POWELL RIVER REGIONAL DISTRICT

SOUTHERN REGION WATER RESOURCE STUDY

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KERR WOOD LEIDAL ASSOCIATES LTD.
CONSULTING ENGINEERS

SOUTHERN REGION WATER RESOURCE STUDY

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This preface has been included for the purpose of providing a capsule summary of the report findings. The highlights of the report are as follows:

Planning Parameters and Considerations

1. The Southern Region consists primarily of low density rural development interspersed with a few small subdivisions and small commercial areas. There are also a considerable number of agricultural holdings and much of the area is in tree farm licence. The estimated current population of the Southern Region is 3250 persons.

2. The anticipated rate of population growth in the Southern Region is 1 to 2% per year. Although several potential development projects are possible, their impact on the area is difficult to foresee at this time.

Review of Existing Waterworks Systems

3. Domestic water supply to the area is in most cases supplied by private wells. There are, however seven existing waterworks systems which supply between 12 and 130 residences each. Four of these systems are supplied from groundwater wells and three rely on surface water sources.

4. Groundwater presently provides domestic water to the majority of residents in the Southern Region. The groundwater resource is summarized as follows:

   - shallow aquifers in the overlying glacial till or marine deposits

   - deeper aquifers in underlying "pre-Vashon" silts, sands and gravels

   - wells in fractured bedrock

5. The surface water resource consists of the following:

   - the Powell River District Municipality water system which originates from Haslam Lake

   - the Lang Creek system which also originates from Haslam Lake

- the Gordon Pasha Lakes/Lois River system which is used by MacMillan Bloedel Ltd. for power generation

- several smaller creeks which are either too small or have potential water quality problems which make them unacceptable as regional water supply sources

6. Water quality has been identified as unacceptable in all of the existing local water systems relying on surface water sources. Only the Stillwater system presently carries out disinfection of the water supply. Water quality is less than satisfactory for many of the groundwater systems as well, however the problems appear to be associated with contamination of the water distribution systems rather than the groundwater supply.

Overview of Regional Water Supply Requirements

7. A design peak day demand for the Southern Region of 350 Imperial gallons per capita per day has been selected on the basis of available information for the District Municipality and the Sunshine Coast Regional District. Present peak demands in the Southern Region are considerably lower since they are in most cases restricted by the available water supply.

8. The existing and projected peak day water demands for the Southern Region are as follows:

YEAR	RATE (Igpm)	ESTIMATED POPULATION
1988	790	3250
2000 (design horizon)	1000	4100
2038 (ultimate case)	2124	8740

Fire protection requirements vary from 400 to 1000 Imp gpm depending upon the locality and the extent of commercial and institutional development.

9. In general surface water supplies in the Southern Region, as elsewhere, must be disinfected prior to domestic use. In addition surface water supplies may eventually have to be treated for removal of waterborne diseases such as Giardiasis.

A water quality testing program is necessary to provide information as a basis for design of a water treatment facility.

10. In general the water sources for the existing small water systems in the Southern Region are scarcely large enough to provide peak demand to their existing service areas. With the exception of the Myrtle Pond system, existing storage facilities are inadequate for any significant expansion.

Assessment of Alternative Water Supply Sources

11. Three surface water sources have been identified as possible regional water supply sources. These are:

    - purchase of water from the Powell River District Municipality

    - construction of an intake and pipeline on Lang Creek

    - purchase of water from MacMillan Bloedel on the Lois River/Gordon Pasha Lakes system

12. The groundwater resource in the Southern Region will be limited to supplying domestic water requirements to single residences and small community water systems.

Master Plan for Regional Water Supply System

13. The master plan for a regional system is based on integrated use of the three primary surface sources as follows:

    - primary supply for the western end (i.e. the Myrtle Creek valley) provided from Powell River's system

    - primary supply for the rest of the region provided from Lang Creek

    - backup supply for the entire region provided from MacMillan Bloedel's system

14. A Class D estimate of the total capital cost to construct the component facilities (i.e. including intake, connections, reservoirs and feedermains) is in the order of $6.5 million (1988 dollars).

15. The additional capital cost to construct a water filtration facility, should it eventually be required, is in the order of $2.4 million.

Implementation of the Regional Plan

16. Implementation of the regional plan involves four types of action on the part of the Regional District:

- secure regional water supply sources

- specify standards for construction of new water systems so that they can be incorporated into a regional system

- establish standards to which existing systems must be upgraded prior to acceptance into a regional waterworks system

- construct key elements of the regional waterworks infrastructure

16. The master plan lends itself to implementation in four phases:

    ° **Phase 1 - Preliminary:** secure sources

    ° **Phase 2 - Major Infrastructure Elements:** develop Lang Creek to serve the Brew Bay-Lang Bay sub-area

    ° **Phase 3 - Municipal Water Supply:** connect to Powell River's system to serve the Myrtle Creek Valley

    ° **Phase 4 - Linking and Infilling:** complete the feeder-main links between the development centres

1.0 INTRODUCTION

1.1 Background

Description of Southern Region

The Southern Region of the Powell River Regional District comprises the area of the British Columbia mainland lying east of the Municipality of Powell River, west of Jervis Inlet, and south of the interior mountain ranges and lake systems. The region is divided between a relatively narrow coastal strip, which is the most densely populated and is experiencing the greatest pressure for development and the forested interior which includes small agricultural holdings and relatively sparse residential areas.

The study area offers an attractive alternative to higher density development in the Municipality of Powell River. Waterfront and areas close to the waterfront are especially in demand. In recognition of the potential development pressure in the Southern Region, an **Official Settlement Plan** was prepared by the Regional District in 1982.

Existing Waterworks Systems

Water supplies for the southern region have been developed almost exclusively by individuals for single or small groups of residences. Groundwater is the predominant source in the western part of the region. Water systems tend to be small and rely on production from one or two wells. Surface water has been used to a significant extent in the central and eastern parts of the region where several relatively large local water systems are in place.

The larger water systems include several dozen residences and some have been recognized as either "Local Improvement Districts" or utilities. In recent years some of these Districts have invested significant sums of money to upgrade their water supply and distribution infrastructure. Other systems appear to lack the strong organization required to maintain, improve, or upgrade the infrastructure. In several cases there appears to be no adequate organization to continue operation of the system if the present operators reduce their committment.

Need for a Regional Water Study

Recognizing the need for a review of water servicing alternatives, and also the possibility that the public water supply function within the study area may eventually be best carried out by a single water supply agency, the Powell River Regional District has commissioned this study. The primary objective is to complete a comprehensive engineering study which provides a practical framework for long term water supply planning and development in the region. More specifically the intent is to address the following:

- identify surface and/or groundwater sources of adequate quality and quantity to serve a future regional water system

- assess the adequacy of existing local water supplies to serve existing and anticipated future users

- prepare a conceptual plan complete with costs, to provide an integrated water supply system to serve existing and new development areas within the southern region of the District

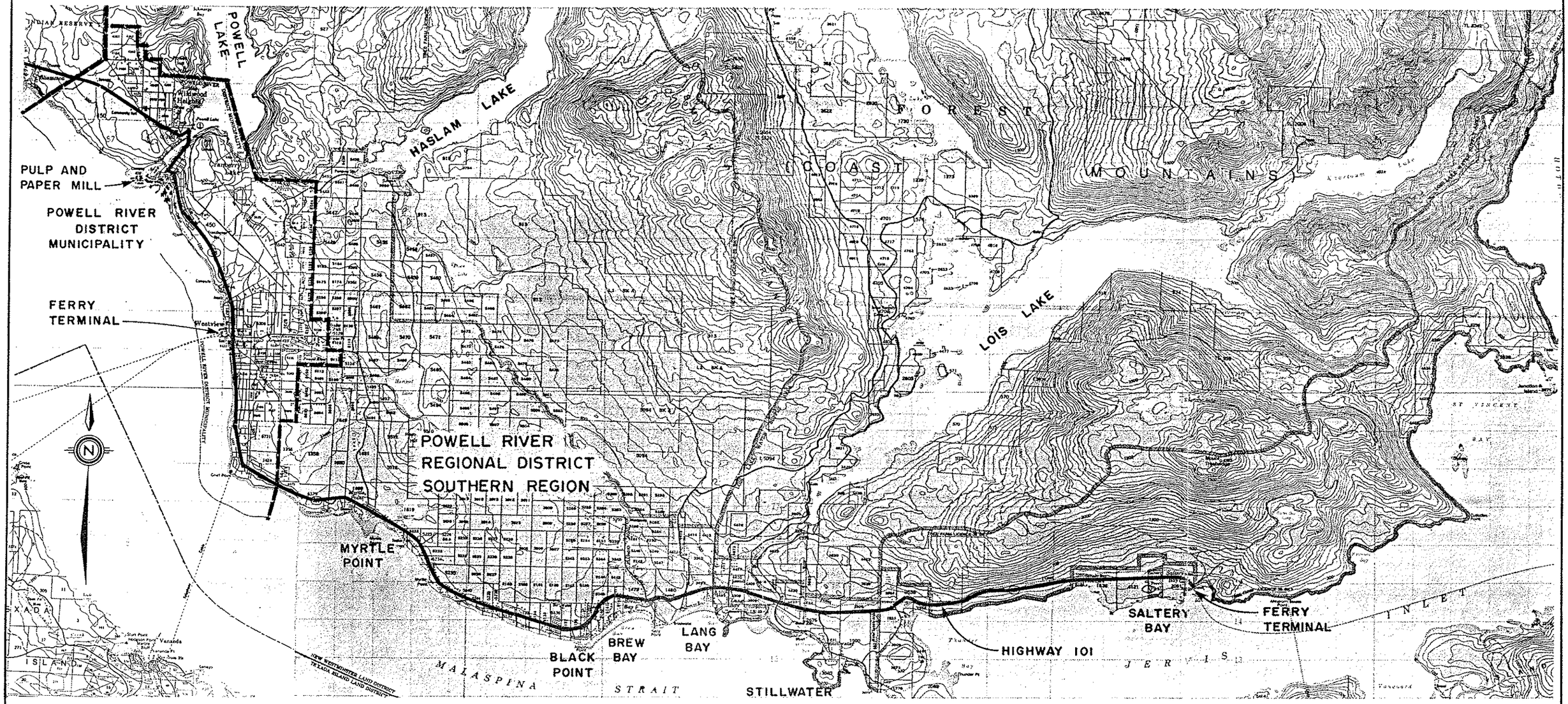
Kerr Wood Leidal Associates Ltd., Consulting Engineers, were selected to undertake the assignment on the basis of considerable related experience in the field of regional water supply planning.

1.2 Study Area

The Study Area is shown on Figure 1. The southern region of the Powell River Regional District is characterized by forested terrain sloping broadly southward from the Smith Mountain range toward Malaspina Strait. The area is marked by three major drainage systems, Myrtle Creek, Lang Creek, and the Lois River, as well as several lesser watersheds.

The eastern extremity of the region consists of steeper forested mountain slopes which extend virtually to the edge of Jervis Inlet.

Presently development is focussed on a relatively narrow strip of land along the coast and in proximity to the main transportation route (Highway 101). The present population of the southern region is estimated to be 3100 people and growth is estimated between 1 and 2 percent per year.



STUDY AREA

POWELL RIVER REGIONAL DISTRICT—SOUTHERN REGION

FIGURE 1

1.3 Scope of Assignment

The purpose of this Water Resource Study is to provide direction with regard to:

- planning for future development and for settlement areas to accommodate future population growth with regard to the location, quality, and quantity of water supply sources

- planning for and taking steps to secure and protect adequate water supply sources for present and future needs

- possible gradual acquisition and amalgamation of existing water supply systems

The study has been completed in three phases. Phase I of the water resource study includes assembly and review of information, review of planning parameters, review of potential surface and groundwater sources, and investigation of existing community waterworks systems.

Phase II of the study provides an assessment of regional needs and potential water resources.

Phase III of the study includes presentation of a concept plan for regional water supply.

1.4 Reference Sources

Field investigations were carried out to obtain first-hand information on the existing systems. This included visits to the watershed areas, examination of intakes, and inspection of groundwater well pumping stations, storage tanks, and water treatment facilities.

The following reports and data have provided historical background information relative to both the planning and operation of waterworks systems:

1. Powell River Regional District, Southern Regional District (Electoral Areas B and C), Official Settlement Plan "Schedule A", May 1982.

2. Waste Management Plan - Supplementary Documents, including a Preliminary Groundwater Assessment prepared by the Water Management Branch and a Review of Surficial Geology prepared by the Waste Management Branch.

3. Surface water licence records and documents made available by the Water Management Branch.

4. Miscellaneous drawings, documents, and records, as well as verbal information relating to the existing local waterworks systems.

2.0 PLANNING PARAMETERS AND CONSIDERATIONS

2.1 Planning Horizon

A critical consideration in long-term water supply planning is the selection of a reasonable time frame for projecting future water supply requirements. The selection of a specific planning horizon for water supply design provides the basis for all subsequent decision making with respect to the sizing of facilities.

For the purpose of this report, the planning horizon for sizing of infrastructure such as intakes, pipelines, and storage facilities will be the year 2000 (i.e. 12 years). Assessment of water sources, however, will be based on a 50 year horizon (i.e. year 2038) to ensure that the Regional District has the flexibility to expand water use over the longer term.

Discussion regarding acquisition of water sources will be based on the estimated population in the year 2038 which, at a 2% growth rate, would be 8740 people.

2.2 Existing Population and Land Use

The current population of the southern region is estimated to be 3250 people. The last census (1986) put the population at 3120.

Land use in the Southern region falls into the following categories:

a) Developed residential, subdivided: Several subdivided areas exist within the region, generally located around areas of historical development. In addition, the density of development is much higher along the waterfront due to the attractiveness of the land.

b) Rural, low density and small holdings: Most development falls into this category with lot sizes ranging between 2 - 5 acres. Emphasis is on recreational aspects of the area as well as some hobby farming.

c) Agricultural: There are a considerable number of agricultural holdings in the interior, inland portion of the region (north of Highway 101).

d) Tree farm licence: Much of the region (especially to the north and east) is currently a part of active tree farm licences with occasional logging activity.

e) Several minor commercial establishments are spread along Highway 101. These are usually located near areas of residential development or adjacent to the boundary of the Powell River Municipality.

f) Outside of logging, industrial development is limited to a few small saw mills. In recent years there have been some applications for commencement of fish farming operations.

