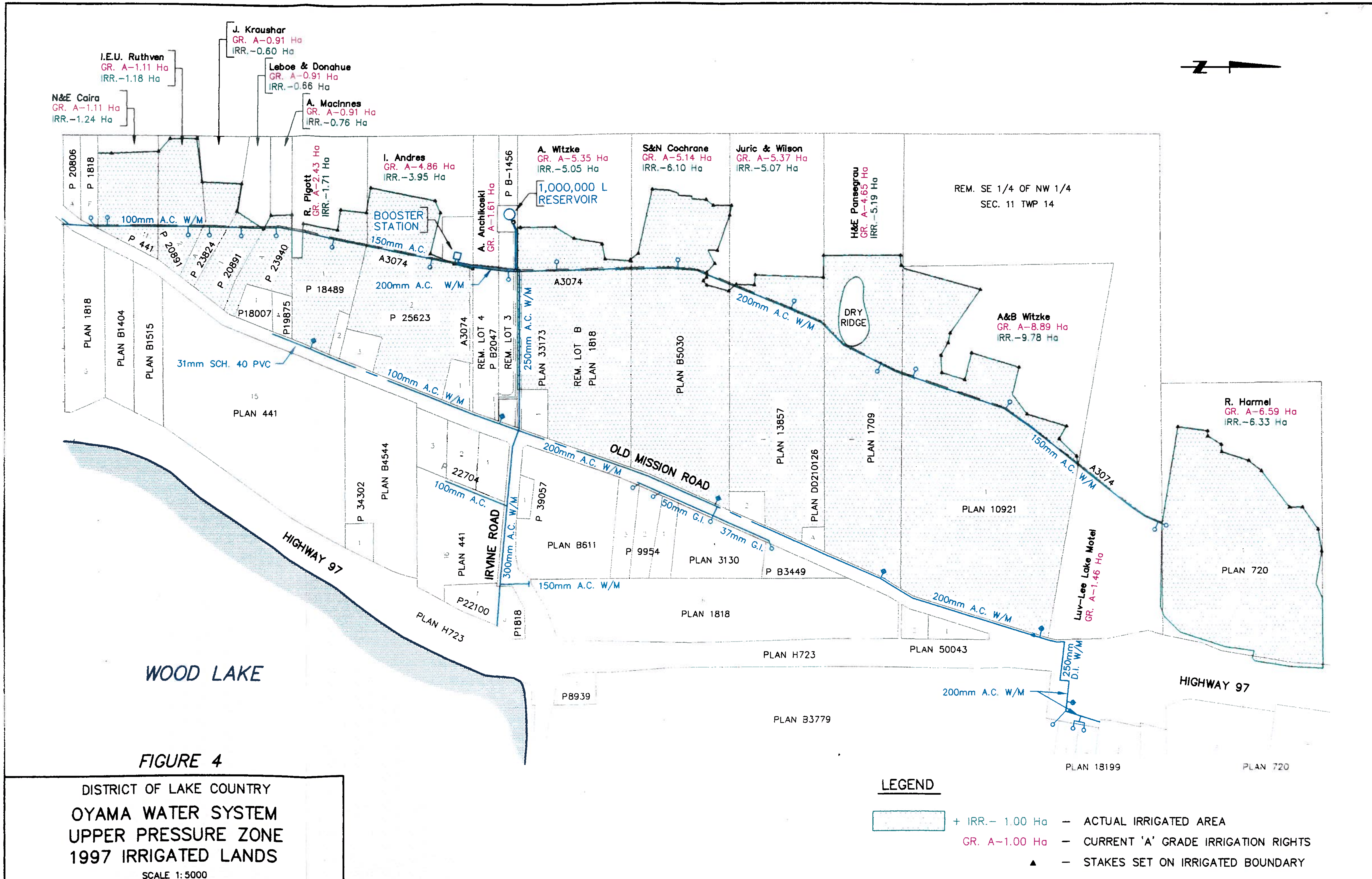


FIGURE 4

DISTRICT OF LAKE COUNTRY

OYAMA WATER SYSTEM
UPPER PRESSURE ZONE
1997 IRRIGATED LANDS

SCALE 1:5000

The analysis of the existing system at Peak Day demand revealed no areas where the minimum pressure criteria is not met and no pipelines where maximum velocities are reached. This is true even in the upper pressure zone where the landowners are irrigating more land than the system was originally designed to supply. A list of landowners in the upper pressure zone together with the highest elevation presently being irrigated is contained in Annex 3. A plan showing the irrigated areas, as surveyed in the summer, is shown in Figure 4 on the opposite page.

The pumping facilities in the upper pressure zone were originally designed to supply an elevation of 473 metres. The system upgrading carried out in 1995 - 1996 included a new booster pump and a new reservoir with an operating level about 7 metres higher than the old reservoir. The combination of these improvements allows the distribution system to supply higher lands and the system can now supply 310 kPa (45 psi) to the 480m contour. The landowners in the upper zone have continued to irrigate higher and higher over the years and the District should establish a new design elevation to which 310 kPa can be supplied. The landowners would then be responsible for providing the additional head required to irrigate above this elevation. This can either be done with individual boosters or the landowners could pay the District to provide the extra head by replacing the pump with a larger unit.

While the existing system can supply to the 480m contour, the system could supply more water if the booster pump was moved to the valve chamber at the new reservoir. Moving the pump to this location would reduce head losses and increase pumping rates. The valve chamber at the new reservoir was designed to accommodate the booster pump when funds become available to make the change.

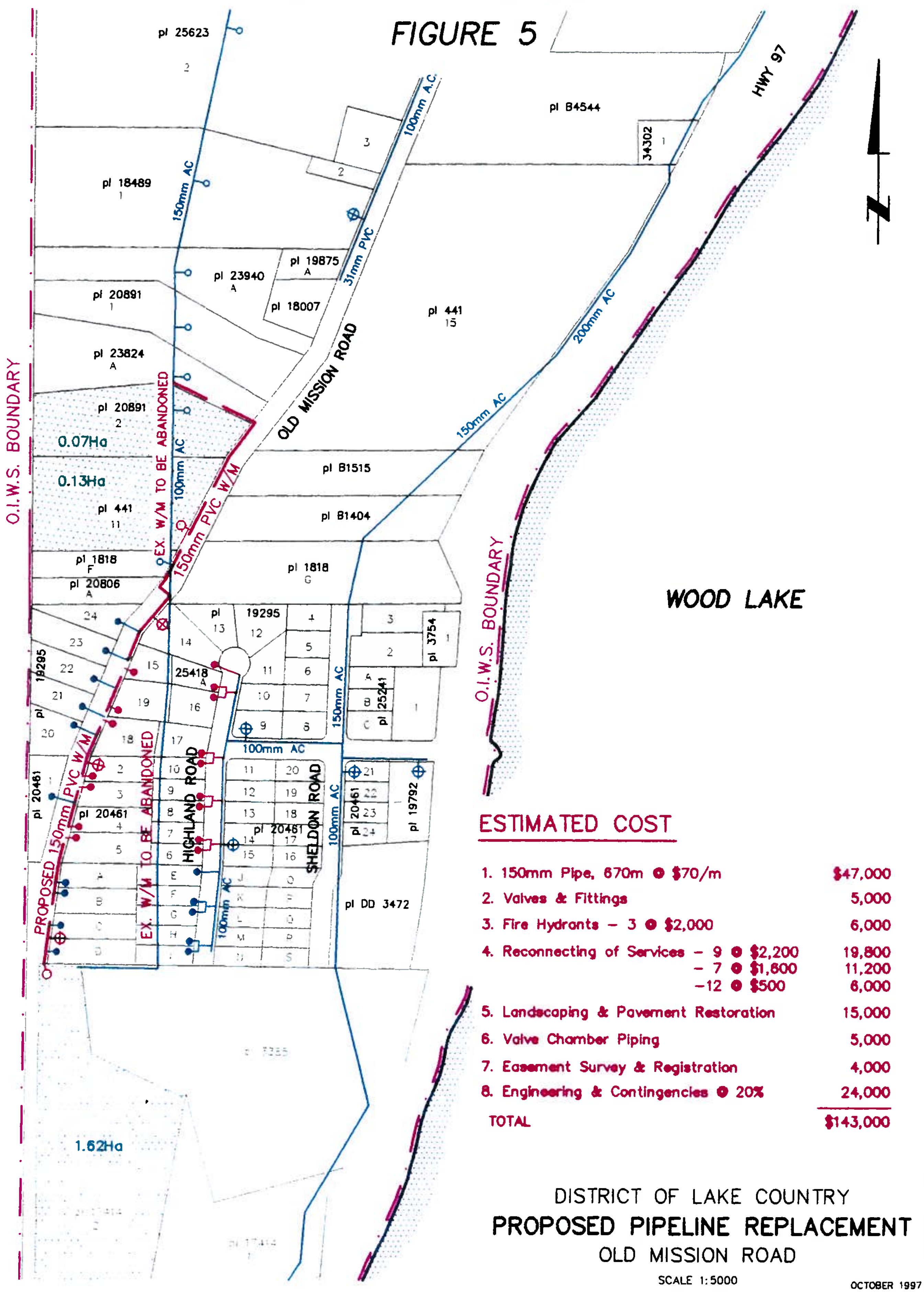
.2 Fire Flows

Fire hydrants are installed in both pressure zones which commits the District to providing an adequate supply of water to the hydrants. Failure to provide adequate flows to these hydrants during a fire could result in more property damage than necessary and it is likely that the District would be held responsible.

