***DISTRICT OF LAKE COUNTRY***

***WOOD LAKE WATER SYSTEM***

# CAPITAL WORKS PROGRAM

***1998 - 2008***

***DISTRICT OF LAKE COUNTRY***

***WOOD LAKE WATER SYSTEM***

# CAPITAL WORKS PROGRAM

**1998 - 2008**


**Report prepared by:**

MOULD ENGINEERING SERVICES LTD.

**Kelowna, BC**



December 1997

*DISTRICT OF LAKE COUNTRY*
**WOOD LAKE WATER SYSTEM**
# CAPITAL WORKS PROGRAM - 1998 - 2007

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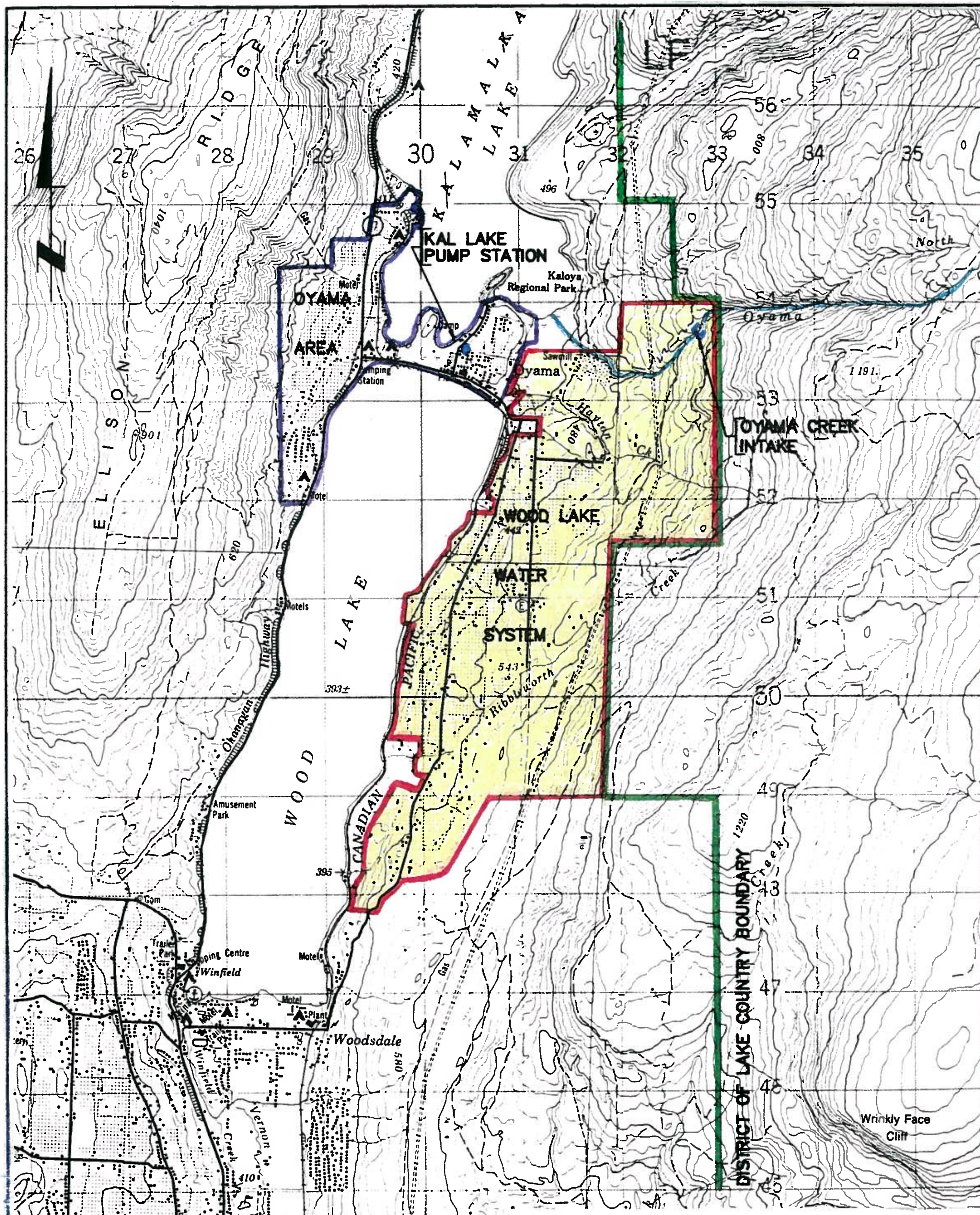


**DISTRICT OF LAKE COUNTRY**
**WOOD LAKE WATER SYSTEM**
**KEY MAP**

***WOOD LAKE WATER SYSTEM***
**CAPITAL WORKS PROGRAM**
**1998-2008**

## 1. INTRODUCTION

### *1.1 Background*

This report updates the Capital Works Program prepared in 1994 for the Wood Lake Improvement District. The District of Lake Country will be taking over operation of the water system on January 1, 1998, and the Trustees felt it was important that the water supply situation be reviewed and a new Capital Works Program be prepared. The water system will be referred to in this report as the Wood Lake Water System. The key map on the opposite page shows the boundaries of Lake Country as well as the old boundaries of Wood Lake I.D.

A number of events have occurred since preparation of the 1994 report which made it important to do the update. The 1994 report had recommended that the District participate in the construction of the Kalamalka Lake pump system which was being proposed for the Oyama Water System. The pump station could have been increased in pumping capacity and supplied water to Wood Lake through an interconnecting pipeline and a booster pump. The landowners rejected the proposal to expand the pump station but the Trustees approved the interconnecting pipeline. The decision not to participate in the pump station effectively stopped any further consideration of servicing new lands.

The 1994 report assumed that the Ministry of Environment would issue water licences to WLID permitting diversion of additional water from Kalamalka Lake and Oyama Creek. The actual licence that will be issued to DLC will permit a diversion of more water from Oyama Creek than was expected. The increase in the amount of water available from Oyama Creek has necessitated a review of the works needed to fully utilize this water source.

The Improvement District has a list of applications for water servicing dating back to 1990, which now totals 100 domestic services and 100 hectares (250 acres) of irrigation. The applications have not been considered due to the uncertainties over the best course of action to be taken.

An important consideration in these applications is the number who actually would pay the necessary costs and take water if offered the opportunity. The costs to install the pipelines needed to deliver water to some of the applicants will be very high and it is expected that many will decline to proceed further when actual costs are known.

This report will provide the technical basis for new Development Cost Charge and Capital Expenditure Authorization bylaws.

Metric units have been used throughout this report in accordance with the general trend towards using international units. 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 Conversions/Units*

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

| | | |
|---|---|---|
| 1m | = | 3.28 ft |
| 1 lps | = | 15.87 USgpm |
| 1 ha | = | 2.47 ac |
| 1 da-$m^3$ | = | 0.8107 ac-ft |
| 1 litre | = | 0.264 US gallons |
| 1 lps/ha | = | 6.424 USgpm per acre |
| 1 lps/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 |
| MELP | Ministry Of Environment | psi | pounds per inch |
| PRV | Pressure reducing valve | m | metres, length |
| m/s | metres per second | ac-ft | acre feet |
| $m^3/s$ | cubic metres per second | OCP | Official Community Plan |
| L/s | Litres per second | | |
| da-$m^3$ | cubic decametre (1000$m^3$) | | |

## 2. Water Supply

The source of water for WLWS is Oyama Creek with storage reservoirs on Oyama Lake (7137 da-m$^3$) and Damer Lake (263 da-m$^3$). Prior to 1994, the amount of water available for diversion was limited to the amount authorized under water licences and the water licences were adequate only for the number of users that were being supplied at that time. The total land being irrigated is 393 hectares and 260 residential units are supplied with domestic water.

A hydrology report prepared by D.B Letvak of the Ministry of Environment in 1987 estimated that the Oyama Creek watershed can supply an annual demand of 4400 da-m$^3$ with very little risk of a shortage. The licensed annual diversion is about 2700 da-m$^3$ and the Ministry has placed a reserve of an additional 1900 da-m$^3$ in favour of Lake Country.

The Ministry also placed a reserve on Kalamalka Lake in favour of Lake Country in the amount of 610 da-m$^3$. The water from this source must also serve the long term needs of the Oyama Service Area.

## 3. Land Use and Development Projections

The lands within the former WLID boundaries are largely within the Agricultural Land Reserve so development for uses other than agriculture will be very limited. Also, the agricultural lands within the old boundaries are largely irrigated now so the demand for irrigation water from owners within the existing service area will likely be relatively small. There are lands outside the service area that could benefit from a supply of water but the economics of distribution systems usually dictate that only those lands close to existing pipelines can afford the cost of installing the works necessary to deliver water to the properties.