2.3 Future Population and Land Use

At present there is no indication that the population of the southern region will expand at a rate in excess of (the current) 1 to 2% per year. Therefore, using an estimated growth rate of 2%, the anticipated population in the year 2000 could be in the order of 4100 persons. Discussion regarding water supply infrastructure will be based on this population.

The District does not anticipate any major shifts in land use in the foreseeable future. The current trend is toward smaller parcels but not high density development. It is felt that the predominant attraction of the area will continue to be availability of larger properties, and escape from higher density development.

In spite of this general trend, there are potential impending developments which could have an impact on the area. These include:

- a possible golf course and resort development near Deighton Creek (east of Myrtle Point)

- activity surrounding mineral claims in the Hammil Hill area

- possible further fish incubation, rearing, and farming activity

- application for development of higher density subdivisions targeting the retirment market is anticipated in some areas

- a large block of land in the interior between Myrtle Point and Black Point has been designated for a possible airport development in the remote future

- some industrial development may occur as a result of connection of the peninsula to the proposed natural gas pipeline to Vancouver Island

The impact of any of these potential development cannot be foreseen at this time.

TABLE 1

SYSTEM	MYRTLE POND SPECIFIED AREA	ERWORKS	SALTERY BAY DISTRICT
AREA SERVED (developed)	35 residences in Myrtle Point Area (plus 21 developed lots (unoccupied)	2(My pc ti	the water 16 residences
SOURCE	one groundwater well rated @ 24 Igpm pumped at 17 Igpm (located in unoccupied subdivision)	on pu ti	reened Bishop Creek, screened intake
STORAGE	60,000+ gal steel reservoir	10 re:	tank c/w none
TREATMENT	iron and manganese removal, chlorination	nor	tion none
DISTRIBUTION SYSTEM	old system at Myrtle Point not sized for fire demand. New 6-in. PVC in unoccupied subdivision	4-i c/w hyd	piping 2-in polyethylene dpipes on. One e re-
COMMENTS	new system designed and constructed for new subdivision. Purchased by the MPSA and connected to old "Munson" system	des str Ste divi	placed em Manage-

3.0 REVIEW OF EXISTING WATERWORKS SYSTEMS

3.1 General

The existing waterworks systems considered in this report only include those which serve subdivisions or a significant area of development. These have been registered as "Local Improvement Districts", Specified Areas, or as utilities.

These systems have evolved in the following ways:

- Engineered water systems installed as part of a subdivision development.
- Private water systems expanded over time to serve a larger area.
- Cooperative ventures formed by users creating a utility or a Local Improvement District and either installing a new water system or modifying and expanding an old one.

The location of these systems is shown in Figure 2. A general description of each system is given in Table 1.

It can be seen from Figure 2 that the existing waterworks systems serve pockets of development which have evolved historically around local industries (i.e. sawmills) and desirable coastal settlement areas. Many of the existing systems are isolated from each other with no potential for linking into combined systems given the present resources of the Improvement Districts. Exceptions are:

- the Myrtle Pond Specified Area which could be expanded to include the Stella Maris Estates system
- the Pinetree and Woodlynn system could be combined subject to investment in suitable pumps and equipment to coordinate the pressure zones

With the exception of the Myrtle Pond Specified Area and the Brew Bay Improvement District, the existing waterworks systems appear to be controlled by organizations predominantly concerned with day to day finances and operation of the facilities. There does not appear to be much interest from many of these groups in improving water quality, upgrading existing facilities, or expansion.

The people responsible for operation of the waterworks facilities are paid nominally, if at all, for their services. In many cases there is a genuine concern regarding who will operate the system once the current staff retire.

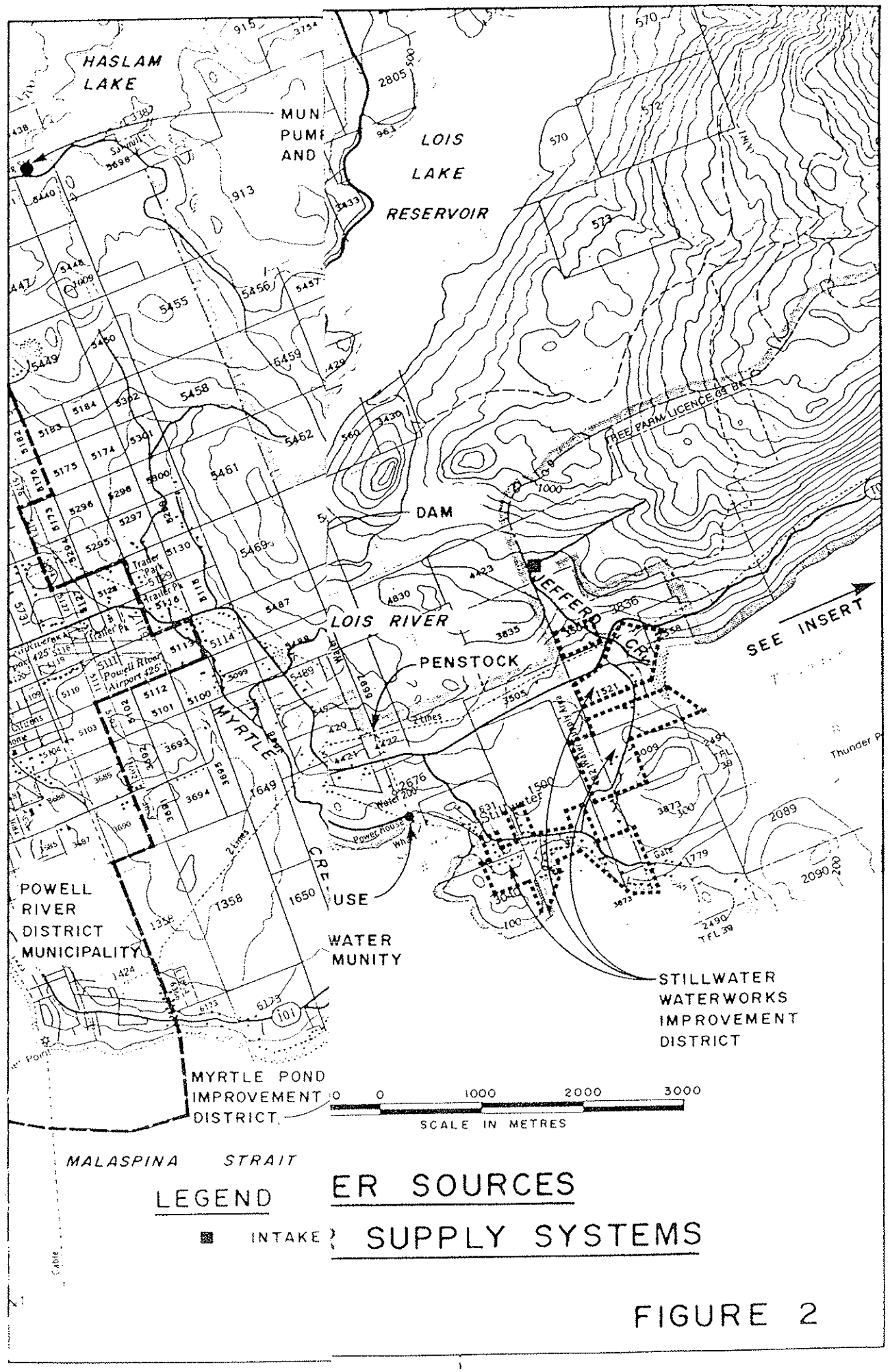

HASLAM LAKE
MUN PUMP AND
LOIS LAKE RESERVOIR
DAM
LOIS RIVER
PENSTOCK
SEE INSERT
POWELL RIVER DISTRICT MUNICIPALITY
WATER MUNITY
USE
STILLWATER WATERWORKS IMPROVEMENT DISTRICT
MYRTLE POND IMPROVEMENT DISTRICT
MALASPINA STRAIT
SCALE IN METRES
0 0 1000 2000 3000
LEGEND
INTAKE
ER SOURCES
SUPPLY SYSTEMS

FIGURE 2

3.2 Water Sources

Groundwater

The majority of residents of the Southern Region obtain their water supply from either excavated or drilled wells. These include users in four of the seven Local Improvement Districts investigated during preparation of this report, as well as several hundred private or shared wells.

The **Groundwater Resource Study** completed by Piteau Associates is included herein as Appendix A. The description of the groundwater resource for the Southern Region is summarized as follows:

- Shallow aquifers representing local permeable zones in the glacial till or marine deposits. These are exploited by excavated wells throughout the Southern Region but water levels tend to fluctuate and the shallow wells may not be reliable.

- The pre-Vashon silts, sands, and gravels underlying the till have been exploited as an aquifer by numerous deeper wells in the area west of Kelly Creek. The total quantity of groundwater available in this aquifer is expected to be significant, but limited by the total recharge possible through the overlying till.

- Several wells have also been successfully completed in fractured bedrock.

Surface Water

The locations of various surface water sources in the Southern Region are noted on Figure 2. A summary of information for each source is presented in Table 2, with potential and existing water supply sources assessed as follows:

° **Powell River District Municipality:** the option exists to supply water to western areas of the Southern Region lying adjacent to the Municipality with water purchased from the Municipality. This is contingent upon the potential requirements being made known to the Municipality so that they can plan their water supply and distribution system accordingly.

TABLE 2

SUMMARY OF SURFACE WATER SUPPLY WATERSHEDS

WATERSHED	AREA (sq.km)	PREDOMINANT LAND USES	EXISTING WATER USE	EXISTING WATER LICENCES	COMMENTS
Myrtle Creek	20	Agriculture, some small holdings, tree farm license	-	-	Hamil Lake currently used by municipality as a domestic water source. Remainder of watershed is contaminated due to agricultural land use.
Deighton Creek	6	Agricultural and tree farm license	Irrigation	5000 Ig per/day domestic 35 Acre/Ft Storage (Irrigation)	Proposed golf course/resort development
Kelly Creek	10	Agricultural, small holdings, tree farm license	Domestic	3600 Ig per/day domestic	Considerable development in lower half of watershed
Lang Creek/Haslam Lake	128	Agricultural and small holdings in lower water shed. Most of water shed is tree farm license	Water Works	39,500 Ig per/day	(27.5 Igpm) Brew Bay
			Miscell. Domestic	4700 Ig per/day	
			Fishery Enhancement	16 cfs	(5980 Igpm)
			Municipal Water Works	25 cfs 14,400 Acre/Ft. per/yr (storage)	(9350 Igpm) Powell River Dist. Municipality intake on Haslam Lake
Whittal Creek	8	Tree farm license, and agricultural. Rural high density at the coast	Domestic	1000 Ig per/day	
Lois River/ Gordon Pasha Lakes	456	Tree farm license	Power Generation	1300 cfs 469,000 Acre/Ft. per/yr (storage)	(486,000 Igpm) controlled by MacMillan Bloedel Ltd.
Silver Creek (tributary to Lois River near highway)	4	Tree farm license	Water Works Miscellaneous Domestic	250,000 Ig per/day 500 Ig per/day	(173 Igpm) Lang Bay Water Works

- **MacMillan Bloedel Ltd:** The Lois River drains the large (450+ sq.km) Gordon Pasha Lakes watershed. The watershed is controlled by MacMillan Bloedel Ltd. who operate a dam, penstock, and powerhouse to generate electrical power for their pulp and paper mill. During low flow periods the entire discharge from the watershed is committed to power generation. However, the mill does have a backup power source from B.C. Hydro, therefore there is the potential for water to be purchased from MacMillan Bloedel at a rate based on the difference in power costs between the Stillwater Power Generating Station and B.C. Hydro.

  In addition to consideration of Lois Lake (above the dam) as a location for a water supply intake, it is possible that the penstock itself could be a source of pressurized water supply. At present MacMillan Bloedel supplies fresh water to the powerhouse and several residences in the Stillwater Bay area through a 150mm diameter flanged connection to the penstock located approximately 100 metres above the powerhouse.

- **Other creeks and river systems:** In general, most of the streams catalogued in Table 2 are quite small with localized watersheds. Of the remainder, Myrtle Creek and Kelly Creek draw from watersheds already largely developed with low density and agricultural settlement. Only Lang Creek has significant potential as a regional source.

The majority of the Myrtle Creek watershed is in an agricultural area, however, Hammil Lake (which is the creek's source) is currently used as a supplementary water source by the District Municipality. The Municipality is planning to abandon the Hammil Lake source in the future rather than make a major investment in a new pipeline and intake. Preliminary investigation indicates that the lake is quite shallow and possibly subject to water quality problems. The watershed is too small to serve as more than a fragment of a regional water supply.

Lang Creek extends from Haslam Lake, (at the northwest corner of the study area), to the central coast of the Southern Region. Haslam Lake is already managed as a watershed for the benefit of the Powell River District Municipality. The Brew Bay Improvement District has an intake on Lang Creek a few hundred metres from the estuary at Lang Bay.

The Lang Creek/Haslam Lake watershed lies predominantly in tree farm licence areas with some agricultural land

use adjacent to the lower three kilometres of the creek. There is a salmonid incubation facility operated by the local salmon society southeast of Duck Lake as well as a spawning channel constructed by the Department of Fisheries and Oceans near the estuary.

The flow into Lang Creek is controlled by the Powell River District Municipality by means of a weir located at the outlet to Haslam Lake. This weir is used to control storage for the municipal water supply from Haslam Lake. It is currently also controlled to maintain minimum flow to the fishery enhancement facilities downstream.