Certain criteria are set out by the Fire Underwriters Survey (FUS) which must be satisfied in order to qualify as a community fire protection system. The system must be able to deliver 15 ℓps (240 USgpm) to each hydrant at 140 kpa (20 psi) minimum pressure for a duration of two hours (see letter from FUS in Annex 4). The fire flow must be in addition to the Peak Day flow of the system. A second important criteria is that the water system must supply the minimum fire flow with the most important pump out of service. This stipulation is important for the upper pressure zone since the zone is supplied with a single unit.

The Kalamalka Lake pump station and the reservoir were designed to meet the fire flow conditions and all hydrants in the lower zone are capable of meeting the minimum 15 ℓps flow. The three hydrants at the south end of Old Mission Road in the upper pressure zone cannot supply the minimum fire flow with the booster pump out of service. A map showing the flows that can be expected from each hydrant was previously sent to the District.

FIGURE 5



ESTIMATED COST

1. 150mm Pipe, 670m @ $70/m	$47,000
2. Valves & Fittings	5,000
3. Fire Hydrants – 3 @ $2,000	6,000
4. Reconnecting of Services – 9 @ $2,200	19,800
– 7 @ $1,600	11,200
–12 @ $500	6,000
5. Landscaping & Pavement Restoration	15,000
6. Valve Chamber Piping	5,000
7. Easement Survey & Registration	4,000
8. Engineering & Contingencies @ 20%	24,000
TOTAL	$143,000

DISTRICT OF LAKE COUNTRY

PROPOSED PIPELINE REPLACEMENT

OLD MISSION ROAD

SCALE 1:5000

OCTOBER 1997

6. System Upgrading

There are two components to the improvements recommended for implementation over the next ten years; those works needed to supply existing users and those required for new users. The two are dealt with jointly in this report because they are inter-related. The funding for remedying the existing deficiencies will come from general revenue whereas the funding for works needed for new users will come from Development Cost Charges.

.1 Existing System Deficiencies

The principal deficiencies in the existing system that need to resolved are:

1. The system supplying the fire hydrants in the upper pressure zone
2. The 100mm AC pipeline in the easement at the south end of the water system

The lack of adequate fire flows to existing hydrants can be resolved without using pumps and/or a new reservoir in the upper pressure zone. The existing reservoir is high enough to provide adequate flow and pressure to the three hydrants providing that the 100mm pipeline on Old Mission Road is replaced with a 150mm pipe as shown on Figure 5 on the opposite page. The larger diameter pipe will reduce head losses so that a flow of 15 ℓps can be supplied at 140 kPa during peak demand conditions with the booster pump out of service. Also, modifications to the piping in the valve chamber are necessary so that water can bypass the booster pump station and flow from the new reservoir into the upper pressure zone with minimum head losses.

The pipeline easement through the lots on the west side of Highland Road has been encroached with buildings, retaining walls, driveways and landscaping making it impossible to maintain the pipeline or services. Small diameter asbestos-cement pipe has a history of having a high rate of failures and the District has been fortunate so far not to have had a serious problem with this pipeline. There also are some areas where the ground cover over the pipe has been removed by the property owner and the cover is now less than three feet. These areas of reduced cover are susceptible to freezing and pipeline breakage. It would be good planning to remove the services from the pipeline on the easement and transfer them to pipelines on road right-of-ways.

The replacement of the 100mm pipeline on Old Mission Road for water supply and fire protection purposes would be an opportune time to move the services from the pipeline on the easement so that it can be abandoned. The total estimated cost is $143,000 which includes provision for relocating services and service lines on private property. It should be noted that a portion of this cost can be funded from Development Cost Charges as some of this work is needed to supply new applicants. A length of 290m of the 100mm AC waterline needs to be replaced with 150mm pipe so that the three applicants shown on the previous plan can be supplied without affecting existing users. The portion of the costs that can be funded from DCC's is estimated as follows:

1.	150mm Pipe, 290m @ $70	$20,300
2.	Valves and Fittings	1,700
3.	Reconnect Services, 2 @ $500	1,000
4.	Landscaping and Pavement Restoration	1,500
5.	Easement Survey & Registration	4,000
6.	Engineering & Contingencies @ 20%	5,500
	Total:	**$34,000**

The balance of the expenditure, $109,000, must come from general revenue.

.2 Improvements Needed to Supply New Development

The water system generally can supply the projected water use for the next ten years without any improvements, however, the new users will be reducing the surplus capacity of the system. The surplus pumping capacity of the Kalamalka Lake station and watermains and reservoir surplus capacities will all be decreased and must be restored at some point. Funds should be collected and works installed to restore at least a portion of this surplus so that applicants for water beyond the ten year planning period are not faced with very large costs to upgrade the system once all surplus capacity is used up. There are two ways of replacing this capacity, supply additional reservoir storage and/or implement a metering/conservation program. A discussion of these two options follows:

.1 Balancing Reservoir

Construction of a second balancing reservoir could provide enough storage to supply fire flows without requiring a back-up pump in the Kalamalka Lake pump station and thereby increase the pumping rate by 79 lps, a 30% increase. This capacity increase is far more than is needed for the new users expected by the end of the ten year planning period.

.2 Conservation Program

A considerable amount of research work is being conducted on the merits of water meters and billing owners for actual water used. The present information indicates that meters combined with an effective public information program is expected to reduce annual water use by up to 30%. A conservative estimate of water use reduction through a metering program is 10% of the total use or 137 da-m^3 annually. The 137 da-m^3 is somewhat less than the 160 da-m^3 that is predicted to be needed by new users. It should be noted that a water conservation program will also reduce annual operating cost, particularly electrical charges.

Table 3

Expenditures to Year 2008

Project	Estimated Cost	
	District Funded	DDC Eligible
1. *Old Mission Road (South)* Install 150mm watermain and transfer services	$109,000	$34,000
2. *Agricultural / Conservation Program* Irrigation meters plus reading and testing equipment		$104,000
3. *Moving Pumps to New Valve Chamber*	$44,000	
4. *Planning and Engineering*		$20,000
5. *Miscellaneous Pipelines*		$30,000
6. *Total Estimated Costs*	**$153,000**	**$188,000**

The present information suggests that the economics of installing meters for agricultural purposes is cost effective whereas metering of water to residential properties is not. The cost of installing meters on irrigation services in OWS is estimated as follows:

1.	Irrigation - 25mm, 14 @ $500	$ 7,000
	- 38mm, 27 @ $1000	27,000
	- 50mm, 14 @ $1200	16,800
	- 63mm, 3 @ $1400	4,200
2.	Meter Reading Equipment	7,000
3.	Testing Equipment	25,000
4.	Engineering & Contingencies @ 20%	17,000
	Total:	**$104,000**

It is recommended that the agricultural metering program be undertaken first with the reservoir being the next facility to be constructed. The timing of the reservoir construction is dependant on the success of the conservation program and the actual increases in new users.

In addition to the projects outlined in the foregoing, funds should be allocated for miscellaneous pipelines that may need to be installed. The location of future development is not predictable and some additional pipelines may be necessary that cannot be foreseen at this time. An amount of $30,000 has been provided for this contingency.

Funds are needed for engineering reviews of individual applications and for periodic updating of Capital Works Programs. A figure of $20,000 has been included in the list of recommended expenditures for this purpose.

A summary of the expenditures needed for the next ten years is shown in Table 3 on the opposite page.

Table 4 - Recommended DCC's

1. Residential Irrigated to Residential - Single Family - Multi-Family Dryland to Residential - Single Family - Multi-Family	 $2,000 per unit $1,500 per unit $3,000 per unit $2,500 per unit
2. Irrigation	$8,000 per hectare
3. Commercial, Institutional & Industrial (based on building floor area) Basic First 250 sq.m. (minimum charge) Over 250 sq.m. Building with approved sprinkler system First 250 sq.m. (minimum charge) Over 250 sq.m.	 $2.000 $6.00 per sq.m. $2,000 $4.00 per sq.m.