The list of applications for water, listed in Annex 1 and shown on Figure 2 opposite page 6, total about 100 hectares of irrigation water and 100 domestic services. In addition to the properties that have applied for servicing, there will be some new applications over the next ten years. Predicting the amount of water that will be applied for in the next ten years is a risky proposition at best, but preparation of a plan requires an estimate of the potential new users in order to predict the water supply facilities needed and the revenues required to fund the installations.

A review of the existing applications was made with District staff and it is considered likely that no more than one-third of the applications for irrigation water and a tenth of the applicants for domestic service will be prepared to take advantage of an offer. Over the nine years following disposition of the initial applicants, it is assumed that an annual growth rate of about 0.5% in irrigated land and domestic services will occur. Table 1 shown below summarizes the anticipated increases in serviced land.

**Table 1 - Growth Projections**

| Category | 1998 | 1998-2008 | Total |
|---|---|---|---|
| Irrigated Land (hectares) | 32 | 18 | 50 |
| Single Family Units on Dry Land | 11 | 9 | 20 |
| Single Family Units on Grade 'A' Land | 1 | 9 | 10 |

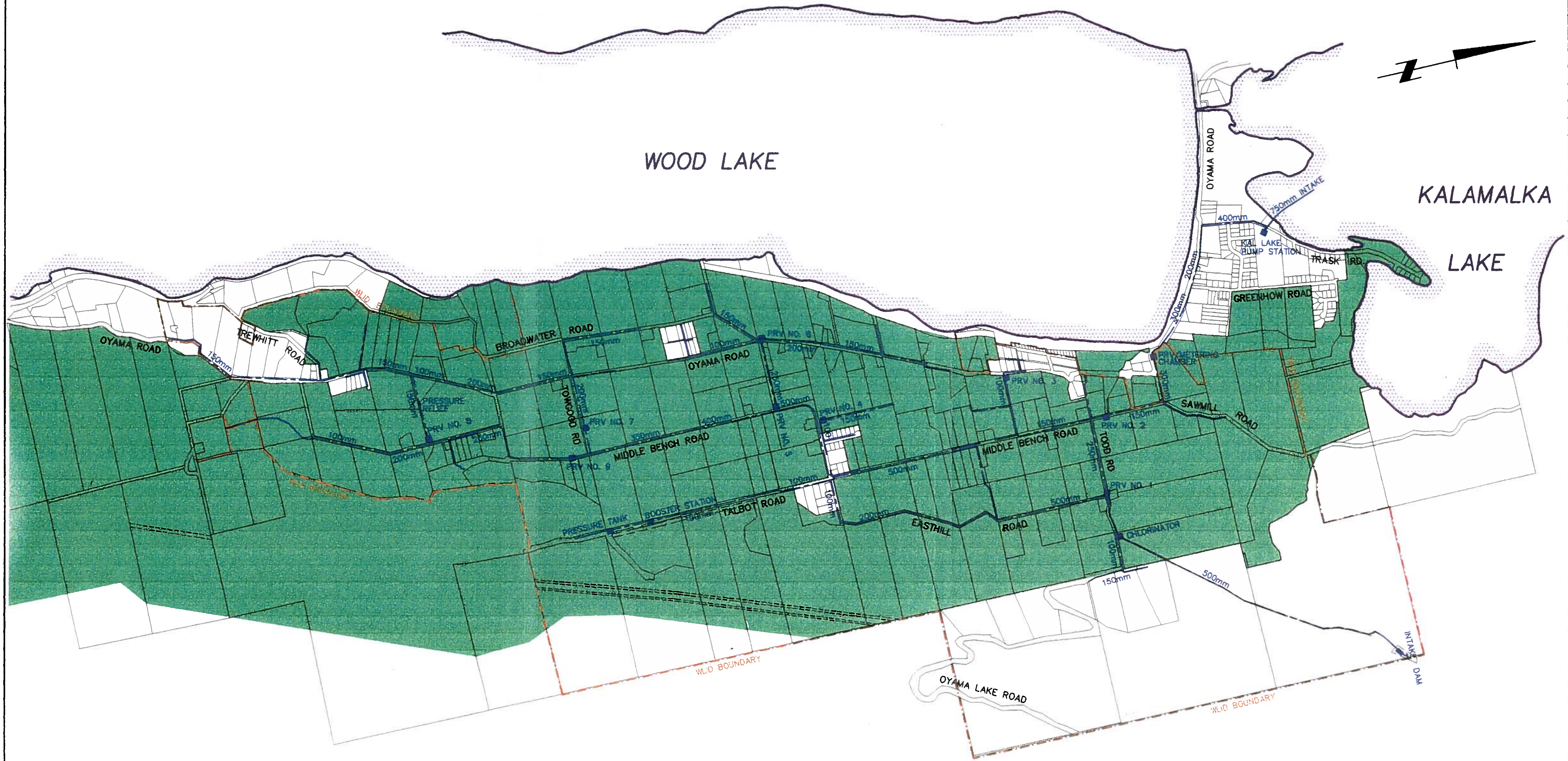


FIGURE 1

DISTRICT OF LAKE COUNTRY

**WOOD LAKE WATER SYSTEM**
**AGRICULTURAL LAND RESERVE**
SCALE 1:20,000

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LEGEND
- WATERMAINS
- WLID BOUNDARY
- AGRICULTURAL LAND RESERVE


FIGURE 2

DISTRICT OF LAKE COUNTRY

WOOD LAKE WATER SYSTEM
1997 REGRADE APPLICANTS

SCALE 1:20,000

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The official Community Plan prepared for D of LC does not provide for any new commercial, industrial and/or multi-family development in the Wood Lake area so no uses of this kind have been considered. Applicants for this type of development can be analyzed on an individual basis should any proposals be submitted.

The predictions of growth rates and timing 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.

## 4. 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 only the existing system at peak day demand was printed. The printout is contained in Annex 3 and a plan showing the pipeline and node labelling system is contained in the pocket of this report.

The criteria for the computer analysis of the system 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<br>a) Irrigation<br>b) Single Family Domestic | <br>0.94 lps/ha @ 80% (6 USgpm/ac)<br>0.126 lps/conn @ 80% (2 USgpm/conn) |
| 2. Peak Hour Demand<br>a) Irrigation<br>b) Single Family Domestic | <br>0.94 lps/ha (6 USgpm/ac)<br>0.189 lps/conn (3 USgpm/ac) |
| 3. Maximum Pipeline Velocities<br>a) Mainlines<br>b) Distribution system - normal conditions<br>c) Distribution System - fire flows<br>d) PR Valves | <br>2.4 m/s (8 fps)<br>2.0 m/s (6.5 fps)<br>4.0 m/s (13 fps)<br>7.5 m/s (25 fps) |
| 4. Pipeline Friction Factors<br>a) Asbestos-Cement<br>b) PVC<br>c) Ductile Iron | <br>C = 120<br>C = 140<br>C = 130 |
| 5. Minimum Design Pressures<br>a) Irrigation @ highest elevation on lot<br>b) Residential @ service connection<br>c) Fire Flows @ hydrant | <br>310 kPa (45 psi)<br>280 kPa (40 psi)<br>140 kPa (20 psi) |
| 6. Maximum Pressure<br>a) Residential & Irrigation | <br>860 kPa (125 psi) |
| 7. Minimum Recommended Fire Flows<br>a) Rural Residential<br>b) Urban Residential | <br>15 lps (240 USgpm)<br>63 lps (1000 USgpm)) |

## *2. Analysis at Peak Day Demand*

The analysis of the existing system at Peak Day demand indicated that the minimum pressure criteria of 310 kPa (45 psi) is being met for all irrigated land. The critical lots for minimum pressures are at the south end of the system on Oyama Road and Trewhitt Road East. The water pressure to properties in these areas is just reaching the minimum so adding additional irrigated land to the system must be accompanied by distribution system upgrading to ensure that users are not adversely affected. There are no single sections of pipeline where losses are particularly high so there is no easy remedy to reducing system head losses.

The analysis also indicated that some of the pressure reducing valves (PR 1, 4, 5 and 8) are approaching maximum velocities and replacement of these valves and associated piping will be necessary if significant areas of new lands are irrigated downstream of the stations.

The minimum pressure of 280 kPa (40 psi) at the service connection is being met for all lots being supplied with domestic water but some homes on larger lots may not receive 280 kPa at the main floor of the residence. Properties that rise considerably in elevation from the service connection to the homesite may have pressure below the minimum. The District has taken the position that where landowners want to construct above the highest elevation that can be supplied with minimum pressure they must provide their own facilities to boost the water pressure to acceptable levels.

Pressure in most of the mainline exceeds 860 kPa (125 psi), the generally accepted maximum for distribution systems. This is not a particularly desirable situation but the topography of the Wood Lake area makes it virtually impossible to avoid the problem. Individual services are pressure reduced which reduces the impact of high pressure but operation of the system is made more difficult by the high pressure.

### *3. Fire Flows*

There are 45 fire hydrants connected to the water system and the available fire flow to all hydrants on the system was estimated using the computer model. The fire flows were calculated at peak day demands.