3.3 Water Quality and Treatment

Groundwater

Groundwater quality in the Southern Region tends to be marginal with regard to some dissolved minerals. In general, however, the numerous "deep" (as opposed to shallow excavated) wells probably provide an acceptable source of domestic water without requiring treatment. Shallow wells, on the other hand, may be subject to contamination from local septic fields or agricultural activities.

At present, the Myrtle Pond Specified Area well is the only system for which the ground water is treated. The treatment facility includes iron and manganese removal (tested somewhat over Provincial guidelines) and chlorination (due to detection of choliform bacteria at the time that the well was drilled and tested).

Surface Water

Surface water sources in the Regional District generally may be subject to contamination from the following sources:

- Human and/or animal contamination from septic fields, agricultural use, and indigenous wildlife. In addition to wastewater contamination (as typically determined from coliform bacteria counts) there is also potential for "giardiasis", a water borne disease originating with native beaver and similar animals.
- Contamination resulting from agricultural activities including fertilizing and spraying.
- Fishery enhancement activities including fish, wastes, chemicals and drugs employed in disease control.
- High turbidity in the water, always a problem on the coast during high run-off periods, will be made worse by improper logging practices within a watershed.
- High tannin levels have been reported in Lang Creek at certain seasons.

At present, only the Stillwater Water Works District provides disinfection (by chlorination) of surface water. The new Brew Bay system, which is currently under construction, will also incorporate a disinfection facility.

The local health unit has identified the following inadequacies in the existing local surface water sources and associated systems:

- Lang Creek (Brew Bay Improvement District): occasional significant coliform counts have been noted in the lower reaches of the creek.

- Silver Creek (Lang Bay Water Users Community): coliform counts have been recorded in the system on a regular basis.

- Jefferd Creek (Stillwater Water Works): coliform counts have been noted on occasion, apparently associated with temporary failure of the chlorinator.

3.4 Water Usage and Design Peak Day Demand

General

Water usage may be categorized in terms of residential, commercial, institutional and industrial demands. For relatively small communities residential demand is the predominant category, and other usages are either not applicable or are insignificant by comparison.

The residential category includes the use of water in homes for both domestic purposes and for irrigation of lawns and gardens.

A regional waterworks system should be designed to provide a level of service adequate to meet all the requirements in the community in accordance with generally accepted standards for water supply. In addition to providing for normal residential needs under conditions of specified maximum demand, a water works system should have sufficient capacity to provide adequate fire protection.

Rates of water usage in residential areas vary with factors such as land use, population density, climate, and system capacity. Therefore, one of the first steps in the process of developing a plan for upgrading a waterworks system is to establish appropriate design criteria for estimating water supply requirements.

Existing Water Consumption Records

One approach to determining water supply requirements is to look at existing records of water consumption in the subject community or adjacent communities with similar requirements. Water usage records for the existing water systems in the Southern Region are sparse. Table 3 shows estimates of water consumption in the various systems and the basis for the estimate.

General comments on Table 3 are as follows:

- peak day demand for systems with marginal or limited water supplies are quite low (i.e. Stella Maris and Pine Tree)

- where the water supply is plentiful, sprinkling tends to be unrestricted, and peak day demands exceed 300 gpcpd (Imperial gallons per capita per day)

- the water demand in the Powell River District Municipality is very high relative to most coastal communities. This is probably due to lack of sprinkling regulations as a result of the secure water supply. Approximately 20% of the peak demand in the municipality is from automatic park sprinkling and golf course irrigation.

In addition to the communities shown in Table 3, the Sunshine Coast Regional District reports that for a population of 12,000 people (including the communities of Sechelt and Gibsons) the peak day demand is 3.5 million Imp. gal or 291 gpcpd.

Design Values for Water Consumption

The peak day demand is the flow criteria most commonly used for sizing infrastructure components such as water supplies, reservoirs, and distribution mains. It consists of the total flow required by the system during the day of the year with the highest water consumption.

The average day demand may be much less than the peak day demand since the peak day demand is usually heavily influenced by seasonal irrigation requirements.

The peak hour demand is often estimated to be 50% greater than the peak day demand. The peak hour demand is usually allowed for by balancing storage in reservoirs.

TABLE 3

EXISTING WATER CONSUMPTION

SYSTEM	ESTIMATED CONSUMPTION PEAK DAY	AVERAGE DAY	BASIS FOR ESTIMATE
Powell River Municipality	582 gpcpd	230 gpcpd	based on Municipal records
Myrtle Pond	186 gpcpd+	85 gpcpd	based on flow meter records
Stella Maris	140 gpcpd+	-	based on existing well capacity and knowledge that capacity is occasionally exceeded
Pinetree	260 gpcpd+	-	based on existing well capacity and knowledge that capacity is marginal at times
Brew Bay	No records		
Lang Bay	-	350 gpcpd	based on Buck Morton estimate - probably includes considerable leakage in system
Stillwater	-	230 gpcpd	1988 flow meter records
Woodlands	No records		

Notes:

gpcpd = Imp gallons/capita/day
Based on 3.5 residents per service connection

The remainder of this section will focus on determination of a design peak day demand since this is the significant figure for most infrastructure requirements.

The "Design Guidelines for Rural Residential Community Water Systems" issued by the Ministry of the Environment (1985) recommend that a range between 1050-1200 Imp. gallons per day per dwelling unit (gpd/du) be allowed for the peak day demand for single family detached housing in temperate areas of B.C. This includes a base of 300 gpd/du for domestic purposes with the remainder devoted to seasonal irrigation demand.

Assuming an occupation rate of 3.5 persons per dwelling unit, the recommended range for peak day design water demand is 300-342 gpcpd (Imperial gallons capita per day).

A design peak day flow of 350 gpcpd is recommended for the Powell River Regional District based on the following:

- exceeds all estimates of peak demand for existing water systems in the Southern Region

- slightly exceeds MOE recommendations due to high demands observed in the District Municipality

- exceeds observed existing demands on Sunshine Coast by 20%

Somewhat higher than usual demand is justified in that lot sizes tend to be large in the Southern region and therefore domestic sprinkling requirements are potentially higher than the norm.

The peak day design flow of 350 gpcpd may at some time entail moderate sprinkling restriction depending upon user trends. There is no allowance in this figure for large scale agricultural irrigation which, if ever required, must be managed through separate water systems.

The alternative design peak day demand of approximatley 600 gpcpd, based solely on the District Municipality demand, would result in significantly increased costs for infrastructure components such as intakes, reservoirs, and transmission mains. A reduction in potential sprinkling restrictions does not justify such substantial increase in capital costs for a regional water system.

The recommended peak hour flow for design purposes should be based on a 50% peaking factor over and above the design peak day flow. The resulting design peak hour flow for the Regional District is 1840 gpd/du or 525 gpcpd.

3.5 Identification of Problem Areas

During examination of the available information on regional planning parameters, surface and groundwater sources, and existing waterworks systems, the following potential problems have become apparent:

- although groundwater has been developed in the region for private systems and small water works communities, there is little chance that wells can be developed of sufficient capacity to be incorporated into a regional system

- many of the surface watersheds currently used for domestic water supply are subject to contamination

- all watersheds are subject, to some degree, to the results of logging practices

- several watersheds are too small to be considered as a reliable regional source

- current and planned land use for agriculture and fishery enhancement is already encroaching on the remaining watersheds

- several of the existing water works districts are operated and controlled by groups which do not appear to have a sufficiently strong organization to manage long term maintenance, upgrading, and expansion of facilities

- although low density settlement is general over most of the subject area, denser development occurs in relatively isolated communities spread along the coast. This factor tends to make the concept of a regional water system more complex and implementation more costly.

4.0 OVERVIEW OF REGIONAL WATER SUPPLY REQUIREMENTS

4.1 Water Supply Requirements

Domestic Demand

Most development within the study area is single family residential, therefore water demand related to residential dwelling units provides the most reasonable and convenient basis for predicting future peak water demand.

It is understood that although there is a fair amount of agricultural activity within the Southern Region, there is little requirement for irrigation. Irrigation requirements (outside of domestic lawns and gardens) are therefore not considered further in this report. It is assumed that if a major need for irrigation arises, it will be supplied by sources quite separate from the Regional water system discussed herein.

It is also assumed that future commercial development will be added approximately in proportion to existing residential development. Estimated water usage by commercial operations is included within the design figures based on per capita water consumption.

For predicting future water demand, the design values developed in Section 3.4 are as follows:

CRITERION	UNIT DEMAND	
	gpd/du	gpcd
peak day	1225	350
peak hour	1840	525

The existing and projected design peak day water demands for the Southern Region are summarized as follows:

YEAR	POPULATION	PEAK DAY DEMAND	
		in "MGD"	in "Igpm"
1988	3250	1.14	790
2000	4100	1.44	1000
2038	8740	3.06	2124

Further to the above table, then, the ultimate bulk water supply requirement is over 3 million gallons per day for the Southern Region.

Fireflow Protection Requirements

There is no regulatory agency that specifies quantities of water to be provided for any particular hazard. It is, however, normal practice to consider the recommendations of the Insurer's Advisory Organization (IAO) of Canada when determining fireflows. They provide guidelines for selecting design fireflows depending on the characteristics of an area.

For communities such as the Southern Region which comprise primarily single family residences, a minimum fireflow value of 400 Imp gpm for a one hour duration represents current recommended practice for most areas. The design fireflow is often increased to at least 1000 Imp gpm with a two hour duration, for relatively small communities that include a school, small commercial area or higher density development. This would apply to specific areas of the Southern Region. On this basis the minimum required fire protection storage reserve for communities such as Myrtle Point, Black Point, and Lang Bay would be 120,000 gallons.

Except in unusual cases, it is presumed that community firefighting equipment will include a pumper type fire truck. The specified minimum pressure required at the hydrant while delivering the design fireflow to the pumper truck is 20 psi. Typically, a network of 150mm diameter watermains fulfills this criteria, however, final design must be based on the specific conditions for each location.

4.2 Water Storage Requirements

Reservoirs should be designed to provide the balance of the peak hourly and instantaneous demands over and above the peak day demand and to provide the required fire protection storage.

Storage requirements vary with the consumption characteristics of a particular area. Studies have shown that for purely single family residential areas, with relatively little leakage, the storage volume required for balancing is typically about 20 percent of the peak day consumption.

4.3 Pressure Zones

In planning a municipal waterworks system, it is normal practice to delineate the service area in terms of "pressure zones". The boundaries of a pressure zone are established on the basis of topography and the acceptable range of static service pressures.

The maximum pressure to which a system may be subjected, referred to as the static pressure, is limited through the creation of pressure zones. To operate the system simply and effectively, particularly during emergency conditions, it is desirable that service pressure zones be as large as possible, and be served from storage which balances the source supply, limits pressure fluctuations, and provides automatic, reliable fireflows.

4.4 Water Quality

Public Health Requirements

Water supplied to consumers should comply with the British Columbia Drinking Water Quality Standards published by the B.C. Ministry of Health. These guidelines cover the microbiological, physical, chemical and radiological quality of drinking water. If necessary, treatment should be provided to ensure that the water meets the guidelines.

Regardless of the water quality, the B.C. Guidelines recommend communities provide disinfection for all supplies derived from surface and shallow groundwater sources. Therefore disinfection should be considered as the minimum treatment requirement.

Additional Water Quality Considerations

In recent years outbreaks of a waterborne disease known as giardiasis or "beaver fever" have become an increasing concern in North America. Giardiasis is an intestinal disease. It causes nausea, cramps and diarrhea in humans, but no long lasting adverse physiological effects. It is transmitted in a number of ways, including via water and mammals, particularly beaver, muskrat and other fur bearing animals.

In the past six years four documented waterborne outbreaks of giardiasis have occurred in B.C. In all four outbreaks, giardia positive beavers were found in the untreated surface supply. In two of the outbreaks giardia positive muskrats were found in the same supply. In this regard it is significant that beavers are known to exist in the Lang Creek/ Haslam Lake watershed.

While chlorine will inactivate giardia at relatively high dosages and with long contact times, some additional treatment is generally considered necessary to prevent giardia cysts entering the water system.

A further possible water quality concern would be aggressiveness. Due to their purity, many B.C. coastal waters are naturally aggressive or corrosive. Aggressiveness is undesirable because it speeds up system deterioration and may introduce materials such as lead and copper from household plumbing into the drinking water. If necessary, treatment should be provided to reduce the aggressiveness of the water.

Treatment Alternatives

There are a number of alternative methods for disinfection of drinking water including:

- chlorination
- ozonation
- ultraviolet (UV) radiation

In British Columbia, as in most of North America, chlorination is generally the preferred treatment. Chlorination offers the advantages of economy and simplicity. In addition, the small amount of chlorine which remains in the water as it passes through the distribution system (chlorine residual) provides protection against contamination from leaks or breaks in the watermains. In contrast, ozonation and UV radiation leave no residual and consequently offer no protection against contaminants entering the distribution system.

There are also a number of treatment methods for control of giardia. These include:

- ozonation
- diatomaceous earth filtration
- coagulation and rapid sand filtration
- slow sand filtration

For small communities, slow sand filters are often the preferred choice since they are relatively inexpensive to construct, and simple and economical to run.

Finally for control of aggressiveness, the treatment would probably involve the use of lime and carbon dioxide or limestone addition.

Water Quality Testing

Good water quality data are a key requirement for designing any water treatment facilities. Therefore, a water quality testing program should be initiated prior to design of an intake and water treatment facility for a Regional District System.

To ensure that the testing covers seasonal variations in water quality, the testing should continue for a minimum of one year. Testing would include:

- turbidity
- colour
- range of physical, chemical and microbiological parameters

The cost of such a program is typically around $2,000 to $3,000.

4.5 Assessment of Existing Waterworks Systems

The purpose of this section is to assess the feasibility of expanding and/or integrating existing water sources into a regional system. This includes a brief review of the adequacy of existing waterworks facilities.

Quantity of Supply

Table 4 summarizes the capacity of the water sources for the existing water systems assessed in this report. The table also shows the present number of service connections and the number of connections which would be allowed using the previously stated design peak day flow of 1225 Imp gal per dwelling unit.