Table 5 - Potential DCC Revenues

DCC Category	Number of Units			Amount
	Upper Zone	Lower Zone	Total	
1. Residential				
Irrigated to Residential - Single Family	2	8	10	$20,000
- Multi-Family				
Dryland to Residential - Single Family		23	23	$69,000
- Multi-Family				
Sub-total:	2	31	33	$89,000
	Area (hectares)			
2. Irrigation	6.0	11	17	$136,000
3. Commercial. Institutional & Industrial		500 sq.m.		$4,000
4. Balance in Fund - 1996				0
5. Total:				$229,000

7. Development Cost Charges

The system upgrading costs outlined in the previous section will partially be borne by the benefiting properties through Development Cost Charges levied on new applications for service. Different types of development place different demands on the water system. For example, commercial developments are usually low water users but require high fire flows. The fire flows have a major impact on pipeline and reservoir sizes and consequently, costs. Residential developments have fairly high water requirements with high peak demands, while agriculture demands are high but only in the summer with no requirements for fire flows. The various user groups should pay charges in accordance with the demands placed on the system.

Taking these variables into consideration as well as relying on past experience in calculating expenditure charges for other Irrigation Districts, it has been concluded that the existing rates need to be revised to better reflect the varied water usage of the different development types. Table 4 opposite shows the recommended DCC rates. Charges at these levels would yield the revenue shown in Table 5. If the cost and revenue projections are reasonably accurate, the District will end up with a DCC fund balance of $54,000 at the end of the ten year plan. This is a reasonable figure considering the uncertainties regarding the rates of growth and locations where development may occur.

Tables 6 and 7 shown opposite page 18 indicate the timing of Capital Works projects and cash flow projections to assist with Financial planning

TABLE 6

ANNUAL EXPENDITURES

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL:
1	Old Mission Road Pipeline	34,000										34,000
2	Irrigation Meters					10,000	94,000					104,000
3	Planning and Engineering	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	20,000
4	Miscellaneous Pipelines					10,000		10,000		10,000		30,000
	TOTAL:	36,000	2,000	2,000	2,000	22,000	96,000	12,000	2,000	12,000	2,000	188,000

TABLE 7

PROJECTED CASH FLOW

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL:
1	Opening Balance	NIL	45,000	60,000	76,000	92,000	89,000	12,000	16,000	30,000	35,000	
2	Capital Outlays	36,000	2,000	2,000	2,000	22,000	96,000	12,000	2,000	12,000	2,000	188,000
3	Revenues	81,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	20,000	229,000
4	Interest		1,000	2,000	2,000	3,000	3,000	0	0	1000	1000	13,000
5	Closing Balance	45,000	60,000	76,000	92,000	89,000	12,000	16,000	30,000	35,000	54,000	

INTEREST RATE: 3% per annum

8. Longer Term Considerations

If projections of growth and water demands contained in this report are reasonably accurate, the District will have an adequate water supply with surplus at the end of the ten year planning period. Ten years is a relatively short period in the life of water systems so it is important to have a longer term strategy for water system expansion. The following projects are possibilities for making more water available:

1. **Water Conservation Program**

   A 10% reduction in water use by implementing an agricultural metering program has been assumed in this report. This figure is considered very conservative and it should be possible to reduce use by at least 30% with an effective rate structure and an extension services program to assist farmers in implementing waste reduction measures. It may also become beneficial to install meters on domestic services to further reduce water use.

2. **Balancing Reservoir**

   A second balancing reservoir with enough capacity to provide fire flows without relying on standby pumps will permit all pumps in the Kalamalka Lake pump station to be used during Peak Demand periods. The reservoir would allow about a 30% increase in pumping rates.

3. **Increased Pumping Capacity**

   The 50 hp pump in the Kalamalka Lake pump station could be replaced with a larger unit to increase pumping rates. The pump replacement would have to be done in conjunction with modifications to the intake system to reduce potentially dangerous pressure surges that can occur during power interruptions.

4. **Oyama Creek Supply**

A supply from Oyama Creek via the inter-connection with the Wood Lake system is a possibility. The Oyama Creek source used by the Wood Lake system has some surplus water available and could be used as a supply for OWS. Extensive upgrading of the WLWS would be required before significant quantities of water could be delivered during peak periods.

The foregoing options, if implemented, would provide a considerable increase in water availability to the Oyama area. It is very unlikely that all projects will be needed in the foreseeable future, however, it is premature to rule any option at this point in time and the economics of any option could change dramatically if development conditions change.

9. Conclusions and Recommendations

The investigation into the Oyama Water System has resulted in the following conclusions and recommendations:

1. The rehabilitation work carried out over the past few years has resulted in a water system that is generally in good condition and, with the exception of supplying fire flow to the upper pressure zone, is capable of meeting the projected future demands of the area until the Year 2008.

2. The District has applications for water servicing on file dating back to 1986. These applications could not be granted due to water licensing limitations and lack of surplus pumping and distribution system capacity. The District was granted a water reserve on Kalamalka Lake by the Ministry of Environment in 1994 and major upgrading of the pumping and distribution systems in 1995 and 1996 has given the District the ability to consider granting the applications as well as consider supplying other new users.

3. The need for water servicing of new lands or changes in use, after the existing applications have been granted, is expected to be quite low. Much of the Oyama area is within the Agricultural Land Reserve which limits the amount of residential/commercial development and most of the agricultural land within the service area is already irrigated. There are some undeveloped lands where owners may want a supply but the economics of water systems are such that supplying much beyond the existing serviced area is cost prohibitive. The estimated increase in serviced agricultural land in the next ten years is 17 hectares and it is projected that 33 new residential services will be added.

4. While the existing system can supply the projected new users without any system improvements, the new users will reduce the surplus capacity of both the supply and distribution systems. At some point in time the surplus capacity will be used up and either further development will have to be curtailed or large expenditures will be necessary to add more capacity. The new users should contribute to the cost of making more capacity

available. In order to increase system capacity, it is recommended that an agricultural metering program be implemented as soon as enough funds have been accumulated in the DCC reserve account. The metering program will reduce water use and restore system capacity for servicing of future developments. A metering program should save at least 10% of the annual water use or 137 da-m³. This amount is less than the quantity needed (160 da-m³) to supply the projected new users within the next ten years.

5. Three hydrants at the south end of the upper pressure zone do not meet fire flow standards specified by Fire Underwriters Survey. In order to supply the minimum 15 ℓps (240 USgpm) fire flow during Peak Day demand with the booster pump out of service, the 100mm AC waterline on Old Mission Road must be replaced with a 150mm pipeline. Also the 100mm AC pipeline located in an easement that services the properties on the west side of Highland Road has been built upon and landscaped making it impossible to maintain or repair. It would be good planning to transfer the services from this pipeline to the pipeline on Highland Road so that it can be abandoned. The estimated cost of this proposal is $143,000 of which $34,000 can be charged to the DCC account.

6. The total capital costs required to supply new users within the next ten years is estimated to be $188,000. The revenue required to fund the capital costs will be generated by Development Cost Charges levied on new developments. A recommended schedule of rates for different types of use is contained in this report. The District should pass a bylaw to authorize collection of the DCC's.

7. The landowners currently pay an annual parcel tax of $250 on every serviced lot. The annual tax pays the debt incurred to rehabilitate the water system in 1995 and 1996. The tax is calculated by dividing the debt by the number of parcels paying tax. The tax rate is essentially unaffected by this Capital Works Program except where previously unserviced lots are added to the system. The new lots will have to pay the tax and as new parcels are added, the tax rate will be reduced accordingly.

8. This plan should be reviewed a minimum of every two years to ensure that it reflects actual conditions and that revenues are adequate to fund the necessary capital improvements.