A map showing the hydrants colour coded according to the flow range expected from the hydrant was provided to the District under separate cover. The analysis indicated that all hydrants can supply the minimum flow of 15 lps (240 USgpm) at 140 kPa (20 psi) required for rural residential properties. While 15 lps has been accepted as a minimum flow rate for rural areas, the size and type of homes being built in the Wood Lake area dictate that a higher minimum should be an objective. A flow of 30 lps is commonly recognized as a minimum for larger residential buildings, and eighteen of the 45 hydrants deliver less than 30 lps. All of these low flow hydrants are connected to 100mm pipelines and are limited by velocity considerations rather than by pressure. When flow velocities exceed 4 m/s serious pressure surges (water hammer) can occur which are capable of bursting pipelines. Asbestos-cement pipelines, which are common in WLWS, are particularly vulnerable to pressure surges and these potentially dangerous situations should be corrected wherever possible. The distribution system upgrading recommended in this report will solve a number of the problem areas but some will still remain.

## 5. WATER QUALITY

The quality of the water in Oyama Creek, like many upland sources in the Okanagan, is coloured and has high turbidity levels during spring runoff. Recent outbreaks of waterborne parasites such as giardia lamblia and cryptosporidium in other areas of the Okanagan make it imperative to give some consideration to water quality issues when making water system improvements.

Water quality concerns can only be partially addressed in this plan which is intended to detail the works needed to make water available to new users. Water quality is a problem that affects existing users as well as new and therefore must be solved by the whole community. However, the use of Kalamalka Lake as an alternate water source may provide an important step in the supply of better domestic water. It is less likely that giardia will be present in Kalamalka Lake than Oyama Creek and while very little is known about the occurrence of cryptosporidium, Kalamalka Lake is considered a lower risk environment than Oyama Creek. Treating Oyama Creek water to remove colour, turbidity and waterborne parasites will be more costly than using Kalamalka Lake, even if Kalamalka Lake water needs treatment. In both options, a separate distribution system to supply domestic water only is much less costly than constructing and operating a treatment plant to treat both irrigation and domestic water.

## 6. Conceptual Plan

The principal problem that must be addressed before more water can be supplied by the Wood Lake system is to prevent further head losses. Water pressure at the south end of the system is just adequate now during peak demand periods and reductions cannot be considered. Oyama Creek has enough runoff to supply more users but the intake screening works and distribution system cannot.

A number of options for increasing the supply of water to the District and reducing head losses were discussed in some detail in the 1994 report and will not be repeated in this document. The recommended option of using the Kalamalka Lake pump station to supply about 50 hectares of land with the remainder supplied from Oyama Creek is still considered to be the best long term option. Increasing the pumping rate of the Kalamalka Lake pump station is however, considerably more expensive now than it would have been when the pump station was originally constructed. The amount of new land that is expected to be supplied in the next ten years is about 50 hectares, so only one of the two sources will be needed within the time frame of this plan. The use of Kalamalka Lake as a water source gives the District the opportunity to supply better quality water during periods of high colour and turbidity in Oyama Creek and could form the basis for a separate domestic water system.

There are some uncertainties about the works needed to utilize more water from Oyama Creek. In particular, the possible relocating of the chlorinator, power supply, access road to the intake, and future works needed to improve water quality are issues that need some time to resolve. It is recommended that the District proceed with a supply from Kalamalka Lake as the first phase of expansion and the Oyama Creek source can be utilized later.

Kalamalka Lake can be used as a source by virtue of the inter-connecting pipeline and the Agreement between the two service areas. Using Kalamalka Lake as an alternate water source resolves only part of the distribution system problem. Other works such as a booster pump station and pipelines are needed. These works, together with the Oyama pump station and reservoir, are explained in more detail in the following:

### 1. *Balancing Reservoir for Oyama System*

In order to use Kalamalka Lake as a water source it will be necessary to increase the pumping rate of the pump station on Trask Road. The pump station can supply the long term projected needs of the Oyama service area but with little to spare.

Fire flows in the Oyama Water System are provided by a combination of pumping and reservoir storage. One of the pumps is kept on standby for use during major fires. The flow for fire protection could also be provided with more reservoir storage capacity rather than by keeping the pump on standby. A 600,000 litre reservoir would provide a flow of 79 lps for two hours which is the same as the pumping rate of the standby unit. If the reservoir was constructed, the standby pump could be used by WLWS during peak periods to supply the projected ten year demand of 40 lps. The supply from Kalamalka Lake would only need to be used on periods of very high demand in the Wood Lake system.

### 2. *Kalamalka Lake Pump Station Modifications*

Running all four pumps in the station at the same time has the potential to cause a fairly large pressure surge in the intake line if the power supply fails. The 900mm diameter intake line is 550 metres in length and the water in the pipe has considerable momentum at peak pumping rates. If a sudden power failure occurred, the water in the intake line would continue to flow towards the pump station and cause some flooding of the facilities. Also the pumps could not be brought back on-line until the surge had abated. Installation of a surge tank would provide control of the pressure surges so that no damage would occur and the pumps could be brought on-line soon after power is restored.

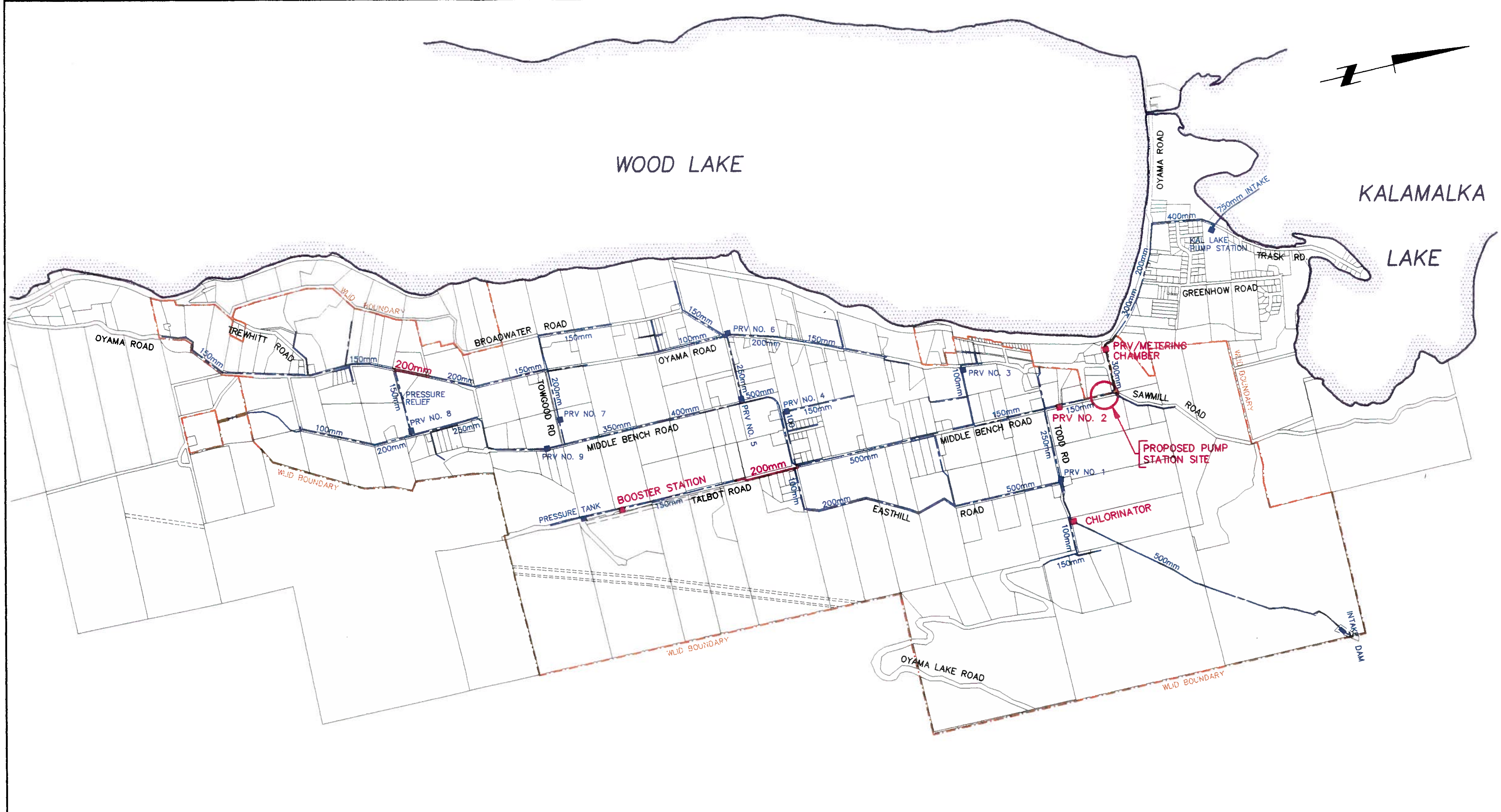


FIGURE 3

DISTRICT OF LAKE COUNTRY

WOOD LAKE WATER SYSTEM
PROPOSED WORKS – 1998 TO 2008

SCALE 1:20,000

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### *3. Booster Pump Station*

Most of the Wood Lake service area is higher than the Oyama system can supply so it will be necessary to install a booster station to pump into the Wood Lake system. The booster station is only required to supply lands above PR No. 2. The flow below PR No. 2, including new applications for water, is about 17 lps, so 23 lps will have to be pumped into the higher pressure zone. The pump needed to deliver this flow to the same hydraulic grade line as PR No.1 is a 40 hp unit. The unit would be controlled by a variable speed drive with water pressure sensing. Fire protection and backup supply would come from the main Wood Lake System via PR No.1. The pressure reducing valve will open to supply water into the pumped zone if pressure drops below the preset point.