It can be seen that virtually all of the systems are currently oversubscribed at the proposed design peak day flow. The single exception is the Lang Bay Water Users Community. Therefore, significant new development in any of these areas must be contingent on additional sources of supply.

Existing Storage Facilities

The existing storage facilities are outlined in Table 1. To date only relatively small reservoirs exist, with a reliance on tank truck support from the local Fire Department. It is reported that fire insurance premiums in the Southern Region are considerably higher than within the District Municipality of Powell River, reflecting its lower standard of fire protection.

The Myrtle Pond Specified Area operates a 60,000 Imp. gallon reservoir which is adequately designed for both the fire and balancing storage requirements of the present service area (i.e. 35 service connections).

Stella Maris Estates and Pinetree Place have storage tanks with adequate capacity for balancing storage only. The wood stave tank at Stella Maris is in poor condition.

TABLE 4

CAPACITY OF EXISTING WATER SYSTEM SOURCES

SYSTEM	SOURCE	CAPACITY Igpm	NO. OF. EXISTING SERVICE CONNECTIONS	NO. OF CONNECTIONS POSSIBLE @ 1225 gpdupd
Myrtle Pond	Well	24	35	28
Stella Maris	Well	9	26	11
Pinetree	Wells	30	48	35
Woodlyn	Well	12	11	14
Brew Bay	Well	27.5 licenced	65	32
Lang Bay	Surface water intake	173 licenced	120	204
Stillwater	Surface water intake	52 licenced	82	61

Although the Brew Bay storage appears undersized, it is probably adequate considering the proximity and quantity of the Lang Creek source. The Brew Bay system (under construction) also includes a 440 Igpm fire pump.

Storage for the Woodlynn, Lang Bay, and Stillwater systems is insufficient to meet the usual balancing storage requirements. This is off-set to some degree by the apparent ability of the three water sources to meet peak instantaneous demand.

In summary, two existing storage facilities for the existing water systems provide adequate balancing storage. Storage for 4 of the systems is insufficient to provide balancing storage, however, these systems have relatively large and reliable water source and supply capabilities. Only the Myrtle Pond reservoir has sufficient storage for fire protection, and it is the only reservoir of sufficient capacity to be of significance in a regional system.

Zoning and Water Pressure in the Existing Systems

Water pressures in the existing water systems vary from a few pounds to over 100 psi. Water pressures tend to be lower than for typical municipal systems because of the limited resources of the small communities and the expense usually associated with pumping and piping to a high elevation reservoir.

In several systems water pressures cannot be increased due to the limited strength of older or non-standard piping materials.

4.6 Quality of Existing Sources

Surface Water Quality

On the basis of bacteriological testing, the raw water quality of the existing surface water sources (Lang Creek, Silver Creek, Jefferd Creek) in the Southern Region is inadequate for a public water supply. The water must therefore be disinfected prior to domestic consumption. The Ministry of Health has identified significant coliform bacteria counts in all three creeks and, although the coliform counts tend to be low and intermittent, there is no question that disinfection is required. In addition, coliform counts have been observed in the Pinetree system. It is reported that this contamination is associated with occasional recharge of the reservoir from a nearby pond.

Jefferd Creek (source for the Stillwater Waterworks District) has a watershed dedicated to and managed for public water supply. Water from Jefferd Creek is chlorinated prior to distribution, thereby meeting public health requirements.

Silver Creek is also used solely as a public water supply. Although there is logging and gravel pit activity in the area, the source is a groundwater outflow which remains relatively unaffected by these activities. The Lang Bay water users community does not disinfect their water supply.

The Lang Creek water shed below Haslam Lake is subject to more complex usage including fishery enhancement, agricultural, and logging activity. The Brew Bay Improvement District system, which is currently under construction, includes a disinfection facility.

Results of chemical testing for Lang Creek and the Lois River are included in Appendix B. Both Sources meet present Federal and Provincial **Drinking Water Standards.**

Groundwater Quality

Most of the existing groundwater sources for which data is available can be characterized as soft, calcium bicarbonate water.

High iron and manganese concentrations have been identified in the Myrtle Pond Specified Area well and may be present in other wells. The Specified Area operates a treatment facility to remove these minerals.

Bacterial contamination has been noted in several of the systems supplied from wells, however, the presence of coliform bacteria is probably associated with connection to shallow groundwater or surface water sources or with bacteria existing in the water distribution system.

Additional discussion of groundwater quality is contained in Section 6 of Appendix A.

5.0 ASSESSMENT OF ALTERNATIVE WATER SUPPLY SOURCES

5.1 General

The primary purpose of this study is to identify water supply sources, sufficient in both quality and quantity, to serve the Southern Region over the design period.

It has been noted in earlier chapters that the western half of the Southern Region suffers from insufficient water supply due to the limitations of the groundwater source. The eastern half of the study area has adequate quantities of supply, however, quality problems are evident which are common to most surface water sources.

5.2 Surface Sources

The following provides a very brief descriptive overview of the surface water sources in the Southern Region of the Powell River Regional District.

Powell River District Municipality

One possibility to be considered in supplying domestic water to the western end of the Southern Region is to purchase water from the District Municipality of Powell River.

- The municipal water supply for Westview (i.e. the municipal area immediately west of the Southern Region) is primarily from Haslam Lake. Hammil Lake is a secondary source which the municipality is hoping to phase out due to inferior water quality. The Haslam Lake source appears to be adequate for both short and long term requirements. (The municipality's water licence on Haslam Lake is for 700 litres/sec. Currently peak hour demand is approximately 470 litres/sec.)

- If the municipality were to provide water to the Regional District, it can be anticipated that they would meter the demand and charge a rate which would at least reimburse them for the costs of supply, treatment and distribution. This rate could be in the order of 5¢ per 1000 litres. (By comparison the Greater Vancouver Water District charges 3.73 cents per 1000 litres to member municipalities.)

- The present water distribution system in the municipality is barely adequate to meet peak demands at the south end of town. Planning will begin in the near future for a new trunk water main to enhance water supply to this area. Supply requirements for the western end of the Southern Region could be incorporated into this plan.

- In summary, the Municipal water system could in future supply water to the western portion of the Southern Region. Sufficient quantity of water can be provided if region requirements are built into future expansion of the municipal water system. Costs for supply from the municipality may be less than costs for development and distribution of other surface water sources in this area.

Myrtle Creek

- Hammil Lake (in upper reaches of the Myrtle Creek watershed) is already used by the District Municipality as a water source. Long term planning is to phase out Hammil Lake as a source, rather than make a large investment in a new pipeline and intake. Hammil Lake is apparently quite shallow and may be subject to water quality problems. The tributary watershed appears too small to be considered a substantial source of water for a regional supply.

- The remainder of the watershed is dominated by agricultural activity which has a definite adverse affect on water quality. In recent years the Myrtle Pond Specified Area has abandoned their intake on Myrtle Creek in favour of a well water supply.

- In summary, Myrtle Creek is not attractive as a domestic water source due to poor water quality, potential difficulties in watershed management, and the resulting requirement for a sophisticated and expensive treatment system. Hammil Lake could be considered as an alternative for a portion of the regional supply if water quality and adequate base flows were confirmed.

Lang Creek/Haslam Lake

- The Haslam Lake watershed is presently managed (in terms of recreational restriction and forestry management) as a municipal water supply for the District Municipality. With the exception of the watersheds controlled by MacMillan Bloedel for power generation, the Haslam Lake/Lang Creek system is (at 128 km^2) the most significant watershed in the Southern Region.

- Lang Creek, which drains Haslam Lake southward to Malaspina Straight, has a multitude of existing water licences. The most significant of these are:

  1. The Powell River Salmon Society which is able to use up to 425 litres/sec toward operation of their incubation and rearing facility.

  2. The Brew Bay Improvement District which has licences totalling 2.1 litres/sec for use in their domestic water supply system.

- The lower reaches of Lang Creek extend through agricultural and developed areas which potentially have a detrimental impact on the water quality. A salmonid enhancement spawning channel also has recently been constructed by the Department of Fisheries and Oceans a few hundred metres from the estuary.

- The quality of water in the upper reaches of Lang Creek is acceptable for domestic use although it will require disinfection as do virtually all surface water sources in British Columbia. Water quality can be expected to deteriorate in the lower reaches due to fishery enhancement and agricultural activity.

- In summary, the Lang Creek/Haslam Lake watershed presents a viable water supply to the district in that:

  - sufficient quantity of water appears available

  - water quality is generally acceptable subject to disinfection

Lois River, Gordon Pasha Lakes

This watershed is essentially controlled by MacMillan Bloedel. It is used for power generation for the pulp and paper mill in Powell River. This source of water is attractive since the reservoir, dam, and pipeline to sea level are already in place.

- If MacMillan Bloedel were to provide water to the Regional District, it would be at a rate equivalent to the amount paid to B.C. Hydro to compensate for lost generation at the Stillwater Power House. This would be in the order of 2¢ per 1000 litres. The Regional District would still be responsible for treatment and distribution of the water.

° Domestic water supply from the Powerhouse penstock would always be secondary to the requirements for power production. The domestic water supply could always be subject to scheduled and unscheduled shutdowns of the penstock. (Shutdowns are currently infrequent, and in the order of twice per decade.)

° The Gordon Pasha Watershed is isolated from residential and agricultural influences, however, it is subject to degradation from logging practices and recreational uses.

° The cost for the District to provide a pump station at Lois Lake and a pipeline to the populated areas of Stillwater and Lang Bay would be considerable given that MacMillan Bloedel would still charge for, and control the water supply.

° Alternatively, taking a water supply directly from the lower penstock would be attractive since it is close to Stillwater and within 2 km of the Lang Bay area.

In summary, a water supply taken from the MacMillan Bloedel penstock at Stillwater would be attractive in terms of both initial and ongoing costs. This supply must be backed up by an alternate source, however, due to potential intermittent poor water quality and shutdown of the penstock for maintenance.

A disinfection facility would be required at the take-off point for the domestic water supply.

Smaller Surface Water Sources

The remaining surface water sources are generally too small to consider as sources for the ultimate regional water system. Some of these are also subject to water quality problems due to existing development and land use. Briefly these systems include:

° Deighton Creek

- relatively small watershed
- currently licenced for agricultural irrigation
- may be used for irrigation of planned golf course
- not considered for regional system

° Kelly Creek

- much of watershed in agricultural use and small land holdings
- not considered for regional system due to proximity to Lang Creek which is a more reliable and better quality source

° Silver Creek

- currently supplies water to the Lang Bay Water Users Community system
- minimum flows (in the order of 600 litres/min) not adequate for ultimate regional system
- this source may be useful as a temporary source during the early development of the regional system and possibly as a backup supply instead of the MacMillan Bloedel Penstock
- complete new intake, piping, and disinfection facilities would be required to make this even a temporary source for the District

° Jefferd Creek

- currently supplies water to the Stillwater Waterworks District
- watershed not of sufficient size to support the ultimate regional system
- this source may be useful in the early development of a regional system and as a backup source for the ultimate system
- the existing intake would require upgrading, however the piping between the intake and Stillwater is in place and a disinfection facility is in operation

5.3 Groundwater Sources

Assessment of the groundwater resource in the Southern Region is detailed in the Piteau Associates report included as Appendix A to this study. The results of the groundwater assessment are summarized as follows:

° Myrtle Point

There are many existing domestic wells completed in the surficial sediments and a few completed in bedrock. These include wells for the existing Myrtle Pond and Stella Maris systems. There is a reasonable probability of successfully completing wells of up to 45 Lpm (10 Igpm) for individual or small groups of residences. Community systems would probably have to rely on multiple wells. (It is noteworthy that the support capacity of a 45 Lpm well is about 12 dwelling units.)

It is estimated that the total available groundwater resource in this area is limited to approximately 2150 Lpm (475 Igpm).

° Black Point

Once again there are many existing wells in this area including wells for the Pinetree Place and Woodlyn Systems.

There is a reasonable probability of completing successful wells to serve single residences in this area, however, the groundwater recharge area is quite limited and indications are that the overall limits of the groundwater resource have been reached.

° Brew Bay/Kelly Creek

Most existing wells in this area are in bedrock and yields, although acceptable for single residences, are typically less than 9 Lpm (2 Igpm). Potential future use of groundwater in this area is limited to single residence type wells.

° Lang Bay

Very few wells have been drilled in this area to date. There is potential for drilling domestic water wells to supply single residences and possibly small community systems.

° Stillwater and South

Wells in this area would be drilled in rock and as such could only be expected to support single residences or very small community systems.

5.4 Summary of Findings

Surface Sources

Lang Creek is the only watershed suitable for development as a regional water supply source.

Supply from the Powell River municipal system would be limited to the western portion of the Southern Region (i.e. the Myrtle Creek valley). Alternatively, an investigation of base flows and water quality from Hammil Lake may show this source to be adequate for the western area.

MacMillan Bloedel's Lois Lake Penstock may only be available for supplementary supply.

Groundwater

The groundwater resource is insufficient for development as a regional water supply source.

6.0 MASTER PLAN FOR REGIONAL WATER SUPPLY SYSTEM

6.1 Introduction

The proposed water supply system for the Southern Region as shown on Figure 3 comprises principal and backup water sources, balancing and fire storage, a coordinated pressure zone layout, and the basic layout of a feedermain system. The purpose of this section is to describe the various system components, and to provide Class D cost estimates (in 1988 dollars).

6.2 Water Sources

Introduction

The proposed plan for water supply to the Southern Region involves water supply from two principal sources and one back up source.

The two principal sources are:

° Powell River District Municipality, which would serve the Myrtle Creek/Myrtle Point sub-area at the western end of the Southern Region. (Hammil Lake may be suitable as an alternate source to the District Municipality.)

° Lang Creek, which would serve the remainder of the Southern Region east to Stillwater

Surface water sources other than Lang Creek and Lois Lake/River have not been considered for the proposed regional system since their watersheds are generally too small.