ANNEX 1

DESIGN FLOWS

LOTS OVER 0.2 HECTARES IN SIZE

Annex 1

Oyama Irrigation Water Service

Design Flows - Lots Over 0.2 Hectares (0.5 acres) in Size

Assessment Roll #	Owner	Legal Description	Grade 'A' Land (hectares)	DOMESTIC CONNECTIONS			Irrigated Land (hectares)	Total Design Flow (lps)
				No.	Land Area (ha.)	Design Flow (lps)		
1	Luv Lee Lake Motel	SE¼ of NW¼ Plan 10921	1.45	6	0.60	1.13	.85	1.93
2	R. Harmel	Lot 1, Plan 720	6.58	1	0.10	0.19	6.48	6.28
4	M. Levorson	Lot 2, Plan 6738	1.06	1	0.10	0.19	.96	1.09
5	Strata-J.Von Hansen	Lot 8, Plan K1, Twp 14	1.98	1	0.10	0.19	1.88	1.96
6	Owls Nest Resort	Lot 9, Plan 720 exc Plan 580&3670	.80	9	0.90	1.70	0	1.70
7	J. McKay	Lot A, Plan 4852	.95	1	0.10	0.19	.85	0.99
8	H. Joachim	Lot 8, Plan 720	5.01	2	0.20	0.38	4.81	4.90
9	B & H Gatzke	Lot 6, Plan 720 exc A399	2.29	1	0.10	0.19	2.19	2.25
10	Okanagan Sausage	SW¼ DD3472 exc Plan 22625 & 19792	.94	2	0.20	0.38	.74	1.07
11	T. Hoolsema	Lot 29, Plan 428 exc 8428 & 18581	1.65	1	0.10	0.19	1.55	1.65
12	R & I Gatzke	Lot K, Plan 1818 exc B4158	4.74	1	0.10	0.19	4.64	4.55
14	Wilson Juric	Lot 2, Plan 13857	4.96	3	0.30	0.57	4.66	4.95
15	Keyser & Bieswick	Lot 2, Plan 9954	.40	1	0.10	0.19	.30	.47
16	D & M Drover	SW¼ of B-611 exc Plan 39057	2.54	3	0.30	0.57	2.24	2.67
17	W. Allan	Lot 1, Plan 22100	.36	1	0.10	0.19	.26	.43
18	P & J Mc Neil	Pt Lot 16, Plan B4544 exc 34302	2.98	1	0.10	0.19	2.88	2.90
19	Leboe & Donahue	Lot 1, Plan 20891	.91	1	0.10	0.19	.81	.95
20	E. Kempf	Lot 15, Plan 441	6.96	2	0.20	0.38	6.76	6.73
21	B & T Witzke	Lot 1, Plan 3385	5.00	1	0.10	0.19	4.90	4.80

Assessment Roll #	Owner	Legal Description	Grade 'A' Land (hectares)	DOMESTIC CONNECTIONS			Irrigated Land (hectares)	Toatal Design Flow (lps)
				No.	Land Area (ha.)	Design Flow (lps)		
22	L. Andres	Lot 2, Plan 25623	5.05	1	0.10	0.19	4.95	4.84
23	R. Pigott	Lot 1, Plan 18489	2.42	2	0.20	0.38	2.22	2.46
24	B, T & R Witzke	Lot G, Plan 1818	1.35	1	0.10	0.19	1.25	1.36
25	A. Anchikoski	Fr. Lots 3-6, B1456, Plan 441	1.61	1	0.10	0.19	1.51	1.61
26	A. Witzke	Lot B, Plan 1818 exc B5030	5.34	1	0.10	0.19	5.24	5.11
27	D. Pansegrau	Fr. SW¼ B3449 & pt Plan B877	.40	1	0.10	0.19	.30	.47
28	H & E Pansegrau	Lot 1, Plan 1709	4.65	2	0.20	0.38	4.45	4.56
29	F. Fumerton	Lot 3, Plan 6738	.59	1	0.10	0.19	.49	.65
30	K & B Hewitt	Lot 3, Plan 9954	.40	1	0.10	0.19	.30	.47
32	Blue Water Lodge	Lot 10, A334, Plan 720	.4	21	2.10	3.97	0	2.37
33	Dr. J. McAnulty	Lot J, Plan 1818	.25	1	0.10	0.19	.15	.33
36	Bailey & Courchesne	Fr. SE¼, Plan B3779 exc red A421 & Plans 8939 & 39746	.53	2	0.20	0.38	.33	.69
38	Teddy Bear Lodge	Lot 1, Plan 17414 exc Plan 34991	.80	6	0.60	1.13	.20	1.32
40	Tween Lakes Resort	Lots 1,2,3, Fr.4, Plan 1931 & B3735	.40	3	0.30	0.57	.1	.66
41	Camp Hatikvah	Fr. SE¼, B1980 exc A541, Plan 4869	2.02	2	0.20	0.38	1.82	2.09
43	Evasohovan	Lot 2, Plan 4867	.37	1	0.10	0.19	.27	.44
44	Oyama Com. Club	Lot 4, Fr. SE¼, Plan 4867	.80	2	0.20	0.38	.60	.94
45	Oyama Fire Dist.	Parc.A, Lot 20, Plan B506 & Parc.A, Lot 21, Plan 428	.40	1	0.10	0.19	.30	.47
51	R&D R&R Peachey	Lot 1, Plan 9523 exc 41753	.58	2	0.20	0.38	.38	.74
52	T. Smithson	Rem Lots 12&13, Plan 20409	.28	1	0.10	0.19	.18	.36
53	Oyama Elementary	Lots 8-11, Plan 428, B2096	.80	8	0.80	1.51	0	1.51
57	E. Nemeth	Lot 33, Plan 428	3.23	1	0.10	0.19	3.23	3.13

Assessment Roll #	Owner	Legal Description	Grade 'A' Land (hectares)	DOMESTIC CONNECTIONS			Irrigated Land (hectares)	Total Design Flow (lps)
				No.	Land Area (ha.)	Design Flow (lps)		
59	J & P Howey	Lot A, Plan 14009	.21	1	0.10	0.19	.11	.29
60	M. Harris	Lot 1, Plan 17040	1.61	1	0.10	0.19	1.51	1.61
69	R & K Renaud	Lot F, Plan 1818 exc 20806	.33	1	0.10	0.19	.23	.41
77	N & E Caira	Lot 11, Plan 441	1.11	1	0.10	0.19	1.01	1.14
78	I & E Ruthven	Rem. Lot 2, Plan 20891	1.05	1	0.10	0.19	.95	1.08
88	Kalaway Bay Resort	SW¼, NE¼, exc A334, Plan 18199	3.23	3	0.30	0.57	2.93	3.32
89	D. Bauman	Lot A, Plan KAP48859	.27	1	0.10	0.19	.17	.35
90	Joachim	Parcel B of Lot 10, Plan 720 exc Plans 39753&KAP48859	.69	1	0.10	0.19	.59	.74
91	S & N Cochrane	Pt. Lot B, Plan 1818 inc. Plan B5030	5.13	2	0.20	0.38	4.93	5.01
92	A & B Witzke	Lot 1, Plan 10921	8.89	1	0.10	0.19	8.79	8.45
93	B, T & R Witzke	N&S½ Lot 12, B1515&1404	2.05	1	0.10	0.19	1.95	2.02
158	R. Ashworth	Lot A, Plan 20806	.30	1	0.10	0.19	.20	.38
160	H. Butterworth	Lot 3, Plan 18199 exc Plan 38982	.40	1	0.10	0.19	.30	.47
186	D & A Ferreira	Lot 1, Plan 19792 exc 20461	.32	1	0.10	0.19	.22	.40
187	A. Gervais	Lot 16, Plan 441	1.86	1	0.10	0.19	1.76	1.84
203	A & M Reich	Lot 1, Plan 22704	.40	1	0.10	0.19	.30	.47
204	S & A Lutyk	Lot 2, Plan 22704	.40	1	0.10	0.19	.30	.47
231	P. Goss	Fr. S½ of SW¼, Plan 34991	.40	1	0.10	0.19	.30	.47
232	A. MacInnes	Lot A, Plan 23940	.91	1	0.10	0.19	.81	.95
247	J. Kraushar	Lot A, Plan 23824	.91	1	0.10	0.19	.81	.95
251	R. Young	Lot 34, Plan 428	2.91	1	0.10	0.19	2.81	2.83
252	D & M Holte	Lot B, Plan 30560	1.42	1	0.10	0.19	1.32	1.43

Asssessment Roll #	Owner	Legal Description	Grade 'A' Land (hectares)	DOMESTIC CONNECTIONS			Irrigated Land (hectares)	Total Design Flow (lps)
				No.	Land Area (ha.)	Design Flow (lps)		
255	GY Lee & Assoc.	amd.Lot 30,Plan 428 exc Pt.A	1.63	1	0.10	0.19	1.53	1.63
258	J. Young	Lot 35, Plan 428	3.43	1	0.10	0.19	3.33	3.32
259	B & M MacCoil	Lot 2, Plan 19472	1.41	1	0.10	0.19	1.31	1.42
260	I. Harmel	Lot 1, Plan 3130	1.61	1	0.10	0.19	1.51	1.61
271	B & H Gatzke	Lot 7, Plan 720 exc A399	2.26	1	0.10	0.19	2.16	2.22
TOTAL:			129.37				118.26	134.82

NOTE: Lots with domestic services only are not included.