### *4. Distribution System Upgrading*

There are several pipelines to be installed to increase distribution system capacity and ensure that existing users are not adversely impacted. The pipelines are shown on Figure No. 3 on the opposite page and listed below.

#### *.1 Talbot Road:*

The 100mm pipeline from the intersection of Middlebench and Talbot Roads needs to be replaced with a 200mm main to supply the applicants at the south end of Talbot Road. Some of these applicants are above the booster station and the pump will need to be replaced with a larger unit. The pump should be controlled by a variable speed drive to reduce pressure fluctuations and save energy. The pressure tank will continue to be used to smooth out abrupt flow changes.

#### *.2 Oyama Road, South of Ribbleworth Road*

A 190 metre length of 100mm A.C. watermain on Oyama Road, south of Ribbleworth Road, needs to be replaced with a 200mm pipeline to reduce head losses.

#### *.3 Miscellaneous Undefined Upgrading*

In addition to the above-noted pipelines there may be some other pipelines that need to be replaced or PR stations that need upgrading depending on the location that development actually takes place. Funds have been allocated in the plan for miscellaneous undefined works.

*5. Flow Meter @ Chlorinator*

The flow meter at the chlorinator utilizes orifice plates to measure flow. The orifice plates have significant head losses at high rates of flow and replacement of the meter with another type of meter will reduce these losses.

*6. PVR Station Modifications*

PR Station No. 2 on Middlebench Road needs to be removed and the valving re-located to the new booster station so that the flow can be reversed when the booster pump is constructed. The pressure reducing station will be replaced with pipe.

*7. Metering Chamber*

The present metering/pressure reducing chamber on the interconnecting pipeline will only permit flows from the Wood Lake system into the Oyama system. The station was intended to allow flows in both directions but the flow meter and a section of piping need to be installed to make this possible.

*8. Planning and Engineering*

Funds of $25,000 have been included for assessing of individual water servicing applications and for periodic updating of the Capital Works Plan.

## 7. Cost Estimates

The estimated cost of the various components required over the next ten year period are summarized as follows:

| | | |
|---|---|---|
| 1. | Oyama Balancing Reservoir | $320,000 |
| 2. | Kalamalka Lake Pump Station Improvements | $10,000 |
| 3. | Metering Chamber Upgrading | $5,000 |
| 4. | Booster Pump Station | $190,000 |
| 5. | Flow Meter @ Chlorinator | $10,000 |
| 6. | Modifying PR #2 | $8,000 |
| 7. | Pipelines | |
| | .1 Talbot Road | $67,000 |
| | .2 Oyama Road South | $35,000 |
| | .3 Undefined Upgrading | $30,000 |
| 8. | Engineering and Planning | $25,000 |
| | **TOTAL:** | **$700,000** |

A more detailed breakdown of the costs of the reservoir, booster pump station, and pipelines is contained in Annex 2.The cost estimates are not based on detailed design information or site investigations and must be considered preliminary ( Class E ) at this time.

It should be noted that the costs are only for those works to be funded by the District and do not include any pipeline extensions, booster pumps or service connections required to serve individual lots. Some lots such as those along Oyama Lake Rd. and Trewhitt Road West will require expensive extensions to supply the properties.

## 8. Development Cost Charges

Development Cost Charges (DCC's) are levied on applicants for new service. Different types of development place different demands on the water system and estimates were made to separate the costs attributable to each class. Residential demands have fairly high water requirements with high fire flow and peak demands, while irrigation demands are relatively constant in summer, with no requirement for fire flows. DCC's have been assessed accordingly and are shown in Table 3. There are no multi-family, commercial, industrial or institutional developments anticipated at this time but DCC rates are included in the table in the event that a land use of this type is proposed.

**TABLE 3**

**DEVELOPMENT COST CHARGE RATES**

| | |
|---|---|
| 1. Residential | |
| Irrigated to Residential | |
| Single Family | $2,000 per unit |
| Multi - Family | $1,500 per unit |
| Dryland to Residential | |
| Single Family - ¼ hectare lot, or less | $5,000 per unit |
| Single Family - ½ hectare lot | $7,000 per unit |
| Multi - Family | $2,500 per unit |
| 2. Irrigation | $12,000 per hectare |
| 3. Commercial, Institutional & Industrial (dependent on building area). | |
| Basic | |
| First 250 sq.m. (minimum charge) | $7,000 |
| Over 250 sq.m. | $6.00 per sq.m. |
| Building with approved sprinkler system | |
| First 250 sq.m. (minimum charge) | $7,000 |
| Over 250 sq.m. | $4.00 per sq.m. |

## TABLE 4 - CAPITAL COSTS

| | | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | TOTAL: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Oyama Balancing Reservoir | | | | | 40,000 | 20,000 | 260,000 | | | | 320,000 |
| 2 | Kalamalka Lake Pump station Improvements | | 10,000 | | | | | | | | | 10,000 |
| 3 | Booster Pump | | 50,000 | 140,000 | | | | | | | | 190,000 |
| 4 | Pipelines | | | | | | | | | | | |
| | .1 Talbot Road | 5,000 | 62,000 | | | | | | | | | 67,000 |
| | .2 Oyama Road South | 5,000 | 30,000 | | | | | | | | | 35,000 |
| | .3 Miscellaneous | | | | 30,000 | | | | | | | 30,000 |
| 5 | Replace Flow Meter | | 10,000 | | | | | | | | | 10,000 |
| 6 | PVR Station Modifications | | | 8,000 | | | | | | | | 8,000 |
| 7 | Metering Chamber Modifications | 5,000 | | | | | | | | | | 5,000 |
| 8 | Engineering & Planning | 5,000 | 2,000 | 2,000 | 4,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 25,000 |
| | TOTAL: | 20,000 | 164,000 | 150,000 | 34,000 | 42,000 | 22,000 | 262,000 | 2,000 | 2,000 | 2,000 | 700,000 |

* Column not included in total

## TABLE 5 - CASH FLOW PROJECTIONS

| | | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | TOTAL: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Opening Balance | NIL | 421,000 | 303,000 | 194,000 | 200,000 | 197,000 | 214,000 | (9,000) | 21,000 | 53,000 | |
| 2 | Capital Outlays | 20,000 | 164,000 | 150,000 | 34,000 | 42,000 | 22,000 | 262,000 | 2,000 | 2,000 | 2,000 | 700,000 |
| 3 | DCC Revenue | 441,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 | 738,000 |
| 4 | Interest | | 13,000 | 9,000 | 6,000 | 6,000 | 6,000 | 6,000 | (1,000) | 1,000 | 2,000 | 48,000 |
| 5 | Closing Balance | 421,000 | 303,000 | 194,000 | 200,000 | 197,000 | 214,000 | (9,000) | 21,000 | 53,000 | 86,000 | |

INTEREST RATE: 3% per annum

## 9. Financial Implications

The financial implications of the ten year plan are summarized in Tables 4 and 5 shown on the opposite page. Table 4 summarizes the estimated Capital Costs and indicates the year in which the cost will be incurred.

Cash flow projections for disbursements and revenues are shown in Table 4. The revenue projections are based on adding 32 hectares of irrigated land and 12 residential units in 1998 and adding 2 hectares of irrigated land and 2 residential units annually. It is assumed that 10 of the residential units will be on Grade 'A' land and 20 will be on Grade 'D' land (not irrigated).

Table 4 shows that the DCC fund will have a surplus of $86,000 at the end of the ten year period, a reasonable amount considering the uncertainties that exist over the amount and timing of development.

Water supply planning is based on predicting growth rates, future construction costs, and interest rates, all of which are uncertain. Also, the plan does not provide for escalation of costs. Annual reviews should be made to monitor growth rates and construction costs to ensure that revenues and expenditures are being maintained. It is likely that bi-annual increases in the DCC rates will be required.

## 10. Longer Term Considerations

The time period used in this plan is ten years, a common time frame for infrastructure works plans. The uncertainties that exist in forecasting the amount and location of new development and estimating the cost of future construction dictate a relatively short planning horizon. However, water systems are installed to last for a much longer period of time and it is important that longer term plans be considered so that works constructed in the short term readily fit into long term strategies.