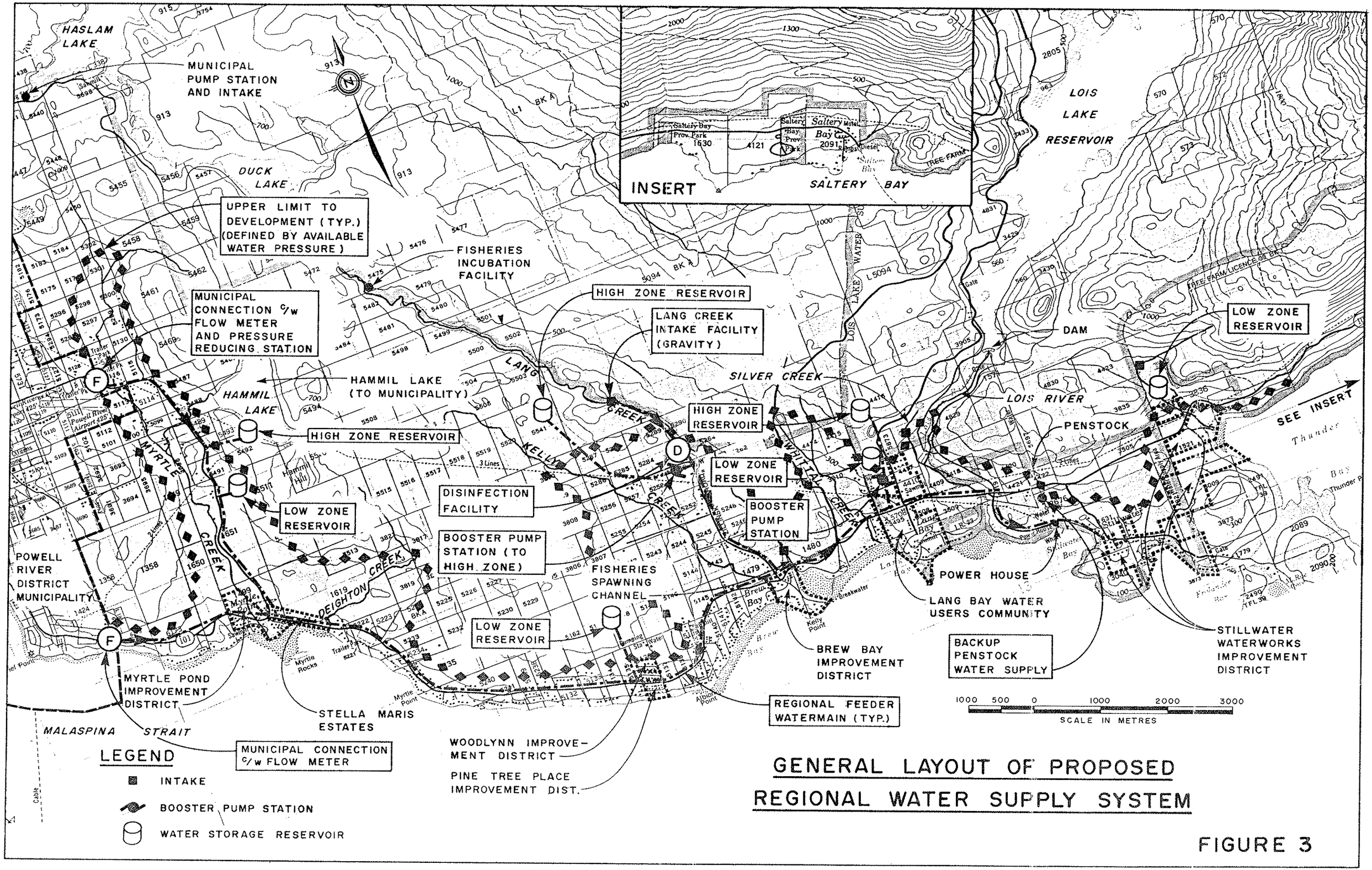
The Lois Lake River System is not suitable as a principal source for the following reasons:

- MacMillan Bloedel would require payment for all water used by the Regional District

- the penstock source is subject to operating controls by the paper mill, including occasional shut downs

- Lois Lake is subject to considerable variations in level and could never be managed solely as a water supply reservoir

The MacMillan Bloedel Penstock from Lois Lake would, however, provide an excellent backup source for the entire Southern Region.



GENERAL LAYOUT OF PROPOSED REGIONAL WATER SUPPLY SYSTEM

FIGURE 3

Lang Creek Intake and Treatment Facility

The source of water to the area east of Myrtle Point would be Lang Creek. A gravity type (i.e. not requiring pumping units) screened intake would be located on Lang Creek 1-1/2 to 2 km north of Zillinsky Road at an elevation of approximately 100 metres (360 ft). A water filtration and disinfection facility would be constructed downstream at a convenient site near the bend in Zillinsky Road.

There is no advantage to locating the intake at a higher elevation (e.g. at El. 150m close to Duck Lake). The additional cost to extend a pipeline the extra 5 km would outweigh any gains asociated with providing a gravity supply to the High Zone in the Kelly Ceek area, or with locating the intake above the existing fisheries incubation facility.

Prior to constructing an intake on Lang Creek the following actions are required:

° It is necessary for the Regional District to acquire a water licence for the ultimate quantity of water to be drawn from the creek. A license for 6 cfs (10,190 Lpm or 2244 Igpm) would be appropriate. This quantity corresponds to the peak day demand for an estimated ultimate population of 8740 persons.

° Water quality records (chemical, biological, turbidity, and colour analysis) should be kept for at least a year prior to designing the treatment facility.

° Land required for the intake, treatment facility, and pipeline should be set aside as necessary.

The intake and treatment facility should be designed to incorporate the following:

° A maximum flow of 4540 Lpm (1000 Igpm) equal to the estimated peak day flow requirement to the Southern Region for the year 2000. Peak instantaneous and fire demands are to be met from local storage facilities.

° A screened intake designed to be self-cleaning and to fisheries requirements regarding inflow velocities and fry screen sizing. (The design phase would include submission of plans for approval to the various regulatory agencies.)

- The intake is to be located at an elevation slightly higher than the "low" pressure zone so that the peak day flow can be conveyed to the local low zone storage reservoirs without any pumping requirements. The gradient of the feedermain must be carefully designed to ensure that no pumping is required.

- The disinfection facility would meter liquid hypochlorite solution into the water supply at a rate determined by a flow meter. The facility would be designed to disinfect the peak instantaneous flow under conditions of the highest turbidity. As discussed in Section 4.3, alternative forms of disinfection such as ozonation and ultraviolet methods are available and may be considered in the final design.

The estimated costs (in 1988 dollars) for the intake and facility are as follows:

DESCRIPTION OF ITEM	COST
° screened intake structure	$ 80,000
° trunk pipeline to Zillinsky Road (assumed 450mm Ø)	360,000
° access to intake structure	200,000
° disinfection facility	75,000
Subtotal	$ 715,000.00

In the longer term, the District could be required to provide a filtration facility for the Lang Creek water supply. This facility would be designed for the estimated peak day demand. Design would include submissions for approval to the Ministry of Health.

The estimated cost for a slow sand filtration facility (in 1988 dollars) is $2,400.00. Alternate means of filtration (i.e. rapid sand filters) may also be considered in the final design.

Powell River District Municipality

Water to the Myrtle Creek/Myrtle Point area is to be supplied from the District Municipality via two connections:

- The upper Myrtle Creek valley would be supplied from the Duncan St./Airport area.

° The Myrtle Point area and adjacent settlements along Highway 101 would be supplied by extending the existing municipal watermain on Marine Ave.

In order to implement this water supply the following steps must be taken:

° The Regional District's water supply requirements for the Myrtle Creek/Myrtle Pond area must be made known to the District Municipality so that these requirements can incorporated in the municipal water supply planning process.

° The Regional District and the District Municipality must negotiate a rate at which the Regional District will compensate the municipality for supply, disinfection, and transport of the water to the boundary of the Southern Region.

The water supply to the region from the municipality would enter the region through a valve chamber at each connection which would include:

- a shut off valve
- a flow meter to monitor demand and to provide a basis for payment
- a check valve to prevent backflow into the municipality

The estimated cost (in 1988 dollars) for the two valve chambers would be $70,000.00.

In the event that negotiations for a water supply from the District Municipality are not successful, Hammil Lake could be investigated as an alternate source. Investigations should include:

- costs for intake, disinfection facility and pipeline construction
- water quality, especially during low water periods
- minimum base flows available to the region on a year round basis

If the Hammil Lake source also proves unfeasible, the Regional District would then have to consider distribution from the Lang Creek source to the west end of the Southern Region. This would require:

- increased feeder main sizing or a feeder main booster station to maintain low zone pressures to the west

- a booster pumping station to the Myrtle Creek area high zone reservoir

MacMillan Bloedel Penstock

The penstock to the Stillwater Power House is to be used as a backup source of water for the entire Southern Region. This supply would be used only in emergencies, such as an extreme fire demand in the Stillwater/Lang Bay area or failure of the Lang Creek intake or supply main.

In order to implement this backup supply it will be necessary for the Regional District to approach the manager of the paper mill (MacMillan Bloedel, Powell River Division) to:

- obtain approval to use the existing 150mm connection as a backup source for the regional water supply

- obtain permission to construct a flow metering/pressure reducing facility adjacent to the penstock

- negotiate a rate for payment for the water based on the equivalent value of the water to MacMillan Bloedel in terms of lost power production

A disinfection facility would be required for this source since it is a surface water supply.

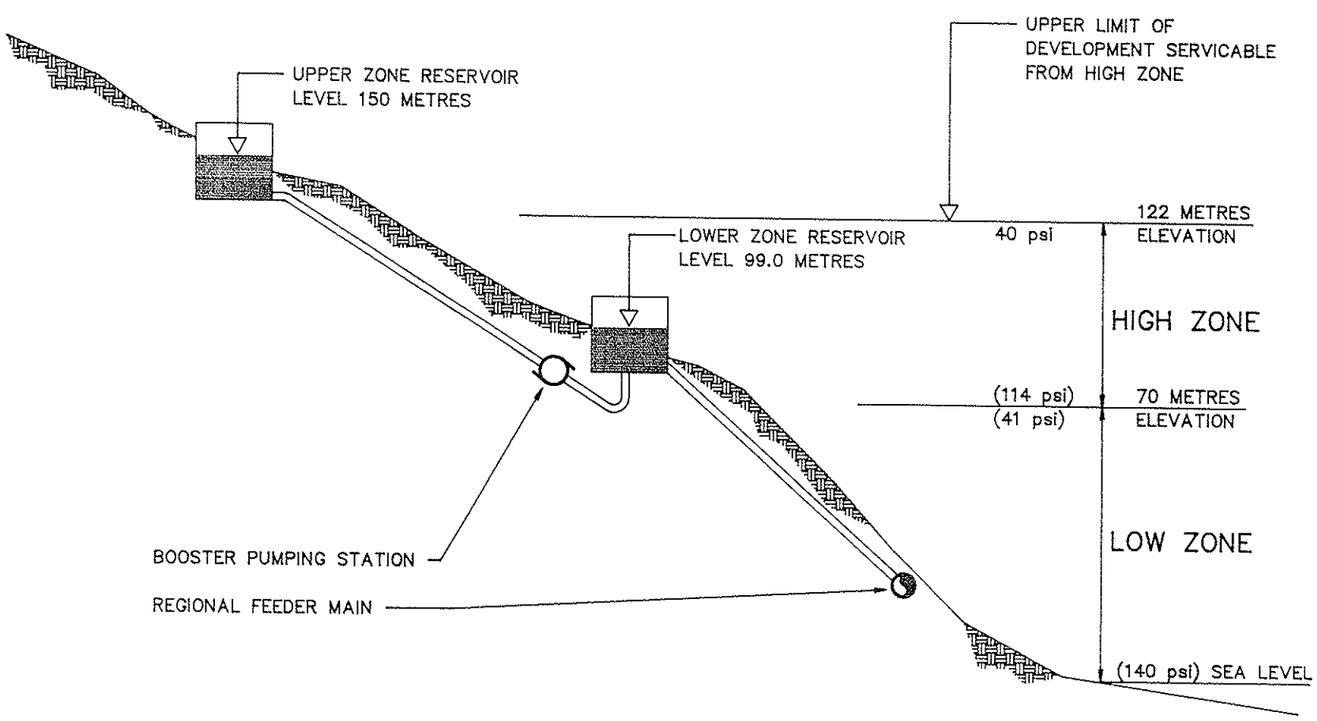
The estimated cost for construction of the pressure reducing and disinfection facility (in 1988 dollars) is $700,000.00.

6.3 Pressure Zones

General Description

The proposed plan for the water supply to the Southern Region calls for creation of pressure zones to ensure adequate water pressure for all users and to make possible the eventual integration of isolated water systems. The service area would be divided into two pressure zones which would economically provide acceptable water pressures to water users throughout the regional system (see Figure 3 and 4).

The proposed pressure zones are:



POWELL RIVER REGIONAL DISTRICT
SCHEMATIC OF PRESSURE ZONE ARRANGEMENT

FIGURE 4

Low Zone

This zone would supply water to the area between sea level and 70 metres elevation. The proposed zone designation (i.e. reservoir elevation) would be 99 metres. (Incidentally, this is equivalent to the District Municipality's Zone 4). Pressures in this zone would vary from 965 KPa (140 psi) at sea level to 283 KPa (41 psi) at an elevation of 70 metres.

The low zone would cover most of the existing settlement in the Southern Region including Myrtle Point, Black Point, Brew Bay, the Lang Bay area below the highway, and Stillwater.

The low zone pressure would be controlled by a series of four balancing and fire storage reservoirs located with a top water elevation of 99 metres. The Lang Creek intake and treatment facility would be located at an elevation to provide gravity flow to the low zone.

High Zone

The high zone would supply water to the area between 70 and 122 metres elevation. The proposed zone designation would be 150 metres. Pressures in this zone would vary from 786 Kpa (114 psi) at elevation 70 metres and 276 KPa (40 psi) at elevation 122 metres.