ANNEX 2

APPLICATION FOR WATER SERVICING

Annex 2
Applications for Water Servicing

Date	Applicant	Legal	Dom.	Irrigation	
				Acres	Hectares
16/01/86	Nigel & June Hughes	Lot 2, Plan 17414		4	1.62
28/01/86	School District #23	Lots 3-7, Plan 428 & Fr. Lot 8-11, Plan 428 on Plan B2096		3	1.21
29/01/86	Arnold Witzke	Lot B, Plan 1818 exc. B5030		0.80	0.32
03/02/86	Amry Devel. (Young)	Lot 28 & Fr. Lot 28, Map 428	30		
10/02/86	Alfred Witzke	Lot 1, Plan 10971		2	0.81
12/02/86	Ron Harmel	Lot 1, Plan 720		1	0.40
27/03/86	H. Pansegrau	Lot 1, Plan 1709		2.5	1.01
27/01/93	R. Good	Subdvn. Pt SE¼ of NW¼, Plan H723 & Plan 10921	1		
10/02/91	Swiss Village	Frac. SW¼ of Sec. 2, Tp 14	3		
04/11/92	Teddy Bear Lodge	Lot 1, Plan 17414	80		
03/08/94	C. & G. Schmidt	NW¼ of Sec. 14, Tp 14, ODYD		20	8.09
25/01/95	Nemeth, O'Connor & Young	Lot B, Plan 1843		2.8	1.13
07/06/95	Ron Harmel	Lot 1, Plan 720		5	2.02
13/09/95	N. Krumbhols	Lot 4, Plan KAS1325	1		
03/10/95	MCB Investments	Lot 1, Plan 8939 exc. 39746	1 Bus	0.7	0.28
03/01/96	Dennis Clayton	Lot A, Plan 20385	1		
07/10/97	Alfred Witzke	Lot 1, Plan 10921		5	2.02

** Plus users from the upper pressure zone that require additional Grade 'A' assessed land to match their existing irrigated land.

09/97	S. & N. Cochrane	Plan B5030		2.38	0.96
09/97	I.E.U. Ruthven	Rem Lot 2, Plan 20891		0.17	0.07
09/97	N. & E. Caira	Lot 11, Plan 441		0.32	0.13

Applicants that have not been included in this report

ANNEX 3

UPPER PRESSURE ZONE

1997 IRRIGATED LANDS

ANNEX 3

OYAMA IRRIGATION WATER SYSTEM UPPER PRESSURE ZONE 1997 IRRIGATED LANDS					
ROLL #	OWNER	LEGAL DESCRIPTION	CURRENT 'A' RIGHTS (hectares)	ACTUAL IRR. AREA (hectares)	HIGHEST ELEVATION
2	Harmel, Ron	Lot 1, Plan 720	6.59	6.33	487.8m
92	Witzke, A&B	Lot 1, Plan 10921	8.89	9.78	487.6m
28	Pansegrau, H&E	Lot 1, Plan 10921	4.65	5.19	490.6m
14	Juric & Wilson	Lot 2, Plan 13857	5.37	5.07	477.3m
91	Cochrane, S&N	Plan B5030	5.14	6.10	493.8m
26	Witzke, A	Lot B, Plan 1818	5.34	5.05	470.0m
22	Andres, L	Lot 2, Plan 25623	5.05	3.95	468.7m
23	Pigott, R	Lot 1, Plan 25623	2.43	1.71	461.6m
47	Macinnes, A	Lot B, Plan 23940	.91	.76	455.8m
19	Leboe & Donahue	Lot 1, Plan 20891	.91	.65	449.7m
247	Kraushar, J	Lot A, Plan 23824	.91	.60	459.0m
78	Ruthven, I.E.U	Rem. Lot 2, Plan 20891	1.11	1.18	470.1m
77	Caira, N&E	Lot 11, Plan 441	1.11	1.24	462.4m

ANNEX 4

LETTER FROM FIRE UNDERWRITERS SURVEY

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

c/o Insurers' Advisory Organization (1989) Inc., P.O. Box 21, 708-595 Howe St., Vancouver, British Columbia V6C 2T5 (604) 681-3113

30 August 1993

Wood Lake Improvement District
P. O. Box 100
Oyama, BC
V0H 1W0

RECEIVED
SEP 29 1993

Attention: Mr. J. Allingham, Manager

Dear Mr. Allingham:

Re: Reply to your 18 August 1993 letter

To clarify our discussion with the Oyama Fire Protection District, my comments were limited to the minimum fire flows needed to meet insurance grading recognition. I indicated that for fire insurance grading purposes, we will recognize a water system if it can provide 200 Imperial gallons per minute (Igpm) for a duration of 2 hours in addition to the maximum daily consumption. Also, standard fire hydrants must be installed. Based on the flow rates listed in your letter, we will recognize Wood Lake's water system.

I cannot comment on Ministry of Environment guidelines and the liability related to their requirements. I suggest your contact them for clarification of their guidelines.

Please contact me if you have any questions or if I can be of further assistance.

Yours truly

Ian Josephson

Ian Josephson, AScT, AIIC
Surveyor
Pacific Region

ANNEX 5

DISTRIBUTION SYSTEM MODEL

1. **PEAK DAY DEMAND**
   EXISTING USERS

2. **PEAK DAY DEMAND**
   EXISTING SYSTEM WITH
   APPLICANTS ADDED

3. **PEAK DAY DEMAND**
   PLUS FIRE FLOW @
   NODE 35-OLD MISSION ROAD

First: *District of Lake Country*
Second: *Oyama Irrigation Water System*
Third: *October 1997*
Fourth: *Peak Day Demand (80%)*

PIPE TABLE

<------------------- Input					---------------->	<---------- Output		----------->	<-Input->	<Extra>
Pipe	UpNode	DnNode	Length ft	Diameter in	Roughness	Flow US gpm	Velocity ft/sec	HeadLoss ft	Status Open	I.D. Label
1	1	2	60	16	140	2317.58	3.70	0.16		
2	2	46	737	16	120	2317.58	3.70	2.57		
3	45	3	1936	14	140	1795.18	3.74	6.06		
4	4	5	787	8	120	348.10	2.22	2.40		
5	5	6	715	8	120	312.10	1.99	1.78		
6	6	7	636	4	120	20.80	0.53	0.31		
7	6	8	164	8	120	255.31	1.63	0.28		
8	8	9	540	4	120	-48.69	-1.24	1.26		
9	46	9	670	4	120	87.09	2.22	4.59		
10	8	11	800	6	120	252.00	2.86	5.44		
11	11	12	1000	6	120	47.20	0.54	0.31		
12	12	13	978	4	120	14.40	0.37	0.24		
13	11	14	460	6	120	154.40	1.75	1.26		
14	14	15	895	4	120	16.65	0.43	0.29		
15	47	54	886	8	120	348.80	2.23	2.71		
16	54	16	656	8	120	348.80	2.23	2.01		
17	16	17	1660	6	120	200.00	2.27	7.36		
18	17	18	360	4	120	48.00	1.23	0.82		
19	18	19	656	4	120	26.40	0.67	0.49		
20	17	20	262	4	120	9.60	0.25	0.03		
21	17	21	460	6	120	100.80	1.14	0.57		
22	21	22	1378	4	120	23.20	0.59	0.82		
23	47	23	656	12	120	1399.18	3.97	3.65		
24	23	24	360	12	120	1356.78	3.85	1.89		
25	24	25	670	4	120	9.60	0.25	0.08		
26	24	26	1982	8	120	372.80	2.38	6.86		
27	26	27	2343	8	120	283.20	1.81	4.88		
28	27	28	1332	6	120	184.80	2.10	5.10		
29	28	29	630	6	120	64.80	0.74	0.35		
30	29	30	505	4	120	64.80	1.65	2.00		
31	24	44	1140	10	120	911.18	3.72	6.97		
32	52	32	40	12	120	150.38	0.43	0.00		Booster
33	31	33	1266	6	120	189.60	2.15	5.09		
34	33	34	690	4	120	140.00	3.57	11.39		
35	34	35	1214	4	120	28.00	0.71	1.02		
36	34	36	1230	4	120	57.60	1.47	3.92		
37	10	37	1660	8	120	393.60	2.51	6.35		
38	37	38	1263	8	120	268.00	1.71	2.37		
39	38	39	951	6	120	104.00	1.18	1.26		
40	41	1	100	8	120	0.00	0.00	0.00		Equivaler
41	42	1	100	8	120	2317.58	14.79	10.21		Equivaler
43	44	52	240	12	140	911.18	2.59	0.45		
44	45	4	260	10	120	362.50	1.48	0.29		
45	46	45	475	16	140	2170.49	3.46	1.10		
46	10	31	394	8	120	282.40	1.80	0.82		
47	48	3	903	14	140	-1757.58	-3.66	2.72		
48	47	48	712	16	120	-1757.58	-2.80	1.49		
49	49	5	1378	12	140	0.00	0.00	0.00		
50	50	49	100	6	120	0.00	0.00	0.00		
51	14	51	720	6	140	60.95	0.69	0.27		
52	51	15	200	6	140	30.55	0.35	0.02		