The nature and amount of new development is fundamental to preparation of a long term plan, particularly since revenues from DCC's will be needed to fund system improvements. The most likely scenario is that the District will remain rural in character and the Agricultural Land Reserve will remain in effect. The amount of new development in both agricultural and residential uses is expected to remain low, a one percent growth rate or less. The growth rate is important since a low rate results in low revenue and limits the ability to fund major system improvements.

In our opinion, water quality will likely become a bigger issue in the future and the Oyama Creek source will not continue to be acceptable for domestic purposes without some form of treatment. The high colour and turbidity levels and low ph makes it difficult and expensive to treat. A more economic option to treating Oyama Creek water would be to use Kalamalka Lake, even if treatment of this source is necessary.

Regardless of whether Oyama Creek or Kalamalka Lake is used for domestic water, it will be necessary to install a separate distribution system. A separate domestic system, comprised of relatively small diameter pipelines would supply the in-house needs while the present system would supply the outdoor and fire protection needs. Since in-house use is a small component of the total, a network of 50mm and 75mm diameter pipelines would be adequate and relatively inexpensive to install.

Assuming that irrigation of agricultural lands remains the principal water user and there continues to be applications to irrigate new land, it will be necessary to upgrade the present distribution

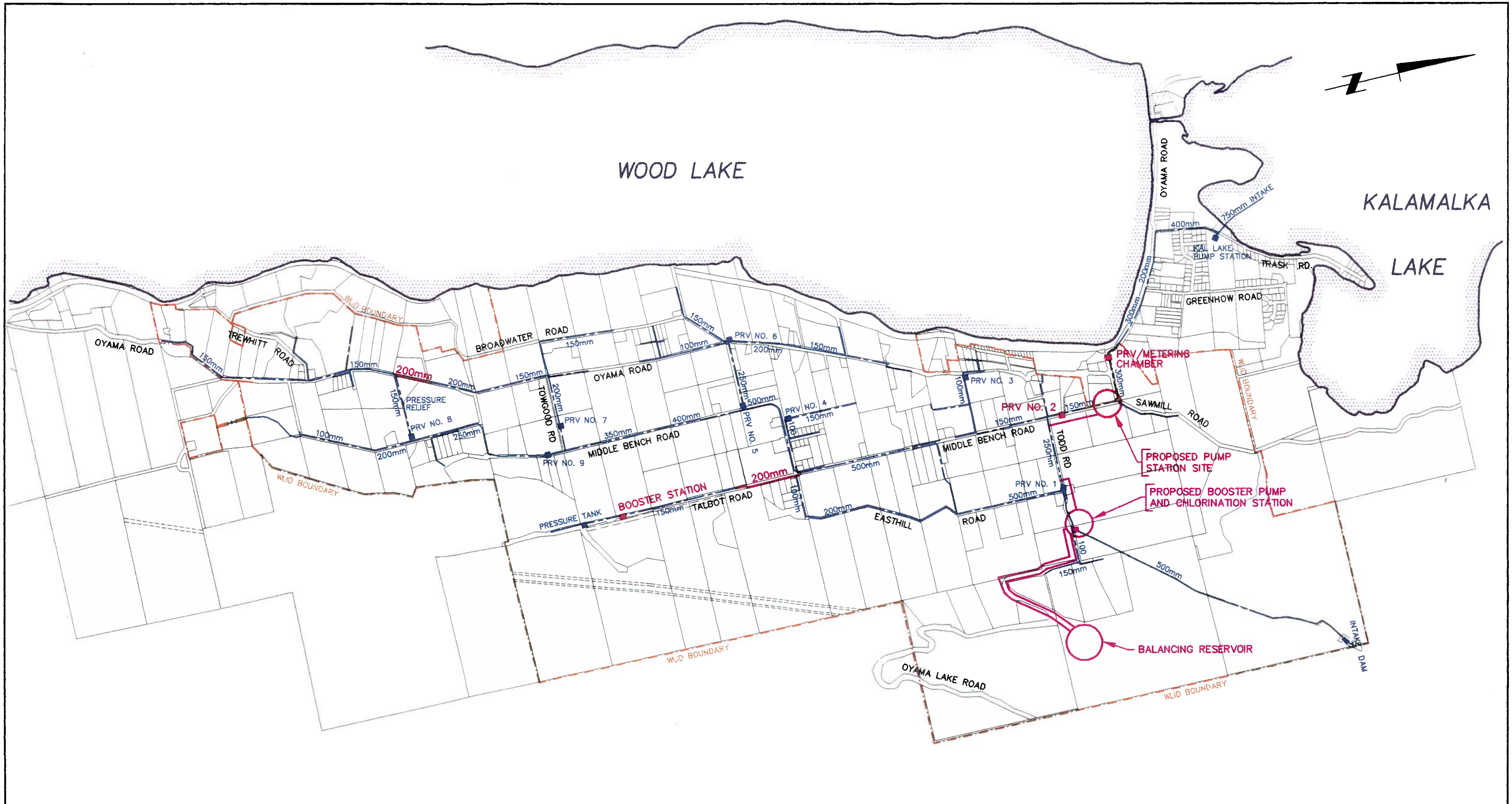


FIGURE 4

DISTRICT OF LAKE COUNTRY

WOOD LAKE WATER SYSTEM
LONG TERM IMPROVEMENTS
SCALE 1:20,000

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LEGEND

- WATERMAINS
- WLID BOUNDARY
- PROPOSED WORKS TO YEAR 2008
- PROPOSED WORKS BEYOND YEAR 2008

system. The principal addition is the installation of a booster pump station at the existing chlorinator site and a balancing reservoir on Oyama Lake Road as shown on Figure 4 opposite. The booster pump and the reservoir will restore the system pressure to near static conditions and thereby eliminate all mainline head losses. A balancing reservoir has some important benefits in addition to restoring system pressure. At present there is no balancing storage on the system and the flow in Oyama Creek must always be higher than the peak instantaneous demand. Since there is a considerable lag time between release adjustments made at Oyama Lake and realization of the flow change at the intake, it is necessary to always maintain a significantly higher creek flow than is needed to meet demands which results in considerable spill or waste at the intake. This is not a problem at present since the watershed can supply considerably more water than is needed to meet demands, but as irrigation use increases it will be necessary to reduce the amount of spill. A balancing reservoir will smooth out fluctuations in demand and augment a supply shortage if demand exceeds the flow in the creek. A reservoir will also be an important component needed to automate Oyama Lake releases. Installation of a telemetry system between the balancing reservoir and an electric gate operator at Oyama Lake could provide automatic gate adjustments and reduce the number of operator trips needed to manually adjust the gate. Another important function of a reservoir could be to provide fire flows in the winter if a separate domestic system is installed. The existing system will continue to be used for fire fighting purposes and a storage reservoir will eliminate the need to maintain flows in Oyama Creek during the winter season.

There are two important features of the long range plan that need to be considered at this time. Firstly, land needed for facilities should be acquired well in advance of any construction. Opportunities to acquire land can arise as a result of land development proposals and can be obtained at a much lower cost than if it has to be purchased on short notice. The two land acquisitions that need to be made for future works are expansion of the existing chlorinator site and a site for a balancing reservoir. The chlorinator property is too small to allow for expansion of facilities and the plan is to add a pump station and relocate PR No. 1 to this location.
A 0.5 hectare site near Oyama Lake Road at an elevation of about 610 metres should be acquired for a balancing reservoir if an opportunity arises to make a reasonable deal.

The other item that needs to be considered at this time is the twinning of any new pipeline installations. There will be pipelines installed within the next ten years and it would be good planning to install two pipelines in the same trench, one of which would be used for domestic water in the future. The cost of installing a second pipeline at the same time is fairly small and would be made at considerable savings compared to putting the line in at a later date.

## 11. Conclusions and Recommendations

The investigations that were conducted into expansion of the Wood Lake water system to supply water to unserviced lands have resulted in the following conclusions and recommendations:

*1.* The District has a list of applications for water servicing which date back to 1990. The applications have not been granted due to water licensing limitations and lack of distribution system capacity. The Ministry of Environment issued a reserve to the district of 1900 da-$m^3$ for diversion from Oyama Creek and 600 da-$m^3$ from Kalamalka Lake. The reserve will permit additional water to be diverted from either source and the District now can consider granting the applications as well as supplying other new users. The existing applications total 565 da-$m^3$ for irrigation purposes and 92 da-$m^3$ for domestic purposes. Many of these applications require extensive and expensive pipeline installations to deliver water from the distribution system to the property. Once the total delivery costs are known it is expected that many owners will decline to proceed. This report assumes that only one-third of the applicants on the list will actually pay the fees and costs required to obtain water.