The high zone would be developed in isolated pockets around existing development at the higher elevations. It would include the upper Myrtle Creek area (Padgett Road), Kelly Creek (Zillinsky Road), the Lang Bay area above the highway, and possibly the dwellings along the highway above Stillwater.

Water to the high zones would be provided by booster pumping stations which would pump from the Low Zone to reservoirs at an elevation of 150 metres. The single exception would be the upper Myrtle Creek area which would be served directly from the Municipal 172 metre zone via a pressure reducing station.

Higher Pressure Zones

The proposed zoning plan for the Southern Region would limit development to below an elevation of 122 metres in areas served by a high zone reservoir and to an elevation of 70 metres everywhere else. This covers virtually all existing development and areas under consideration for development.

Any proposals for new development above an elevation of 122 metres must take into account requirements for booster pumping stations and reservoirs to serve the higher zone. The proposed facilities should be regional in character (as opposed to isolated and small systems) and should include all required upgrading to lower zone pumping and storage facilities.

The proposed pressure zone boundaries will require that each water service in the lower part of each zone be equipped with a pressure regulating valve to keep house pressures in the order of 414 to 517 Kpa (60 to 75 psi).

Alternative Pressure Zoning

Consideration has been given to splitting the Southern Region into three pressure zones instead of two. This would allow reduction of maximum service pressures to less than 690 Kpa (100 psi). This is a common upper limit for service pressures in rural systems and waives the requirement for pressure regulating valves in most residences.

Provision of three pressure zones, however, would require the two lower zones to extend the length of the Southern Region. Typically, areas above the highway would be fed directly from the trunk main which would be at mid-zone pressure. Numerous pressure reducing stations would be required to provide low zone pressure to each road and pocket of development below the highway.

The expense of constructing, operating, and maintaining such a number of pressure reducing stations outweighs any advantages associated with the three zone system.

6.4 Water Storage Reservoirs

The proposed plan for the regional water system includes provision of storage reservoirs at seven locations in the Southern Region. Each reservoir is to be sized to provide balancing storage for peak flows as well as fire protection storage for its service area.

The proposed reservoirs and the associated preliminary estimate of required storage volume and cost are as follows:

Myrtle Creek High Zone Reservoir

- tentatively located on the 150m contour near Hammil Lake
- estimated 136,000 litres balancing storage and 545,000 litres of fire storage for a total of 645,000 litres (150,000 Imp gallons)

  Estimated Cost $320,000

  (The existing Myrtle Pond Improvement District reservoir may be able to provide a significant portion of this storage depending upon its precise elevation.)

Myrtle Creek Low Zone Reservoir

- tentatively located on the 99m contour below Hammil Hill
- estimated 136,000 litres balancing storage and 545,000 litres of fire storage for a total of 645,000 litres (150,000 Imp. gallons)

  Estimated Cost $240,000

Black Point Low Zone Reservoir

- tentatively located on the 99m contour above the existing Pinetree Place system
- estimated 363,000 litres balancing storage and 545,000 litres of fire storage for a total of 908,000 litres (200,000 Imp. gallons)

  Estimated Cost $380,000

Kelly Creek High Zone Reservoir

- tentatively located on the 150m contour northwest of Zillinsky Road
- estimated 136,000 litres balancing storage and 545,000 litres of fire storage for a total of 645,000 litres (150,000 Imp. gallons)

  Estimated Cost $380,000

Lang Bay Low Zone Reservoir

- tentatively located on the 99m contour near Dixon Road
- estimated 363,000 litres balancing storage and 545,000 litres of fire storage for a total of 908,000 litres (200,000 Imp gallons)

Estimated Cost $300,000

Lang Bay High Zone Reservoir

- tentatively located on the 150m contour above Dixon Road
- estimated 73,000 litres balancing storage and 109,000 litres of fire storage for a total of 182,000 litres (40,000 Imp. gallons)

Estimated Cost $115,000

Stillwater Low Zone Reservoir

- tentatively located on the 99m contour adjacent to the existing supply main from Jefferd Creek
- estimated 136,000 litres balancing storage and 545,000 litres of fire storage for a total of 681,000 litres (150,000 Imp. gallons)

Estimated Cost $315,000

In summary, the locations and sizes shown in this report are intended to provide a guideline as to the requirements for providing adequate water storage facilities for the region. It is recognized, however, that alternative reservoir sites may become apparent during the design phases of the regional water system.

6.5 Water Distribution

The proposed plan for a regional water system includes a network of feedermains that convey water from the supply sources to the storage facilities, and that also provide the backbone of the water distribution network.

The feedermains are sized to convey the peak day flow from the supply sources to the various balancing reservoirs throughout the system. Peak instantaneous flows and fire flows are then provided from local storage.

The feedermain network comprises the following:

- Approximately 2.5 km of 400mm diameter pipeline from Zillinsky Road to Highway 101 designed for a peak day flow of 4520 lpm (1000 Igpm)

  Estimated Cost $400,000

- Approximately 18 km of 200mm, 250mm and 300mm diameter pipeline from the District Municipality to Stillwater designed to distribute peak day flows to the various balancing reservoirs and booster pumping stations

  Estimated Cost $2,160,000

- A total of approximately 10 km of various diameter pipelines to conduct water to the various high zone reservoirs as well as a pipeline along Padget Road to distribute high zone water from the Municipality

  Estimated Cost $900,000

- Two booster pumping stations are required to pump to the high zone reservoirs at Kelly Creek and at Lang Bay. In addition to the pumping units, each station must be equipped with appropriate controls to maintain the reservoir levels

  Estimated Cost (2 stations) $130,000

It is anticipated that the regional piping would include some of the existing Stillwater Waterworks System watermain.

6.6 Summary of Capital Costs

The Class D estimates of capital costs as presented in the foregoing sections are summarized as follows:

ITEM	DESCRIPTION	ESTIMATE (x $1000)
1.	Lang Creek source:	
	° Intake, feedermain to Zillinsky Rd. and disinfection facility	$ 715
2.	Connections to Powell River system	70
3.	Connection to MacMillan Bloedel system	100
4.	Water Storage Reservoirs (7):	
	° Low Zone	1235
	° High Zone	815
5.	Feedermains	3460
6.	Booster Pumping Stations	130
	TOTAL CAPITAL COST	$ 6525

The total capital cost is almost $7 million in 1988 dollars, and includes an allowance for engineering. It does not include costs for property acquisition, financing charges, and legal costs.

In the event that Ministry of Health regulations are tightened so as to require filtration of all surface water sources, the District would be required to constuct a filtration facility for the Lang creek water supply. The estimated cost for such a facility is $2,400,000 (in 1988 dollars).

7.0 IMPLEMENTATION OF THE REGIONAL PLAN

7.1 General

Implementation of the proposed regional water supply system will require four types of action on the part of the Regional District:

- secure regional water supply sources
- specify standards for construction of new water systems so that they can be incorporated into a regional system
- establish standards to which existing systems must be upgraded prior to acceptance into a regional water works system
- construct key elements of the regional waterworks infrastructure

7.2 Securing of Water Supply Sources

As discussed previously, the Regional District should take immediate steps to:

- secure a water licence on Lang Creek for approximately 10,200 Lpm (6 cfs)
- provide the District Municipality with planning information so that Southern Region demands can be included in future work to upgrade their water system; the specific requirements from the District Municipality are:
  - a peak day flow of 340 Lpm (75 Igpm) from the Duncan/Airport area
  - a peak day flow of 480 Lpm (105 Igpm) from Marine Avenue

  Fire protection requirements and peak instantaneous flows will be met from storage provided by the Regional District.
- failing an agreement with the District Municipality, conduct an investigation of Hammil Lake as a water shed in terms of water quality, base flows, and cost of development
- initiate negotiations with MacMillan Bloedel for Penstock Backup supply

7.3 Standards for New Development

All new development within the Southern Region must be designed with water systems suitable for incorporation in the regional water system. This would include:

- capability of being served from the proposed regional pressure zones without pumping
- water distribution system engineered to conform to current standards for providing peak domestic demands and fire flows
- as constructed drawings and information necessary to operate and maintain the system
- each residence or building to be equipped with a pressure regulating valve

In general, new water systems should be designed to the requirements of the Ministry of Environment's **Design Guidelines for Rural Residential Community Water Systems.** Among other items, these standards require:

- design for domestic, domestic irrigation, and fire demand
- minimum of 150mm diameter watermains

Smaller developments cannot be expected to include trunk watermains or major storage facilities which would benefit the remainder of the system. The key is that the smaller developments be compatible with the regional system when installed.

Major developments which will require significant water distribution and storage facilities must be required to design these so that they become a part of the regional water supply system.

7.4 Water Sources for New Development

As discussed in previous sections, the existing water systems have barely sufficient capacity to serve their existing users and do not have sufficient water to meet demands from significant further development.

Therefore, new developments must provide their own temporary water source until such time as they can be provided from the regional system. In most cases, groundwater wells will continue to be the appropriate water source for small developments due to:

- ease of development (no intakes or long pipelines)
- no usual need for disinfection

7.5 Incorporation of Existing Systems

Several of the existing water systems (Stella Maris, the new section of the Myrtle Pond system, the Brew Bay System and the Stillwater System) have generally been designed to provide peak domestic and fire flows and have incorporated suitable waterworks materials in their construction. The key elements required prior to incorporation of these systems in a regional system include:

- provision of municipal type fire hydrants
- provision of up to date drawings and operating manuals
- provision of pressure regulating valves at each residence and building

The remaining systems, while they serve in many ways, do not approach a standard which is acceptable for incorporation into a regional system.

7.6 Major Works to be Constructed by the Regional District

The following items must be constructed by the Regional District since the larger items of the infrastructure cannot be adequately financed or coordinated at a lower level.

- Lang Creek Intake and Pipeline
- Feedermains along Highway 101 and Padgett Road
- Regional Storage Reservoirs

7.7 Strategy for Implementation and Impact on Regional Planning

The following suggests a program for construction and implementation of a regional water system by the Regional District. The program shows key phases in the sequence of implementation and at the same time shows the impact of each phase on development planning in the Southern Region.

Phase 1 - Preliminary

The preliminary phase includes:

- securing of water sources (Lang Creek, Municipal, MacMillan Bloedel)

- water quality study of Lang Creek

- preliminary surveys, location of intake, treatment facility, major watermains, water storage reservoirs

- securing easements, rights of way, and land as required for the various water supply facilities

During this phase all new development in any area of the Southern Region will have to be self-sufficient in terms of water supply.

Phase 2 - Major Infrastructure Elements (Brew/Lang Bays)

Phase 2 would include detailed design and construction of:

- the Lang Creek Intake

- the disinfection facility

- the feedermain from the intake to Highway 101, and then along Highway 101 east to Lang Bay and west to Black Point

- construction of low zone reservoirs at Black Point and at Lang Bay

- construction of a filtration facility would be allowed for in the design, however, actual construction could be deferred depending upon current Ministry of Health requirements

The intake structure and treatment facility could be of a staged type of design which would allow some of the construction and material purchases to be deferred until the system is expanded.

This work would release the lower Zillinsky Road, Black Point, Lang Bay and Brew Bay areas from development restrictions due to inadequate water supply.

The existing Woodlyn, Pinetree, Brew Bay, and Lang Bay water systems could be incorporated into the regional system once suitable reconstruction and/or upgrading has been completed.

Phase 3 - Municipal Water Supply (Myrtle Creek/Myrtle Point)

Implementation of Phase 3 is contingent upon the District Municipality having completed sufficient upgrading to supply the required peak day flows at Marine Avenue. The required work by the Regional District includes:

- provision of two flow metering stations

- construction of high and low zone reservoirs

- construction of Padgett Road and Highway 101 watermains to Myrtle Point

This phase will allow development in the Myrtle Creek valley to proceed unrestrained by the limitations of the groundwater resource in the area.

The existing Myrtle Pond and Stella Maris systems, suitably upgraded, could be incorporated into the regional water system at the completion of this phase.

Phase 3 - Alternate

If negotiations for connection to the Municipal water system fail, Hammil Lake may be developed as an alternate source based on an investigation into water quality, base flows, and costs.

If neither source is available or adequate, this area will have to be supplied from Lang Creek. The distribution system would then be designed with appropriate booster facilities to maintain pressures at the west end of the Southern Region.

Phase 4 - Linking and Infilling

The remaining work to be completed by the Regional District in order to implement a comprehensive regional water supply is:

- extension of the trunk watermain along Highway 101 from Myrtle Point to Black Point and from Lang Bay to Stillwater

- construction of a low zone reservoir at Stillwater (Jefferd Creek)

- construction of high zone reservoirs at Lang Bay and Kelly Creek

- provision of the standby water supply from the MacMillan Bloedel Penstock

The existing Stillwater system would be incorporated into the regional system and the existing trunk watermain upgraded to ensure supply of the new low zone reservoir at Jefferd Creek.

At the completion of Phase 4, the regional water system would be available to support development along the coast and near any of the existing centres of development.

Impact on Planning

Based on the strategy for implementation outlined above the following guidelines will apply to future development in the Southern Region.

° Myrtle Creek/Myrtle Point

- Development is to be limited by the availability of groundwater until the Municipal water supply becomes available.

° Coast from Myrtle Point to Black Point

- Development must be restricted to what can be supported from groundwater wells until the final phase of regional water system implementation. Significant development proposals may warrant accelerated extension of the regional water system.

° Black Point/Brew Bay/Lang Bay/Zillinsky Road

- Increased development in these areas can be supported by the first stages of the proposed regional water system.

° Stillwater

- Development in this area will be restricted to the capacity of the existing system until the final phase of implementation of the regional water system.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Based on the information and data presented in the foregoing sections, it is concluded that:

Existing Waterworks Systems and New Land Development

1. Existing community water supply systems are typically small, and the sources of supply are generally fully utilized.

2. Additional higher density land development (i.e. which cannot be supported by small groundwater wells) of any significance in the Southern Region is therefore contingent on development of major new sources of supply.