54	53	10	207	8	140	760.80	4.86	2.02
55	40	54	100	6	120	0.00	0.00	0.00

Peak demand Ratio= 0.80

NODE TABLE

<---------- Input ---------><----- Output ----><--- Optional ---><-Input->,<---- Extra ---->

Node	Elevation ft	Demand US gpm	Pressure psi	HGL ft	XCoord	YCoord	Status ON	Average Demand	
1	1295	0.00	122.97	1579.07				0.00	
2	1293	0.00	123.77	1578.91				0.00	
3	1296	37.60	118.26	1569.17	470	735		47.00	
4	1298	14.40	119.89	1574.95	865	670		18.00	
5	1292	36.00	121.45	1572.55	1010	615		45.00	
6	1355	36.00	93.41	1570.77	1050	720		45.00	
7	1303	20.80	115.78	1570.46	1140	690		26.00	
8	1365	52.00	88.95	1570.49	1050	744		65.00	
9	1345	38.40	98.16	1571.75	975	770		48.00	
10	1510	84.80	92.95	1724.72	890	810		106.00	
11	1433	50.40	57.16	1565.04	1080	865		63.00	
12	1312	32.80	109.41	1564.73	970	920		41.00	
13	1303	14.40	113.20	1564.50	1035	1050		18.00	
14	1424	76.80	60.51	1563.78	1090	932		96.00	
15	1405	47.20	68.61	1563.49	1132	950		59.00	
16	1312	148.80	107.47	1560.25	254	503		186.00	
17	1309	41.60	105.58	1552.88	154	315		52.00	
18	1355	21.60	85.31	1552.06	100	315		27.00	
19	1381	26.40	73.84	1551.57	90	215		33.00	
20	1296	9.60	111.19	1552.85	200	308		12.00	
21	1335	77.60	94.07	1552.31	152	245		97.00	
22	1312	23.20	103.68	1551.49	132	45		29.00	
23	1365	42.40	84.99	1561.32	275	720		53.00	
24	1398	63.20	69.88	1559.42	220	734		79.00	
25	1401	9.60	68.55	1559.35	150	540		12.00	
26	1388	89.60	71.24	1552.56	330	1020		112.00	
27	1335	98.40	92.07	1547.69	465	1310		123.00	
28	1362	120.00	78.17	1542.58	570	1480		150.00	
29	1319	0.00	96.64	1542.23	540	1570		0.00	
30	1362	64.80	77.16	1540.23	610	1520		81.00	
31	1493	92.80	99.96	1723.90	90	680		116.00	
32	1552	0.00	0.00	1552.00	50	695		0.00	Reservoir
33	1445	49.60	118.53	1718.82	70	492		62.00	
34	1421	54.40	123.99	1707.42	70	390		68.00	
35	1453	28.00	109.70	1706.41	7	210		35.00	
36	1398	57.60	132.25	1703.50	69	200		72.00	
37	1530	125.60	81.54	1718.36	120	935		157.00	
38	1547	164.00	73.16	1715.99	205	1114		205.00	
39	1500	104.00	92.96	1714.73	290	1225		130.00	
40	1291	0.00	117.43	1562.25	308	594		0.00	25 Hp
41	1292	0.00	124.27	1579.07				0.00	50 Hp
42	1292	0.00	128.69	1589.28				0.00	125 Hp
44	1510	0.00	18.38	1552.46	80	695		0.00	
45	1289	12.80	123.91	1575.24				16.00	
46	1290	60.00	123.96	1576.34				75.00	
47	1291	9.60	118.60	1564.97	365	707		12.00	
48	1295	0.00	117.51	1566.45	350	730		0.00	
49	1312	0.00	112.79	1572.55				0.00	
50	1312	0.00	112.79	1572.55				0.00	
51	1380	30.40	79.44	1563.51				38.00	

52	1537	0.00	6.50	1552.00	0.00 Up Booster
53	1537	0.00	82.14	1726.74	0.00 Dn Booster
54	1291	0.00	117.43	1562.25	0.00

INFLOW TABLE

<---------- Input			---------->	<------ Output	------>	<-Input->
Node	Pumps	OpCurve	%Estimate	%Actual	Inflow US gpm	Status ON
32	1	RESERVOIR		-0.07	150.38	
40	1	25 Hp		0.00	0.00	no
41	1	KALPUMP1		0.00	0.00	no
42	2	KALPUMP2		1.07	-2317.58	
50	1	WOODLAKE		0.00	0.00	no

BOOST TABLE

<----- - Input		------>	< Output >	<-Input->
Pipe	Pumps	OpCurve	Boost ft	Status ON
53	1	BOOSTER	180.00	

REDUCING (PRV) TABLE

<------------- Input			------------->		<---- Output	---->	PRV #
Pipe	Source	Pressure psi	OpenK	CKV	PRVLoss ft	CKVState	
50	50	100		yes	0.00	Closed	

CHECK (CKV) TABLE

<Input>	< Output >
Pipe	State
50	Closed

RESERVOIR		25 Hp		BOOSTER	
<------- Input	------>	<------- Input	------->	<------- Input	------->
Flow US gpm	Head ft	Flow US gpm	Head ft	Flow US gpm	Head ft
0	0	0	380	0	180
500	0	100	323	300	180
1500	0	150	278	600	180
3500	0	200	240	900	180
5500	0	250	194	1000	180
7000	0	300	133	1200	180
				1500	80

KALPUMP1		KALPUMP2		WOODLAKE	
<------- Input ------->		<------- Input ------->		<------- Input ------->	
Flow	Head	Flow	Head	Flow	Head
US gpm	ft	US gpm	ft	US gpm	ft
0	369	0	398	0	315
150	345	300	384	200	312
300	327	600	360	500	306
450	295	900	331	1000	295
600	263	1200	292	1500	280
		1500	238	2000	250

First: *District of Lake Country*
Second: *Oyama Irrigation Water System - October 1997*
Third: *Peak Day Demand (80%)*
Fourth: *Existing System Plus Proposed Water Applicants*

PIPE TABLE

<-----	Input	-----	-----	-----	----->	<-----	Output	----->	<-Input->	<Extra>
Pipe	UpNode	DnNode	Length ft	Diameter in	Roughness	Flow US gpm	Velocity ft/sec	HeadLoss ft	Status Open	I.D. Label
1	1	2	60	16	140	2351.60	3.75	0.16		
2	2	46	737	16	120	2338.16	3.73	2.61		
3	45	3	1936	14	140	1726.17	3.60	5.64		
4	4	5	787	8	120	411.51	2.63	3.27		
5	5	6	715	8	120	361.11	2.31	2.33		
6	6	7	636	4	120	20.80	0.53	0.31		
7	6	8	164	8	120	304.31	1.94	0.39		
8	8	9	540	4	120	-2.89	-0.07	0.01		
9	46	9	670	4	120	113.29	2.89	7.47		
10	8	11	800	6	120	255.20	2.90	5.57		
11	11	12	1000	6	120	49.60	0.56	0.34		
12	12	13	978	4	120	14.40	0.37	0.24		
13	11	14	460	6	120	155.20	1.76	1.28		
14	14	15	895	4	120	16.83	0.43	0.29		
15	47	54	886	8	120	356.00	2.27	2.82		
16	54	16	656	8	120	356.00	2.27	2.09		
17	16	17	1660	6	120	207.20	2.35	7.86		
18	17	18	360	4	120	48.00	1.23	0.82		
19	18	19	656	4	120	26.40	0.67	0.49		
20	17	20	262	4	120	9.60	0.25	0.03		
21	17	21	460	6	120	108.00	1.23	0.65		
22	21	22	1378	4	120	30.40	0.78	1.35		
23	47	23	656	12	120	1317.21	3.74	3.26		
24	23	24	360	12	120	1274.81	3.62	1.69		
25	24	25	670	4	120	9.60	0.25	0.08		
26	24	26	1982	8	120	375.20	2.40	6.94		
27	26	27	2343	8	120	283.20	1.81	4.88		
28	27	28	1332	6	120	184.80	2.10	5.10		
29	28	29	630	6	120	64.80	0.74	0.35		
30	29	30	505	4	120	64.80	1.65	2.00		
31	24	44	1140	10	120	826.81	3.38	5.82		
32	52	32	40	12	120	-42.87	-0.12	0.00		Booster
33	31	33	1266	6	120	208.80	2.37	6.08		
34	33	34	690	4	120	159.20	4.07	14.45		
35	34	35	1214	4	120	28.00	0.71	1.02		
36	34	36	1230	4	120	76.80	1.96	6.68		
37	10	37	1660	8	120	479.44	3.06	9.16		
38	37	38	1263	8	120	330.40	2.11	3.50		
39	38	39	951	6	120	132.80	1.51	1.98		
40	41	1	100	8	120	0.00	0.00	0.00		Equivaler
41	42	1	100	8	120	2351.60	15.01	10.48		Equivaler
43	44	52	240	12	140	826.81	2.35	0.38		
44	45	4	260	10	120	425.91	1.74	0.39		
45	46	45	475	16	140	2164.87	3.45	1.10		
46	10	31	394	8	120	301.60	1.93	0.92		
47	48	3	903	14	140	-1688.57	-3.52	2.52		
48	47	48	712	16	120	-1682.81	-2.69	1.37		
49	49	5	1378	12	140	0.00	0.00	0.00		
50	50	49	100	6	120	0.00	0.00	0.00		
51	14	51	720	6	140	61.57	0.70	0.27		
52	51	15	200	6	140	31.17	0.35	0.02		
53	52	53	100	6	120	869.68	9.87	173.25		Equivaler