*2.* The demand for servicing of new land or changes in land use after the existing applications have been dealt with is expected to be quite low. Most of the serviced land is within the Agricultural Land Reserve and is already irrigated. There are some undeveloped lands outside the service area where owners may want a supply but the economics of water system installations are such that the costs of supplying land much beyond the existing service area is usually prohibitive. It is estimated that about 50 hectares of irrigated land and 30 residential services will be added to the system within ten years. The estimates of growth are very speculative and actual growth rates should be monitored to ensure that this plan is up to date.

*3.* The runoff in Oyama Creek is adequate to supply considerably more users than is currently the case but the distribution system cannot deliver more water without adversely affecting existing landowners. Some property owners at the south end of the District already are receiving water at minimum pressure during peak use periods and more users cannot be added without system upgrading.

*4.* In order to supply the water requirements of new users expected within the next ten years, without adversely affecting existing customers, it is recommended that the Trustees consider construction of the following works:

*.1* A 1,000,000 litre balancing reservoir near the existing Oyama reservoir to provide fire flows. The reservoir will supply the fire flows now provided by a standby pump in the Kalamalka Lake pump station which will free up the pump for use during peak demand periods. Water can then be supplied by the Kalamalka Lake pump station to the Wood Lake system.

*.2* The metering/PR station on the pipeline interconnecting the Oyama and Wood Lake water systems requires some piping and valve additions to permit water to flow from the Oyama system to the Wood Lake system.

*.3* A 40 hp booster pump station near the Sawmill/Middlebench Roads intersection is needed to deliver water from the Kalamalka Lake system to the Wood Lake system since most of the land in Wood Lake is higher than can be supplied directly from the Kalamalka Lake system.

*.4* Pipelines in the distribution system are required to increase system capacity. These pipelines are located as follows:

.1 Talbot Road - A 370 metre section of 100 mm pipe needs to be replaced with 200mm and the 2 hp booster pump needs to be replaced with a larger unit.

.2 Oyama Road South - A 190 metre section of Ribbleworth Road needs to be replaced with 200mm pipe.

.3 Miscellaneous - In addition to these pipelines there will be some other sections that need to be replaced depending on where new development occurs. An amount of $30,000 has been included for undefined works.

5. The District should adopt a new Development Cost Charge bylaw authorizing the collection of charges on new developments as outlined in this report.

6. Once the DCC bylaw is adopted and approved by the Ministry of Municipal Affairs, the applicants for water need to be contacted to determine whether they are still interested in obtaining a water supply. The owners need to know the cost of any pipeline extensions and/or service connections as well as the DCC's in order to make a decision.

7. The number of affirmative responses to increased water supply will be an important factor in determining the works that must be installed in the short term. It may be necessary to revise some details of this plan to reflect actual conditions.

8. This plan should be reviewed annually to ensure that it is kept current with actual growth rates and construction costs.

**ANNEX 1**

# WOOD LAKE IMPROVEMENT DISTRICT

## Applicants for Water

**ANNEX 1**

WOOD LAKE IMPROVEMENT DISTRICT

Applicants for Water

| APPLICATION DATE | OWNERS | LOT | PLAN | DOMESTIC | IRRIGATION (HECT.) |
|---|---|---|---|---|---|
| 21/02/90 | Allingham, Dave | 69 | 808 | | 0.4 |
| | | 70 | 808 | | 0.6 |
| 07/03/90 | Krumbhols, N. | 1 | 30948 | 1 | 0.4 |
| | | 2 | 30948 | 1 | 0.4 |
| 21/03/90 | Allingham, Ted | 68 | 808 | | 2.02 |
| 28/03/90 | Caulifield, D. | 1 | 35092 | | 2.02 |
| 02/04/90 | Eberle, N. | 7 & 8 | 1001 | | 2.83 |
| /04/90 | Tupman, H.G. (re-issued) | 2 | 19935 | 1 | 0.4 |
| | | 2 | 25600 | 1 | 0.4 |
| 24/10/90 | MacDonnell, A.M. | 2 | Sec25/Twp20 | | 1.21 |
| 24/10/90 | MacDonall, A.J. | 45 | 1001 | | 0.8 |
| 24/10/90 | MacDonall, A.J. | East ½ | Sec 25 | | 0.8 |
| 16/01/91 | Hughes, E.A. | 1 | 9718 | 1 | 0.4 |
| 05/09/91 | Tarasewich, E. | 1 & 4934 | 33312 | | 3.64 |
| 25/09/91 | Lunggren, G. | A | 33075 | 6 | 2.42 |
| 11/12/91 | Schwaiger, J. | 3 | 34917 | 40 | |
| 12/02/92 | Berger, Paul | A | 35204 | 1 | 2.02 |
| 05/08/92 | Tranfield, T. & R. | 89 | 215 | | 2.02 |
| 23/09/92 | Deering, Lynn | 2 | 2484 | | 11.33 |
| 11/01/93 | Vouladakis, T. | SW¼ | SecPl. 16275 | 40 | |
| 17/02/93 | Vouladakis,T. | SW¼ | (exc34917) | | 20.23 |
| 16/02/93 | Troock, Brian | 1 | 808 exc pls A315, A583,B3617, B4879 | 3 | 1.12 |
| 07/05/93 | Folz, R. | 10 | 1001 | 1 | |
| 12/05/93 | Starling, D. | 1 | 34721 | | 0.8 |
| | | 1 | 27288 | | 0.8 |
| 28/06/93 | Gill, F. | 19 | 1001 | | 0.8 |
| 25/08/93 | Schwarzfirm, R. | 1 | 25990 | 1 | 0.4 |
| 01/12/93 | Schon, F. | C | 21962 | | 0.6 |
| 01/12/93 | Allingham,D. | 33 | 1001 | | 3.64 |
| | | 37 | 1001 | | 2.42 |
| | | 38 | 1001 | | 3.23 |
| | | 39 | 1001 | | 0.8 |
| | | 70 | 808 | | 7.28 |
| | | 69 | 808 | | 7.28 |
| 23/12/93 | Ellison, K. | 51 | 808 DL7 | | 1.21 |
| | | B | 973 DL7 | | 0.8 |
| | | A | 33642 Sec7&12 | | 1.61 |
| 31/01/94 | Marshall, F.L. | 9, 10 & 11 | 808 | | 2.02 |
| 22/06/94 | Bell, Rod | 1 | 30465 | | 0.4 |
| 10/08/94 | Sims, W. | 1 | KAP 51893 | | 0.8 |
| 14/09/94 | Allingham, Ted | 69 | 808 | | 6.87 |
| 09/11/94 | Conti, T. | NW¼ | Sec.6 Twp10, ODYD | 3 | 4.04 |
| | **TOTAL:** | | | **100 Dom.** | **101.2 Irr.** |

ANNEX 2

## DETAILED COST ESTIMATES

1. **Oyama Balancing Reservoir**
2. **Booster Pump Station**
3. **Pipelines**
    1. **Talbot Road**
    2. **Oyama Road, South of Ribbleworth Road**

# ANNEX 2 - CAPITAL WORKS PLAN
## COST ESTIMATES

| | | | |
|---|---|---|---|
| **1.** | **Oyama Balancing Reservoir, 600,000 litres** | | |
| .1 | Land Acqisition,0.2 ha | 40,000 | |
| .2 | Excavation, 3,000m³ @ $10 | 30,000 | |
| .3 | Structure | 150,000 | |
| .4 | Piping | 20,000 | |
| .5 | Backfilling and Landscaping | 25,000 | |
| .6 | Engineering and Contingencies @ 20% | 55,000 | |
| | **Sub-total:** | | **$320,000** |
| **2.** | **Booster Pump Station, 40 hp** | | |
| .1 | Land Acquisition | 30,000 | |
| .2 | Excavation, 500m³ @ $10 | 5,000 | |
| .3 | Structure, 40 sq. m @ $500 | 20,000 | |
| .4 | Mechanical | 23,000 | |
| .5 | Electrical | 30,000 | |
| .6 | Pumps and Motors | 10,000 | |
| .7 | Flow and Pressure Measuring Equipment | 7,000 | |
| .8 | Telemetry 15,000 | 15,000 | |
| .9 | Backfilling and Landscaping | 10,000 | |
| .10 | Power Supply | 10,000 | |
| .11 | Engineering and Contingencies @ 20% | 30,000 | |
| | **Sub-total:** | | **$190,000** |
| **3.** | **Pipelines** | | |
| .1 | Talbot Road | | |
| | .1 200mm pipe, 370m @ $110 | 41,000 | |
| | .2 Valves and Fittings | 7,000 | |
| | .3 Booster Pump | 8,000 | |
| | .4 Engineering and Contingencies | 11,000 | |
| | **Sub-total:** | | **$67,000** |
| .2 | Oyama Road, South of Ribbleworth Road | 23,000 | |
| | .1 200mm pipe, 190m @ $120 | 6,000 | |
| | .2 Valves and Fittings | 6,000 | |
| | .3 Engineering and Contingencies | | |
| | **Sub-total:** | | **$35,000** |