3. New major sources of supply can be most effectively provided as part of a regional system.

Capacity Limitations of Groundwater

4. The groundwater resource in the Southern Region is insufficient for development as a regional source of supply.

5. The service potential for the largest capacity production wells is limited to small subdivisions (i.e. typically up to 12 dwelling units), primarily in the Myrtle Point area.

Surface Water Potential and Development

6. Lang Creek is the only surface source with streamflow capacity sufficient for development as a regional supply.

7. A connection to the Powell River municipal system would provide the most effective means of supplying the Myrtle Creek/Myrtle Point sub-area. Use of Hammil Lake could be considered as an alternate subject to review of base flows and water quality.

8. A connection to MacMillan Bloedel's Lois Lake Penstock could provide a backup supply for the entire Southern Region.

9. A regional plan for water supply should therefore be based on integrated use of these major surface water sources.

10. These sources must be linked by means of a feedermain installed along Highway 101.

Water Supply System Planning

11. Two pressure zones are required in order to ensure adequate water pressure for all users, as well as to facilitate the eventual integration of isolated water systems.

12. The proposed pressure zoning would limit development to El. 70m in the Low Zone, and to El. 122m in the High Zone.

13. Balancing and fireflow storage for each zone must be provided in a series of reservoirs located strategically from west to east across the Southern Region.

14. On a long-term basis, water from the Lang Creek source may have to be filtered as well as disinfected.

Implementation of a Regional Plan and Impact on Land Development

15. The plan for a regional system as presented on Figure 3 lends itself to phased implementation in order to promote orderly land development.

16. Construction of an intake on Lang Creek complete with feedermain links to both Lang Bay and Black Point would facilitate land development in the central portion of the Southern Region.

17. Similarly, extension of the Powell River municipal system would facilitate development in the Myrtle Creek valley (in the western portion of the Southern Region).

18. Finally, construction of feedermain links between Myrtle Point and Black Point, and between Lang Bay and Stillwater, would facilitate development along the entire coast.

8.2 Recommendations

Based on the foregoing conclusions, it is recommended that:

1. The Master Plan for a regional system as presented on Figure 3 be adopted-in-principle for phased implementation in conjunction with future land development.

2. Regional water supply be added to the functions of the Powell River Regional District.

3. A **Southern Region Water Supply District** be established to implement the Master Plan and to manage the regional system.

4. A **Water Licence** be obtained for utilization of Lang Creek as a regional supply source.

5. A water quality study of Lang Creek be undertaken in order to quantify design criteria for a future water treatment facility.

6. Agreements be negotiated with both the Powell River District Municipality and MacMillan Bloedel Ltd. for eventual tie-ins to the municipal and penstock systems, respectively.

On the matter of new subdivision developments, and until such time as Phase 2 (Major Infrastructure Elements) of the Master Plan is implemented, it is further recommended that:

7. A community waterworks system (complete with local supply source) be provided as part of the development.

8. Waterworks systems be designed in accordance with the Ministry of Environment's **Design Guidelines for Rural Residential Community Water Systems.**

9. System design provide for possible future integration into a regional system.

APPENDIX A

GROUNDWATER RESOURCE STUDY
(BY PITEAU ASSOCIATES ENGINEERING LTD.)

PITEAU ASSOCIATES
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Our file: 88-060

November 18, 1988

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Kerr Wood Leidal Associates Ltd.
139 West 16th Street
North Vancouver, B.C.
V7M 1T3

Attention: Mr. Ted Steele, P.Eng.

Dear Sirs:

Re: Powell River Regional District Water Supply Study

Enclosed is one (1) copy of our report entitled "Groundwater Resource Study for the Powell River Southern Regional District". Once you have had a chance to review it, and assuming it will adequately back-up any groundwater related statements in your report, we will prepare additional copies and forward some directly to Frances Ladret.

Please let us know if you would like any changes to this report, and also inform us as to the number of copies required.

Yours very truly,

PITEAU ASSOCIATES ENGINEERING LTD.

Andrew T. Holmes, P.Eng.

ATH/ef

Enc.

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KERR WOOD LEDIAL ASSOCIATES LTD.

POWELL RIVER REGIONAL DISTRICT

GROUNDWATER RESOURCE STUDY

FOR THE

SOUTHERN REGIONAL

DRAFT

PROJECT 88-060

NOVEMBER 1988

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FIGURES

TABLES

1. INTRODUCTION

1.1 BACKGROUND

Community planning work for the area south of Powell River is currently being undertaken by the Powell River Regional District (PRRD). In order to develop a community plan, information is required on the feasibility of constructing water systems to service new subdivisions in the area. To obtain this information, a water resource study was commissioned by the PRRD. This study was undertaken by Kerr Wood Leidal Associates Ltd (KWL), who retained Piteau Associates Engineering Ltd (PAEL) to evaluate the groundwater resource in the study area. The results of the groundwater evaluation which was carried out are summarized in the following report.

1.2 TERMS OF REFERENCE

The terms of reference for this study were set out in a request for proposal letter from Frances Ladret of the PRRD to Kerr Wood Leidal Associates Ltd, dated June 6, 1988.

Groundwater aspects of the study were to include:

i) Determining the location, quality and quantity of aquifers which may be capable of supplying a regional water system.

ii) Assessing the adequacy of any existing independent and community domestic water supplies which are based on a groundwater source, and estimating the present capacity of these systems.

In order to carry out the groundwater resource evaluation, information on existing wells and water supply systems in the area was to be collected and evaluated.

1.3 SOURCES OF INFORMATION

The three principal sources of information for this assessment of the groundwater resource were:

i) Well logs obtained from Ministry of Environment Files.

ii) Discussions with the persons responsible for operating the small community systems in the area which are supplied by a groundwater source.

iii) Review of reports concerning the geology of the area. These reports included:

McCammon, J.W., 1977. "Surficial Geology and Sand and Gravel Deposits of Sunshine Coast, Powell River and Campbell River Areas." Ministry of Mines and Petroleum Resources, Bulletin 65, 36p.

Wei, M., 1987. Memorandum to A.P. Kohut, of the Groundwater Section of the Ministry of the Environment, regarding the Solid Waste Management Plan for the Regional District of Powell River (dated November 20th).

Wiens, J.H., 1987. "A Review of Surficial Geology and Soil Conditions at Potential Landfill Sites - Powell River, B.C." Internal report for Waste Management Branch, Ministry of Environment and Parks, 14p.(issued in November).

2. PHYSIOGRAPHY

2.1 LOCATION

The study area extends from Saltery Bay to the southeastern boundary of Powell River District Municipality, a distance of approximately 25 km (Fig. 1). Most of the residential development to date has taken place in a band along the coast. Land further inland is generally used for agriculture, or low density rural development.

2.2 CLIMATE

A number of climate stations are maintained in the area by Environment Canada. Data from these stations is summarized on Fig. 1. Average annual precipitation in the area ranges from about 1200 to 1400mm/year. Most of the precipitation occurs as rain during the period from October to March of each year. Approximately 5% of average annual precipitation falls as snow. Average annual temperature in the study area ranges from about 9°C to 10.5°C. Average daily temperature ranges from about 3°C in January, to about 18°C in July.

2.3 TOPOGRAPHY AND DRAINAGE

The study area includes a gently sloping coastal plain with a plateau behind, at an average elevation of about 130m. About 6km inland along the north side of the plateau area, the land rises sharply towards the Smith Mountain Range.

The plateau and coastal plain are drained by five creeks and one river which have cut down into the plateau. From west to east, these creeks are Myrtle, Deighton, Kelly, Lang and Whittal (see Fig 2). Lois River is located near the eastern boundary of the area and drains Lois Lake.

A series of points and bays are the major features present along the coast. From west to east, these include Myrtle Point, Albion (Black) Point, Brew Bay, Kelly Point, Lang Bay, Stillwater Bay, Frolander Bay, Thunder Bay and Saltery Bay (Fig. 2).

3. GEOLOGY AND HYDROGEOLOGY

3.1 BEDROCK GEOLOGY

The area is underlain principally by intrusive rocks (granites) which, for the most part, are overlain by a thick mantle of glacial and glaciomarine sediments. Some sedimentary bedrock is present in the Kelly Point area and is known to extend eastwards, up to the mouth of Lois River. This sedimentary rock is evidently of tertiary age. Where bedrock was noted in well logs, it was typically described as granite, sandstones or shales, or has not been classified. Bedrock outcrops at a number of locations in the study area, as shown on Fig.3.

3.2 SURFICIAL GEOLOGY

Depth of surficial sediments in the study area probably ranges up to about 150 metres in some areas. The coverage is very irregular, as illustrated in the plan (Fig. 3) and sections (Figs. 4 and 5). There are three distinct units, which when described from the ground surface downwards, are as follows:

Unit I: Capilano Marine - Glacio Marine Deposits: Ranging from a gravelly sand to a very silty sand, and in some places a stoney clay (McCammon, 1977).

Unit II: Vashon Till: This is a very dense, poorly sorted, silty sandy gravel with some cobbles. Thicknesses of up to 35m are inferred in areas near Myrtle Point.

Unit III: Pre-Vashon Deposits: Typically consist of bedded sand, silt, silty sand and some gravel layers. Thickness of these pre-Vashon sediments exceeds 90m in some areas near Myrtle Point.

Bedrock underlies the pre-Vashon unit, or directly underlies the Vashon till unit (Figs. 4 and 5). Near Hamill Lake, Kelly Point, Lang Point and west of Lois Creek, bedrock outcrops are very prevalent, and only a thin veneer of marine and glaciomarine sediments is present between outcrops.

3.3 HYDROGEOLOGY

Groundwater flow in the area occurs primarily in the more permeable pre-Vashon unit (aquifer) which underlies much of the area west of Kelly Creek. Recharge to this aquifer is limited in areas near the coastline because of the overlying low permeability till cap. However, as the recharge area extends from near the coastline inland to Kelly Creek and possibly northwards, the total quantity of recharge, even through the overlying till, is expected to be significant in terms of groundwater supply potential.

At least one high yield well has been constructed in bedrock near Myrtle Creek, indicating that major fracture zones in bedrock also exist as aquifers in the area. East of Kelly Creek, most of the wells have been completed in fractured bedrock, as the pre-Vashon sediments are not prevalent in this area. Marine, glaciomarine, and glacial sediments, which are generally moderately permeable, directly overlie bedrock in most of the area east of Kelly Creek.

Some shallow aquifers exist throughout the area, and dug wells have been developed as groundwater supplies in the past. These shallow aquifers represent local permeable zones within the till unit, or sandy gravelly zones in the veneer of marine - glaciomarine deposits. Shallow aquifers of this type are generally not very extensive, and water levels will often fluctuate significantly during the year. For this reason, water supplies developed in shallow aquifers are not very reliable, particularly following prolonged periods of low precipitation, which often occur during the summer months.

4. ASSESSMENT OF GROUNDWATER SUPPLY POTENTIAL

4.1 AREA I - MYRTLE POINT

This area is considered to extend from the eastern edge of the Powell River District Municipality to a point about midway between Myrtle Point and Albion (Black) Point (see Fig. 6). A veneer of sand and gravel overlies the till in much of this area, but few, if any, dug wells have been constructed to obtain shallow groundwater supplies.

4.1.1 Wells Completed in Surficial Sediments

Most water wells in the area have been completed in the pre-Vashon unit which underlies the till unit. Average well depths range from about 25 to 35m, but a few wells have been drilled to depths in excess of 120m (see Sections A-A, B-B and H-H on Fig. 4). Many wells drilled near the foreshore are slightly artesian, but all wells used for domestic supply will require pumping.

Many of the well drillers logs for the area report that they encountered clay and stoney clay. Some of the shallower clay or stoney clay is likely Capilano glaciomarine deposits (unit 1) or possibly Vashon Till (unit 2), but clay at depth is probably pre-Vashon in origin, and is interbedded with sand and gravel which represent the aquifer in this area. Virtually all wells in the area are completed in these sand or gravelly sand interbeds within the pre-Vashon unit which underlies the till unit. Due to the variability present in the pre-Vashon sediments, success of any individual well is difficult to predict, but approximately 70% of the wells drilled in the area (for which logs are available) have yields of about 0.15 to 0.75 L/s (2 to 10 igpm), and about 12% have yields in excess of 0.75 L/s (10 igpm). Thus, development in this area can proceed on the basis of individual wells, or small, water-well based community water supply

systems. Community systems would likely require multiple wells if they were to supply more than about 20 homes, unless an exceptionally productive aquifer within the pre-Vashon sediments was encountered. Details on some of the more productive wells which have been drilled to date are included in Table I, which summarizes information available for small community water systems in this area.

4.1.2 Bedrock Wells

At least five wells in the area have encountered bedrock, but there are only two logs available for wells which were actually completed in bedrock. One of these wells was rated at 6.4 L/s (80 igpm), while the other was rated at 0.01 L/s (0.1 igpm). Based on the available data, it is apparent that bedrock is typically at depths in excess of 60m throughout the Myrtle Point area, but that the bedrock surface is irregular. Yields from wells drilled in bedrock are dependent upon the degree of fracturing in the rock. Experience elsewhere and information available for the Saltery Bay area indicates that wells drilled in crystalline rocks, such as granite and basalt, can usually supply sufficient water to meet domestic requirements for an individual house; hence, even if wells cannot be successfully completed in surficial sediments, there is a very good probability that a well could be continued into bedrock to obtain the required yield. This could incur considerable costs, as wells may have to be drilled to depths of up to 200m, but it need only be done as a last resort to obtain a water supply on an individual lot.

4.1.3 Groundwater Development Potential

If development in the Myrtle Point area is to proceed on the basis of a groundwater supply to meet domestic requirements, it is recommended that ultimate growth in the area does not exceed the local groundwater recharge rate. Based on a recharge area about 7 km (along the coast) by 2.5 km, average annual precipitation of 1300mm, and an infiltration factor of 5%, groundwater recharge is estimated to be about 36 L/s (475 igpm). Thus,

ultimate develoment in this area should not exceed a level that would require a total domestic water supply of much more than about 35 L/s, if the local groundwater resource is to meet the total local water demand.