54	53	10	207	8	140	869.68	5.55	2.59
55	40	54	100	6	120	0.00	0.00	0.00

Peak demand Ratio= 0.80

NODE TABLE

<---------- Input		--------->	<----- Output	---->	<--- Optional	--->	<-Input->,	<---- Extra	---->
Node	Elevation ft	Demand US gpm	Pressure psi	HGL ft	XCoord	YCoord	Status ON	Average Demand	
1	1295	0.00	121.89	1576.56				0.00	
2	1293	13.44	122.68	1576.40				16.80	
3	1296	37.60	117.34	1567.05	470	735		47.00	
4	1298	14.40	118.74	1572.30	865	670		18.00	
5	1292	50.40	119.92	1569.02	1010	615		63.00	
6	1355	36.00	91.64	1566.69	1050	720		45.00	
7	1303	20.80	114.02	1566.38	1140	690		26.00	
8	1365	52.00	87.14	1566.30	1050	744		65.00	
9	1345	110.40	95.80	1566.31	975	770		138.00	
10	1510	88.64	92.06	1722.67	890	810		110.80	
11	1433	50.40	55.29	1560.73	1080	865		63.00	
12	1312	35.20	107.53	1560.39	970	920		44.00	
13	1303	14.40	111.32	1560.15	1035	1050		18.00	
14	1424	76.80	58.64	1559.45	1090	932		96.00	
15	1405	48.00	66.74	1559.16	1132	950		60.00	
16	1312	148.80	106.60	1558.25	254	503		186.00	
17	1309	41.60	104.49	1550.38	154	315		52.00	
18	1355	21.60	84.23	1549.56	100	315		27.00	
19	1381	26.40	72.76	1549.07	90	215		33.00	
20	1296	9.60	110.11	1550.35	200	308		12.00	
21	1335	77.60	92.96	1549.73	152	245		97.00	
22	1312	30.40	102.33	1548.39	132	45		38.00	
23	1365	42.40	84.37	1559.88	275	720		53.00	
24	1398	63.20	69.35	1558.20	220	734		79.00	
25	1401	9.60	68.02	1558.12	150	540		12.00	
26	1388	92.00	70.67	1551.25	330	1020		115.00	
27	1335	98.40	91.51	1546.38	465	1310		123.00	
28	1362	120.00	77.61	1541.27	570	1480		150.00	
29	1319	0.00	96.07	1540.93	540	1570		0.00	
30	1362	64.80	76.59	1538.92	610	1520		81.00	
31	1493	92.80	99.02	1721.75	90	680		116.00	
32	1552	0.00	0.00	1552.00	50	695		0.00	Reservoir
33	1445	49.60	117.17	1715.66	70	492		62.00	
34	1421	54.40	121.30	1701.21	70	390		68.00	
35	1453	28.00	107.01	1700.19	7	210		35.00	
36	1398	76.80	128.37	1694.53	69	200		96.00	
37	1530	149.04	79.44	1713.51	120	935		186.30	
38	1547	197.60	70.57	1710.01	205	1114		247.00	
39	1500	132.80	90.06	1708.04	290	1225		166.00	
40	1291	0.00	116.59	1560.33	308	594		0.00	25 Hp
41	1292	0.00	123.19	1576.56				0.00	50 Hp
42	1292	0.00	127.72	1587.04				0.00	125 Hp
44	1510	0.00	18.35	1552.38	80	695		0.00	
45	1289	12.80	122.81	1572.68				16.00	
46	1290	60.00	122.85	1573.78				75.00	
47	1291	9.60	117.81	1563.15	365	707		12.00	
48	1295	5.76	116.68	1564.52	350	730		7.20	
49	1312	0.00	111.27	1569.02				0.00	
50	1312	0.00	111.27	1569.02				0.00	
51	1380	30.40	77.57	1559.18				38.00	

52	1537	0.00	6.49	1552.00	0.00 Up Booster
53	1537	0.00	81.49	1725.25	0.00 Dn Booster
54	1291	0.00	116.59	1560.33	0.00

INFLOW TABLE

<---------- Input ----------><------ Output ------><-Input->

Node	Pumps	OpCurve	%Estimate	%Actual	Inflow US gpm	Status ON
32	1	RESERVOIR		0.02	-42.87	
40	1	25 Hp		0.00	0.00	no
41	1	KALPUMP1		0.00	0.00	no
42	2	KALPUMP2		0.98	-2351.60	
50	1	WOODLAKE		0.00	0.00	no

BOOST TABLE

<----- - Input ------>< Output ><-Input->

Pipe	Pumps	OpCurve	Boost ft	Status ON
53	1	BOOSTER	180.00	

REDUCING (PRV) TABLE

<-------------- Input --------------><---- Output ----> PRV #

Pipe	Source	Pressure psi	OpenK	CKV	PRVLoss ft	CKVState
50	50	100		yes	0.00	Closed

CHECK (CKV) TABLE

<Input>< Output >

Pipe	State
50	Closed

RESERVOIR		25 Hp		BOOSTER	
<------- Input ------>		<------- Input ------->		<------- Input ------->	
Flow US gpm	Head ft	Flow US gpm	Head ft	Flow US gpm	Head ft
0	0	0	380	0	180
500	0	100	323	300	180
1500	0	150	278	600	180
3500	0	200	240	900	180
5500	0	250	194	1000	180
7000	0	300	133	1200	180
				1500	80

KALPUMP1		KALPUMP2		WOODLAKE	
<------- Input ------->		<------- Input ------->		<------- Input ------->	
Flow	Head	Flow	Head	Flow	Head
US gpm	ft	US gpm	ft	US gpm	ft
0	369	0	398	0	315
150	345	300	384	200	312
300	327	600	360	500	306
450	295	900	331	1000	295
600	263	1200	292	1500	280
		1500	238	2000	250

First: *District of Lake Country*
Second: *Oyama Irrigation Water System - October 1997*
Third: *Proposed System @ Peak Day Demand Plus Fire Flow of 210 USgpm*
Fourth: *(13.2 lps) @ S End of Old Mission Rd.(Node 35), Booster Pump Off*

PIPE TABLE

<-------------------- Input ------------------><----------- Output ------------><-Input-> <Extra>