**ANNEX 3**

**NETWORK ANALYSIS**

1. **Existing System @ Peak Day Demand (80%)**

*First:* *Wood Lake Water System*
*Second:* *Updated November - 1997*
*Third:* *Existing System*
*Fourth:* *Peak Day Demand*

PIPE TABLE

| <-------------------- Input | | | | | -----------------> | <---------- Output | | ----------> | <-Input-> | <Extra> |
|---|---|---|---|---|---|---|---|---|---|---|
| Pipe | UpNode | DnNode | Length | Diameter | Roughness | Flow | Velocity | HeadLoss | Status | I.D. |
| | | | m | mm | | l/s | m/s | m | Open | Label |
| 1 | 1 | 2 | 1128 | 500 | 140 | 342.14 | 1.74 | 5.21 | | |
| 2 | 2 | 3 | 549 | 500 | 140 | 334.27 | 1.70 | 2.43 | | |
| 3 | 3 | 4 | 17 | 350 | 100 | 334.27 | 3.47 | 0.80 | | ORIFICE |
| 4 | 4 | 5 | 185 | 100 | 130 | 3.28 | 0.42 | 0.45 | | |
| 5 | 4 | 6 | 30 | 500 | 140 | 327.54 | 1.67 | 0.13 | | |
| 6 | 6 | 7 | 9 | 100 | 130 | 50.40 | 6.42 | 60.53 | | PRV #1 |
| 7 | 7 | 8 | 411 | 250 | 130 | 44.58 | 0.91 | 1.46 | | |
| 8 | 8 | 66 | 78 | 150 | 130 | 15.20 | 0.86 | 0.46 | | |
| 9 | 9 | 10 | 320 | 150 | 130 | 12.86 | 0.73 | 1.37 | | |
| 10 | 10 | 11 | 320 | 100 | 130 | 6.71 | 0.85 | 2.96 | | |
| 11 | 8 | 12 | 241 | 100 | 130 | 0.00 | 0.00 | 0.00 | | |
| 12 | 8 | 13 | 200 | 150 | 130 | 20.35 | 1.15 | 2.00 | | |
| 13 | 13 | 14 | 215 | 150 | 130 | 13.98 | 0.79 | 1.07 | | |
| 14 | 14 | 15 | 160 | 150 | 130 | 11.77 | 0.67 | 0.58 | | |
| 15 | 15 | 67 | 160 | 100 | 130 | 4.45 | 0.57 | 0.69 | | |
| 16 | 6 | 17 | 585 | 500 | 140 | 271.86 | 1.38 | 1.76 | | |
| 17 | 17 | 18 | 410 | 500 | 140 | 243.92 | 1.24 | 1.01 | | |
| 18 | 18 | 19 | 390 | 500 | 140 | 233.58 | 1.19 | 0.89 | | |
| 19 | 17 | 20 | 445 | 200 | 140 | 14.64 | 0.47 | 0.52 | | |
| 20 | 20 | 21 | 450 | 200 | 140 | 13.37 | 0.43 | 0.44 | | |
| 21 | 19 | 22 | 400 | 500 | 140 | 224.49 | 1.14 | 0.85 | | |
| 22 | 21 | 22 | 250 | 100 | 130 | 5.83 | 0.74 | 1.78 | | |
| 23 | 22 | 23 | 366 | 100 | 130 | 5.43 | 0.69 | 2.29 | | |
| 24 | 23 | 24 | 597 | 150 | 140 | 1.70 | 0.10 | 0.05 | | |
| 25 | 24 | 25 | 22 | 150 | 140 | 1.70 | 0.10 | 74.38 | | BOOSTER |
| 26 | 25 | 26 | 485 | 150 | 140 | 1.70 | 0.10 | 0.04 | | |
| 27 | 22 | 27 | 305 | 500 | 140 | 213.62 | 1.09 | 0.59 | | |
| 28 | 27 | 28 | 223 | 100 | 130 | 2.49 | 0.32 | 0.33 | | |
| 29 | 68 | 29 | 157 | 150 | 130 | 14.48 | 0.82 | 0.84 | | |
| 30 | 29 | 30 | 255 | 100 | 130 | 8.06 | 1.03 | 3.31 | | |
| 31 | 27 | 31 | 245 | 500 | 140 | 193.19 | 0.98 | 0.39 | | |
| 32 | 31 | 32 | 9 | 100 | 130 | 48.40 | 6.16 | 73.21 | | PRV #5 |
| 33 | 32 | 33 | 370 | 250 | 130 | 45.81 | 0.93 | 1.38 | | |
| 34 | 33 | 34 | 395 | 100 | 130 | 6.14 | 0.78 | 3.10 | | |
| 35 | 34 | 35 | 93 | 100 | 130 | 6.14 | 0.78 | 0.73 | | |
| 36 | 33 | 36 | 9 | 100 | 130 | 32.98 | 4.20 | 32.28 | | PRV #6 |
| 37 | 36 | 37 | 215 | 200 | 130 | 20.11 | 0.64 | 0.52 | | |
| 38 | 37 | 38 | 450 | 150 | 130 | 15.33 | 0.87 | 2.67 | | |
| 39 | 38 | 39 | 235 | 100 | 130 | 6.94 | 0.88 | 2.31 | | |
| 40 | 36 | 40 | 311 | 150 | 130 | 9.82 | 0.56 | 0.81 | | |
| 41 | 40 | 41 | 160 | 150 | 130 | 1.06 | 0.06 | 0.01 | | |
| 42 | 31 | 42 | 250 | 400 | 130 | 140.90 | 1.12 | 0.76 | | |
| 43 | 42 | 43 | 465 | 400 | 130 | 132.07 | 1.05 | 1.25 | | |
| 44 | 43 | 44 | 310 | 350 | 130 | 113.40 | 1.18 | 1.21 | | |
| 45 | 44 | 69 | 140 | 200 | 130 | 37.36 | 1.19 | 1.06 | | |
| 46 | 45 | 46 | 277 | 200 | 130 | 37.36 | 1.19 | 2.11 | | |
| 47 | 46 | 47 | 203 | 100 | 130 | 3.29 | 0.42 | 0.50 | | |
| 48 | 46 | 48 | 229 | 150 | 130 | 9.07 | 0.51 | 0.51 | | |
| 49 | 46 | 49 | 195 | 150 | 130 | 12.27 | 0.69 | 0.77 | | |
| 50 | 49 | 50 | 210 | 150 | 130 | 9.28 | 0.53 | 0.49 | | |
| 51 | 50 | 51 | 210 | 100 | 130 | 4.06 | 0.52 | 0.76 | | |
| 52 | 44 | 52 | 105 | 250 | 130 | 68.37 | 1.39 | 0.82 | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 53 | 52 | 53 | 320 | 250 | 130 | 66.65 | 1.36 | 2.40 | |
| 54 | 53 | 54 | 293 | 250 | 130 | 62.39 | 1.27 | 1.94 | |
| 55 | 54 | 55 | 271 | 250 | 130 | 57.75 | 1.18 | 1.56 | |
| 56 | 55 | 56 | 357 | 200 | 130 | 15.49 | 0.49 | 0.53 | |
| 57 | 56 | 57 | 261 | 150 | 130 | 8.86 | 0.50 | 0.56 | |
| 58 | 55 | 58 | 9 | 75 | 130 | 33.50 | 7.58 | 28.20 | PRV #8 |
| 59 | 58 | 59 | 369 | 150 | 130 | 23.80 | 1.35 | 4.94 | |
| 60 | 59 | 64 | 200 | 100 | 130 | -3.21 | -0.41 | 0.22 | |
| 61 | 59 | 60 | 250 | 150 | 130 | 21.89 | 1.24 | 2.87 | |
| 62 | 60 | 61 | 241 | 150 | 140 | 14.53 | 0.82 | 1.13 | |
| 63 | 61 | 62 | 395 | 150 | 140 | 5.80 | 0.33 | 0.34 | |
| 64 | 62 | 63 | 392 | 150 | 140 | 1.72 | 0.10 | 0.04 | |
| 65 | 48 | 65 | 192 | 200 | 140 | 3.21 | 0.10 | 0.01 | |
| 66 | 65 | 64 | 271 | 200 | 140 | 3.21 | 0.10 | 0.02 | |
| 67 | 66 | 9 | 9 | 100 | 130 | 15.20 | 1.94 | 45.91 | PRV #2 |
| 68 | 67 | 16 | 9 | 32 | 130 | 4.45 | 5.53 | 64.02 | PRV #3 |
| 69 | 27 | 68 | 9 | 50 | 130 | 14.48 | 7.38 | 58.70 | PRV #4 |
| 70 | 69 | 45 | 9 | 100 | 130 | 37.36 | 4.76 | 35.92 | PRV #7 |