Pipe	UpNode	DnNode	Length ft	Diameter in	Roughness	Flow US gpm	Velocity ft/sec	HeadLoss ft	Status Open	I.D. Label
1	1	2	60	16	140	2351.69	3.75	0.16		
2	2	46	737	16	120	2338.25	3.73	2.61		
3	45	3	1936	14	140	1726.25	3.60	5.64		
4	4	5	787	8	120	411.51	2.63	3.27		
5	5	6	715	8	120	361.11	2.31	2.33		
6	6	7	636	4	120	20.80	0.53	0.31		
7	6	8	164	8	120	304.31	1.94	0.39		
8	8	9	540	4	120	-2.89	-0.07	0.01		
9	46	9	670	4	120	113.29	2.89	7.48		
10	8	11	800	6	120	255.20	2.90	5.57		
11	11	12	1000	6	120	49.60	0.56	0.34		
12	12	13	978	4	120	14.40	0.37	0.24		
13	11	14	460	6	120	155.20	1.76	1.28		
14	14	15	895	4	120	16.83	0.43	0.29		
15	47	54	886	8	120	356.00	2.27	2.82		
16	54	16	656	8	120	356.00	2.27	2.09		
17	16	17	1660	6	120	207.20	2.35	7.86		
18	17	18	360	4	120	48.00	1.23	0.82		
19	18	19	656	4	120	26.40	0.67	0.49		
20	17	20	262	4	120	9.60	0.25	0.03		
21	17	21	460	6	120	108.00	1.23	0.65		
22	21	22	1378	4	120	30.40	0.78	1.35		
23	47	23	656	12	120	1317.29	3.74	3.26		
24	23	24	360	12	120	1274.89	3.62	1.69		
25	24	25	670	4	120	9.60	0.25	0.08		
26	24	26	1982	8	120	375.20	2.40	6.94		
27	26	27	2343	8	120	283.20	1.81	4.88		
28	27	28	1332	6	120	184.80	2.10	5.10		
29	28	29	630	6	120	64.80	0.74	0.35		
30	29	30	505	4	120	64.80	1.65	2.00		
31	24	44	1140	10	120	826.89	3.38	5.82		
32	52	32	40	12	120	-252.79	-0.72	0.01		Booster
33	31	33	1266	6	120	418.80	4.75	22.07		
34	33	34	690	6	140	369.20	4.19	7.16		
35	34	35	1214	6	140	238.00	2.70	5.59		
36	34	36	1230	4	120	76.80	1.96	6.68		
37	10	37	1660	8	120	479.44	3.06	9.16		
38	37	38	1263	8	120	330.40	2.11	3.50		
39	38	39	951	6	120	132.80	1.51	1.98		
40	41	1	100	8	120	0.00	0.00	0.00		Equivalen
41	42	1	100	8	120	2351.69	15.01	10.49		Equivalen
43	44	52	240	12	140	826.89	2.35	0.38		
44	45	4	260	10	120	425.91	1.74	0.39		
45	46	45	475	16	140	2164.96	3.46	1.10		
46	10	31	394	8	120	511.60	3.27	2.45		
47	48	3	903	14	140	-1688.65	-3.52	2.53		
48	47	48	712	16	120	-1682.89	-2.69	1.37		
49	49	5	1378	12	140	0.00	0.00	0.00		
50	50	49	100	6	120	0.00	0.00	0.00		
51	14	51	720	6	140	61.57	0.70	0.27		
52	51	15	200	6	140	31.17	0.35	0.02		
53	52	53	100	6	120	1079.68	12.25	10.07		Equivalen

54	53	10	207	8	140	1079.68	6.89	3.86
55	40	54	100	6	120	0.00	0.00	0.00

Peak demand Ratio= 0.80

NODE TABLE

<---------- Input		--------->	<----- Output	---->	<--- Optional	--->	<-Input->,	<---- Extra ---->	
Node	Elevation	Demand	Pressure	HGL	XCoord	YCoord	Status	Average	
	ft	US gpm	psi	ft			ON	Demand	
1	1295	0.00	121.88	1576.55				0.00	
2	1293	13.44	122.68	1576.39				16.80	
3	1296	37.60	117.33	1567.04	470	735		47.00	
4	1298	14.40	118.74	1572.29	865	670		18.00	
5	1292	50.40	119.92	1569.02	1010	615		63.00	
6	1355	36.00	91.64	1566.68	1050	720		45.00	
7	1303	20.80	114.02	1566.38	1140	690		26.00	
8	1365	52.00	87.14	1566.29	1050	744		65.00	
9	1345	110.40	95.80	1566.30	975	770		138.00	
10	1510	88.64	12.15	1538.06	890	810		110.80	
11	1433	50.40	55.29	1560.72	1080	865		63.00	
12	1312	35.20	107.53	1560.39	970	920		44.00	
13	1303	14.40	111.32	1560.15	1035	1050		18.00	
14	1424	76.80	58.63	1559.45	1090	932		96.00	
15	1405	48.00	66.73	1559.15	1132	950		60.00	
16	1312	148.80	106.60	1558.24	254	503		186.00	
17	1309	41.60	104.49	1550.38	154	315		52.00	
18	1355	21.60	84.22	1549.56	100	315		27.00	
19	1381	26.40	72.75	1549.06	90	215		33.00	
20	1296	9.60	110.11	1550.35	200	308		12.00	
21	1335	77.60	92.95	1549.72	152	245		97.00	
22	1312	30.40	102.33	1548.38	132	45		38.00	
23	1365	42.40	84.36	1559.88	275	720		53.00	
24	1398	63.20	69.35	1558.19	220	734		79.00	
25	1401	9.60	68.01	1558.11	150	540		12.00	
26	1388	92.00	70.67	1551.25	330	1020		115.00	
27	1335	98.40	91.50	1546.37	465	1310		123.00	
28	1362	120.00	77.60	1541.27	570	1480		150.00	
29	1319	0.00	96.07	1540.92	540	1570		0.00	
30	1362	64.80	76.59	1538.92	610	1520		81.00	
31	1493	92.80	18.45	1535.61	90	680		116.00	
32	1552	0.00	0.00	1552.00	50	695		0.00	Reservoir
33	1445	49.60	29.67	1513.54	70	492		62.00	
34	1421	54.40	36.96	1506.38	70	390		68.00	
35	1453	238.00	20.69	1500.79	7	210		35.00	
36	1398	76.80	44.03	1499.70	69	200		96.00	
37	1530	149.04	-0.47	1528.90	120	935		186.30	
38	1547	197.60	-9.35	1525.41	205	1114		247.00	
39	1500	132.80	10.14	1523.43	290	1225		166.00	
40	1291	0.00	116.59	1560.32	308	594		0.00	25 Hp
41	1292	0.00	123.18	1576.55				0.00	50 Hp
42	1292	0.00	127.72	1587.04				0.00	125 Hp
44	1510	0.00	18.34	1552.37	80	695		0.00	
45	1289	12.80	122.80	1572.68				16.00	
46	1290	60.00	122.85	1573.78				75.00	
47	1291	9.60	117.81	1563.14	365	707		12.00	
48	1295	5.76	116.67	1564.51	350	730		7.20	
49	1312	0.00	111.26	1569.02				0.00	
50	1312	0.00	111.26	1569.02				0.00	
51	1380	30.40	77.56	1559.17				38.00	

KALPUMP1		KALPUMP2		WOODLAKE	
<------- Input ------->		<------- Input ------->		<------- Input ------->	
Flow US gpm	Head ft	Flow US gpm	Head ft	Flow US gpm	Head ft
0	369	0	398	0	315
150	345	300	384	200	312
300	327	600	360	500	306
450	295	900	331	1000	295
600	263	1200	292	1500	280
		1500	238	2000	250

52	1537	0.00	6.49	1551.99	0.00 Up Booster
53	1537	0.00	2.13	1541.92	0.00 Dn Booster
54	1291	0.00	116.59	1560.32	0.00

INFLOW TABLE

Node (Input)	Pumps (Input)	OpCurve (Input)	%Estimate (Input)	%Actual (Output)	Inflow US gpm (Output)	Status ON (Input)
32	1	RESERVOIR		0.10	-252.79	
40	1	25 Hp		0.00	0.00	no
41	1	KALPUMP1		0.00	0.00	no
42	2	KALPUMP2		0.90	-2351.69	
50	1	WOODLAKE		0.00	0.00	no

BOOST TABLE

Pipe (Input)	Pumps (Input)	OpCurve (Input)	Boost ft (Output)	Status ON (Input)
53	1	BOOSTER	0.00	no

REDUCING (PRV) TABLE

Pipe (Input)	Source (Input)	Pressure psi (Input)	OpenK (Input)	CKV (Input)	PRVLoss ft (Output)	CKVState (Output)	PRV #
50	50	100		yes	0.00	Closed	

CHECK (CKV) TABLE

Pipe (Input)	State (Output)
50	Closed

RESERVOIR Input Flow US gpm	RESERVOIR Input Head ft	25 Hp Input Flow US gpm	25 Hp Input Head ft	BOOSTER Input Flow US gpm	BOOSTER Input Head ft
0	0	0	380	0	180
500	0	100	323	300	180
1500	0	150	278	600	180
3500	0	200	240	900	180
5500	0	250	194	1000	180
7000	0	300	133	1200	180
				1500	80