Peak demand Ratio= 0.80

NODE TABLE

| <---------- Input | ---------> | <----- Output | ----> | <--- Optional | ---> | <-Input-> | ,<---- Extra | ----> |
|---|---|---|---|---|---|---|---|---|---|
| Node | Elevation | Demand | Pressure | HGL | XCoord | YCoord | Status | Average | |
| | m | l/s | kPa | m | | | ON | Demand | |
| 1 | 613.0 | 0.00 | -0.29 | 613.00 | | | | 0.00 | INTAKE |
| 2 | 534.9 | 7.87 | 713.59 | 607.79 | | | | 9.84 | |
| 3 | 509.3 | 0.00 | 940.53 | 605.37 | | | | 0.00 | GAUGE |
| 4 | 506.9 | 3.46 | 956.24 | 604.57 | | | | 4.32 | |
| 5 | 516.9 | 3.28 | 853.85 | 604.12 | | | | 4.10 | |
| 6 | 498.0 | 5.28 | 1042.15 | 604.44 | | | | 6.60 | |
| 7 | 496.8 | 5.82 | 461.10 | 543.91 | | | | 7.27 | |
| 8 | 465.1 | 9.03 | 757.24 | 542.45 | | | | 11.29 | |
| 9 | 460.9 | 2.34 | 344.29 | 496.08 | | | | 2.93 | |
| 10 | 420.0 | 6.14 | 731.42 | 494.71 | | | | 7.68 | |
| 11 | 402.9 | 6.71 | 869.90 | 491.75 | | | | 8.39 | |
| 12 | 433.1 | 0.00 | 1070.62 | 542.45 | | | | 0.00 | |
| 13 | 480.1 | 6.38 | 590.72 | 540.45 | | | | 7.97 | |
| 14 | 493.2 | 2.21 | 451.91 | 539.37 | | | | 2.76 | |
| 15 | 467.0 | 7.32 | 702.80 | 538.79 | | | | 9.15 | |
| 16 | 438.9 | 4.45 | 344.30 | 474.08 | | | | 5.56 | |
| 17 | 530.4 | 13.30 | 707.57 | 602.68 | | | | 16.62 | |
| 18 | 508.1 | 10.34 | 916.06 | 601.67 | | | | 12.93 | |
| 19 | 524.0 | 9.09 | 751.66 | 600.78 | | | | 11.36 | |
| 20 | 534.0 | 1.26 | 667.23 | 602.16 | | | | 1.58 | |
| 21 | 559.6 | 7.54 | 412.16 | 601.72 | | | | 9.43 | |
| 22 | 533.1 | 11.27 | 654.25 | 599.94 | | | | 14.09 | |
| 23 | 560.8 | 3.73 | 360.57 | 597.65 | | | | 4.66 | |
| 24 | 573.0 | 0.00 | 240.57 | 597.59 | | | | 0.00 | |
| 25 | 573.0 | 0.00 | 969.01 | 671.98 | | | | 0.00 | |
| 26 | 620.0 | 1.70 | 508.30 | 671.94 | | | | 2.13 | |
| 27 | 502.0 | 3.46 | 953.06 | 599.35 | | | | 4.32 | |
| 28 | 506.3 | 2.49 | 907.73 | 599.02 | | | | 3.11 | |
| 29 | 502.0 | 6.42 | 370.02 | 539.81 | | | | 8.03 | |
| 30 | 481.9 | 8.06 | 534.47 | 536.50 | | | | 10.07 | |
| 31 | 491.9 | 3.89 | 1048.13 | 598.95 | | | | 4.86 | |
| 32 | 487.1 | 2.59 | 378.22 | 525.75 | | | | 3.24 | |
| 33 | 456.9 | 6.69 | 660.43 | 524.36 | | | | 8.36 | |
| 34 | 486.2 | 0.00 | 343.11 | 521.26 | | | | 0.00 | |
| 35 | 473.0 | 6.14 | 465.23 | 520.53 | | | | 7.68 | |
| 36 | 456.9 | 3.04 | 344.29 | 492.08 | | | | 3.80 | |
| 37 | 449.9 | 4.78 | 407.76 | 491.56 | | | | 5.98 | |
| 38 | 433.1 | 8.39 | 546.17 | 488.89 | | | | 10.49 | |
| 39 | 431.9 | 6.94 | 535.30 | 486.58 | | | | 8.67 | |
| 40 | 438.0 | 8.76 | 521.46 | 491.27 | | | | 10.95 | |
| 41 | 415.1 | 1.06 | 745.66 | 491.26 | | | | 1.33 | |
| 42 | 504.1 | 8.83 | 921.22 | 598.20 | | | | 11.04 | |
| 43 | 513.0 | 18.67 | 821.80 | 596.94 | | | | 23.34 | |
| 44 | 505.1 | 7.66 | 887.35 | 595.74 | | | | 9.58 | |
| 45 | 499.0 | 0.00 | 584.92 | 558.75 | | | | 0.00 | |
| 46 | 495.0 | 12.74 | 603.48 | 556.65 | | | | 15.92 | |
| 47 | 500.2 | 3.29 | 547.65 | 556.15 | | | | 4.11 | |
| 48 | 489.8 | 5.86 | 649.38 | 556.14 | | | | 7.32 | |
| 49 | 480.1 | 2.99 | 741.90 | 555.88 | | | | 3.74 | |
| 50 | 473.0 | 5.22 | 806.62 | 555.39 | | | | 6.53 | |

| | | | | | |
|---|---|---|---|---|---|
| 51 | 470.0 | 4.06 | 828.52 | 554.63 | 5.07 |
| 52 | 509.9 | 1.72 | 832.27 | 594.91 | 2.15 |
| 53 | 519.1 | 4.26 | 718.71 | 592.52 | 5.33 |
| 54 | 495.9 | 4.64 | 926.90 | 590.58 | 5.80 |
| 55 | 513.0 | 8.76 | 744.20 | 589.02 | 10.95 |
| 56 | 525.2 | 6.62 | 619.52 | 588.49 | 8.28 |
| 57 | 527.6 | 8.86 | 590.52 | 587.93 | 11.08 |
| 58 | 513.0 | 9.70 | 468.08 | 560.82 | 12.13 |
| 59 | 484.9 | 5.12 | 694.91 | 555.89 | 6.40 |
| 60 | 493.5 | 7.36 | 582.63 | 553.02 | 9.20 |
| 61 | 504.7 | 8.73 | 461.90 | 551.89 | 10.91 |
| 62 | 513.6 | 4.08 | 371.44 | 551.55 | 5.10 |
| 63 | 503.5 | 1.72 | 470.01 | 551.52 | 2.15 |
| 64 | 483.1 | 0.00 | 714.67 | 556.10 | 0.00 |
| 65 | 482.2 | 0.00 | 723.67 | 556.12 | 0.00 |
| 66 | 461.8 | 0.00 | 785.10 | 541.99 | 0.00 |
| 67 | 439.8 | 0.00 | 962.41 | 538.10 | 0.00 |
| 68 | 502.0 | 0.00 | 378.22 | 540.65 | 0.00 |
| 69 | 499.0 | 0.00 | 936.67 | 594.67 | |

INFLOW TABLE

| <---------- Input | | | ----------> | <------ Output ------> | <-Input-> |
|---|---|---|---|---|---|
| Node | Pumps | OpCurve | %Estimate | %Actual | Inflow l/s | Status ON |
| 1 | 0 | INTAKE | | 1.00 | -342.14 | |

BOOST TABLE

| <----- - Input | | ------> | < Output > | <-Input-> |
|---|---|---|---|---|
| Pipe | Pumps | OpCurve | Boost m | Status ON |
| 25 | 1 | BOOSTER | 74.39 | |

REDUCING (PRV) TABLE

| <-------------- Input | | | | --------------> | <---- Output | ----> | PRV # |
|---|---|---|---|---|---|---|---|
| Pipe | Source | Pressure kPa | OpenK | CKV | PRVLoss m | CKVState | |
| 6 | 1 | 462 | | no | 57.05 | Open | 1 |
| 67 | 1 | 345 | | no | 45.54 | Open | 2 |
| 68 | 1 | 345 | | no | 54.03 | Open | 3 |
| 69 | 1 | 379 | | no | 48.59 | Open | 4 |
| 32 | 1 | 379 | | no | 69.98 | Open | 5 |
| 36 | 1 | 345 | | no | 30.70 | Open | 6 |
| 70 | 1 | 586 | | no | 33.92 | Open | 7 |
| 58 | 1 | 469 | | no | 21.56 | Open | 8 |

| INTAKE <------- Input ------> | | BOOSTER <------- Input ------> | |
|---|---|---|---|
| Flow l/s | Head m | Flow l/s | Head m |
| 0.0 | 0 | 0.0 | 83.8 |
| 63.1 | 0 | 1.1 | 80.2 |
| 126.2 | 0 | 1.9 | 72.5 |
| 189.3 | 0 | 3.2 | 53.3 |
| 315.5 | 0 | 4.4 | 22.9 |
| 441.6 | 0 | | |