4.2 AREA II - ALBION POINT

Area II is considered to run from the eastern boundary of Area I to Kelly Creek (see Fig. 6).

4.2.1 Water Bearing Zones

The sequence of surficial sediments which underlie this area is shown in Sections C-C and D-D on Fig. 5. This sequence is similar to Area I, as the Vashon till unit, up to 40m thick, overlies the more permeable pre-Vashon unit. The pre-Vashon unit typically consists of interbedded fine sand, sand, silt and clay near the shoreline, but becomes coarser to the north and northeast. For this reason, wells located to the east of Albion Point or further inland tend to be more productive than those wells drilled near the shoreline west of Albion Point.

4.2.2 Existing Wells

Drillers logs for 55 wells in this area were obtained from Ministry of Environment files. Of these logs, four were for dug wells and included no flow information. The remainder were for drilled wells, and all but one were completed in permeable zones within the till, or in sand or sand and gravel interbeds within the pre-Vashon sediments. One well at the extreme eastern edge of the area was completed in bedrock.

About 80% of the wells in this area yielded in excess of 0.15 L/s (2 igpm) and 18% yielded in excess of 0.75 L/s (10 igpm). Only 2 % of the wells, for which logs are available, have marginal yields for domestic purposes, i.e. less than 0.15 L/s (2 igpm). Both the Woodlynn Improvement District and Pinetree Place Improvement District, which are located in this area

are supplied by productive wells which are capable of producing more than 0.75 L/s (10 igpm).

4.2.3 Groundwater Development Potential

There is a good potential for developing more groundwater to provide water to future homes in the area. The actual amount will depend upon the rate at which recharge is occurring, which must exceed the long term groundwater withdrawal rate.

Based on data that is at hand, it is concluded that supply systems could be developed in areas north of the existing subdivisions. Also individual domestic wells could be drilled successfully almost anywhere throughout Area No. II, although yields from occasional wells may prove to be marginal even for individual domestic use.

The ultimate yield that can be obtained from groundwater supplies in this area will be limited by the relatively small groundwater recharge area. Due to the lack of permeable sediments to the east and possibly north of Kelly Creek, the creek should be considered as the boundary of the recharge area. Recharge to this area is estimated to be about 8 L/s (105 igpm), based on a recharge area of about 4 km^2, average annual precipitation of 1300mm and a 5% infiltration factor. It is suggested that development should not proceed beyond a density which will require a groundwater supply source with total yield of more than 8 L/s (average daily demand), unless a more detailed hydrogeological evaluation is carried out in the Albion Point area.

4.2.4 Groundwater Level Trends and Implications for Development

Groundwater level data was available from 1985 to present, for the Ministry of Environment Monitoring Well No. 292, which is located northeast of the Pinetree Place Improvement District Well Field. This data, which has been plotted in Fig. 7, indicates that there has been a

slight (0.4m) but steady decline of groundwater level since data collection started in 1985. At Powell River Airport, rainfall was slightly above average in 1984, significantly below average in 1985, average in 1986, slightly below average in 1987, and average during the first half of 1988. The net lower than average precipitation over the last three and one-half years may account for some of the decline, but as the decline continued throughout 1986, which was an average precipitation year in this area, it may also signify that the rate of groundwater abstraction in the area is approaching the rate of recharge to the aquifer.

There are many productive wells which exist in the Nassichuck Road area, located 1.5 km north of the monitoring well. Possibly some of these wells are being pumped much in excess of domestic requirements, and may be at least partially responsible for the declining trend in groundwater level. In any case, groundwater recharge in this area appears to be quite limited, which in turn limits the groundwater supply potential. Long term water level monitoring indicates a steadily declining trend, and any further development in this area, which is to be supplied by a groundwater source, should proceed with caution.

4.3 AREA III - KELLY POINT

Surficial sediments which underlie the Kelly Point area (Fig. 6) are limited to depths of less than 20m, and are typically till or fine grained glaciomarine sediments (see Section E-E, Fig. 5). Most wells in this area are completed in granite or sandstone/shale bedrock which underlies the area. Wells are generally between 60 and 100m deep and typically produce marginal yields for domestic supply (less than 0.15 L/s). Any new subdivisions in this area, which are to have a community system, would most likely have to be supplied from a surface water source. Development of single lots with individual bedrock wells could be feasible in this area, but long term growth in this area would likely require construction of a community water system.

4.4 AREA IV - LANG BAY

Very few wells have been drilled in this area, presumably because the spring-fed Lang Bay Water Users Community System supplies most of the homes in the immediate vicinity. One well, which was drilled between Whittal Creek and Lois River south of the highway, encountered coarse sand and gravel at a depth of 15m, and yielded about 0.4 L/s (5 igpm). Another well, drilled near the spring which supplies the community water system, was drilled in granite to a depth of 72m (236 ft), and had a reported yield of 3 L/s (40 igpm).

There is a potential for developing further groundwater sources in the Lang Bay area, particularly in the vicinity of the highway, between Whittal Creek and Lois River. It is anticipated that wells drilled in this area could be completed in permeable sediments which may be hydraulically connected to either Lois River or Whittal Creek. If this were the case, these wells could be used as water sources for community systems with peak day demands of about 1 L/s or possibly higher.

Some small scale development could proceed in the Lang Bay area on the basis of individual wells completed in either bedrock or surficial sediments. A small scale community system could possibly be based on a well source, if the permeable sediments encountered in a well drilled between Whittal Creek and Lois River are fairly extensive. Any large community water supply systems would have to be supplied from the existing spring, or from a surface water source.

4.5 AREA V - FROLANDER BAY/SALTERY BAY

This area is underlain by a thin veneer of surficial sediments overlying granitic bedrock (see Sections F-F and G-G, Fig. 5). Wells completed in the granite vary in depth from about 20 to 100m (60 to 350 ft), and have yields which vary from less than 0.08 L/s (1 igpm) to 2.3 L/s (30 igpm). A small community system (up to about 1.0 L/s) in this area could probably be based on a groundwater source, provided some care was taken to locate the well along a well defined fracture zone in the rock. Community systems requiring a higher capacity source

will likely require a surface water intake. Some small scale development could proceed on the basis of individual bedrock wells, as the well records which were obtained from the Ministry of Environment indicate that the granite bedrock is sufficiently fractured to provide well yields in excess of about 0.15 L/s (2 igpm), in most instances.

4.6 SUMMARY

A summary of the recommendations regarding development of the groundwater resource in each of the areas listed above is presented in Fig. 6. This plan is intended for use in community plan development, and provides a range of probable well yields which could be obtained, plus an estimate of the total groundwater resource which could be developed in the western portion of the study area.

5. EVALUATION OF EXISTING GROUNDWATER BASED WATER SYSTEMS

Information on the community systems which are currently supplied from a groundwater source is summarized in Table I. Further discussion is provided in the following.

5.1 MYRTLE POND IMPROVEMENT DISTRICT

The well which currently supplies this water system has a rated yield of about 1.8 L/s (23.8 igpm), according to information provided on as-built engineering drawings. Indications are that this rating is realistic and that the present capacity of this system is more than adequate to meet the current demands. An existing well or additional wells could be added to this system to augment the supply, on an as-required basis.

Iron and manganese concentrations in the well water exceed Canadian Drinking Water Guidelines. Limits for both these parameters are based on aesthetic criteria, and are not considered to pose any threats to health; however, a filtration system is being operated to remove most of the iron and manganese from the water.

5.2 STELLA MARIS ESTATES

The rated yield of this well is about 9 gpm (Imperial or U.S. not specified). At present, the well is pumped at a rate of about 9 gpm, and during the site visit on August 31, the water level was very close to the pump intake. Safe yield for this well is between 60 and 80% of the present pumping capacity, and hence additional wells should be developed to adequately service the 41 lot subdivision. Currently, there are 26 houses connected to the system and reports indicate that the well cannot meet the summer water demand unless sprinkling restrictions are imposed. If all 41 lots are to be properly serviced, any new well or wells should have a safe yield of about 0.6 L/s, thereby doubling the present source capacity.

5.3 GARNET ROCK MOBILE HOME PARK

The log for this well indicates that a 6m thick layer of gravelly sand was encountered within a marine clay unit at a depth of about 120m. Initially, this well was pumped at a rate of 4.5 L/s (60 igpm), but this rate has evidently decreased to about 0.75 L/s (10 igpm). Whether this decrease is due to a reduction in well efficiency, a reduction in aquifer hdyraulic head, or a combination of the two factors is not known. The long term safe yield of this well is likely about 0.75 L/s (10 igpm), although it could be pumped at rates much greater than this for short periods of time, to meet peak day demand flows.

5.4 WOODLYNN IMPROVEMENT DISTRICT

The well which supplies the Woodlynn Improvement District is apparently adequate for the approximately 14 homes that are connected, but very little data could be obtained on which to base any meaningful conclusions.

5.5 PINE TREE IMPROVEMENT DISTRICT

Two wells are currently being operated to supply this water system. Based on water levels measured on August 31, 1988, the most productive of the wells must maintain a pumping level very near the top of the well screen, when it is operated in the summer months. Thus, there is virtually no factor of safety in the water source for this system. Some redevelopment of the wells could improve reliability of the supply, but it appears that the aquifer yield is the principal limiting factor. The supply could probably be increased by drilling an additional well to augment the existing source wells; any new wells should be located at least 200m from the present well field, in order to limit interference effects. However, as water levels in the aquifer in this area appear to be declining, it is concluded that significant additional expansion of the groundwater supply is not likely to be obtained at this site.

5.6 LANG BAY WATER USERS COMMUNITY

The spring which currently supplies the Lang Bay Water Users Community is fed by shallow groundwater flow in moderately permeable sediments. This shallow groundwater flow system discharges on top of the bedrock which underlies much of the area and is exposed in the vicinity of the springs. Flow at the time of the site visit was estimated to be about 10 L/s. As this estimate was made in the late summer, it should be reasonably indicative of annual low flows. Winter and spring flows are expected to be much greater than 10 L/s, due to the response which shallow groundwater flow systems typically show to ambient precipitation. If further development of the spring is being considered for domestic water, it is recommended that a weir be constructed immediately downstream of the spring (but upstream of the intake) so that seasonal flow data could be collected.

6. GROUNDWATER QUALITY

Only limited groundwater quality data was available for this study. Data is summarized on Table II and locations of the wells from which the samples were obtained are shown on Fig. 2. Chemistry data was available for only two of the community water systems (Stella Maris Estates and Lang Bay).

Most of the groundwater in the area can be characterized as soft, calcium-bicarbonate water. The two main problems associated with groundwater quality in this area are dissolved iron and manganese and, to a lesser extent bacterial contamination. The latter is mainly a problem with the spring which supplies Lang Bay, and is only occasionally a problem with water wells in the area (R. Palliardi, pers. comm.). As coliform bacteria are not expected to exist in wells completed in confined aquifers, and as coliform levels in the deeper groundwater sources are generally acceptable, any coliform found in tap water is probably associated with the distribution system as opposed to the groundwater source. Regular monitoring for coliform is recommended for the community water systems supplied by groundwater in the area, but chlorination is not expected to be necessary. All wells should be completed with adequate surface seals, as per MOE guidelines for well construction, to minimize the chances of pollution from septic tanks.

Iron and manganese are only known to be a problem with the well which supplies the Myrtle Pond Improvement District. As occurrences of excessive iron and manganese concentrations appear to be restricted to local areas, and as there are various forms of treatment available to remove these metals (e.g. filtration, ion exchange), they are not considered to represent a major problem in terms of developing the groundwater resource in the study area.

Contamination of groundwater from surface sources is not expected to be significant, due to the low permeability till layer which overlies the aquifer, and restricts downward flow of infiltrating water. In areas which are to be deve-

loped at a density of greater than two housing units per hectare, on the basis of septic tank/drainfield systems for septic effluent disposal, a hydrogeological assessment for potential nitrate contamination of nearby wells should be considered.

If a landfill is to be sited in this area, the thickness and continuity of the till under the landfill would have to be investigated, but any other potential sources of contamination are expected to be small in scale, and should not significantly affect the quality of groundwater in the pre-Vashon aquifer.

Contamination of wells due to salt water intrusion could occur in some localized areas along the coast line, especially in the case of bedrock wells located on peninsulas, such as Kelly Point.

7. CONCLUSIONS AND RECOMMENDATIONS

1. Groundwater sources capable of supplying individual homes or small community water systems could be developed in most areas along the coast, southeast of the southerly boundary of Powell River Municipality. However, there is no single aquifer that could be developed to provide a groundwater source or sources for a regional water supply system.

2. Groundwater is the main source of domestic water for homes in the Myrtle Point - Albion Point areas. Future development in these areas should not proceed beyond a level which would exceed the estimated groundwater supply potential, unless a water system with a surface source is to be constructed to supply the area. In this regard, water level monitoring data indicates that the current rate of groundwater withdrawal in the Albion Point area may be close to the rate of groundwater recharge, hence future development in this area should proceed with caution. Similar long term water level monitoring data is not available for the Myrtle Point area.

3. It is recommended that a monitoring well be established in the vicinity of Stella Maris Estates. The Groundwater Section of the Ministry of the Environment could possibly assist in setting up this monitoring station, or a water level monitoring program could possibly be a condition imposed upon any future development in this area. After a few years of data has been collected, it should be reviewed by a hydrogeologist with a view to reassessing both present and potential groundwater development potential.

4. In the eastern two thirds of the study area, east of Kelly Point, surface water has been the most viable source of domestic water, and as a result very little groundwater development has taken place.

5. A review of data on wells that have been drilled in the Kelly Point - Saltery Bay area indicates that some development can proceed on the basis of wells to service individual homes. Also, it may be possible to develop some small community systems in specific areas.

6. Six community water systems in the study area are known to rely on a groundwater source. Of these, both the Stella Maris Estates and the Pinetree Place Improvement District Systems have insufficient supply to meet the current demand unless watering restrictions are imposed in the summer. Additional source wells would be required if these two water systems are to provide adequate supply throughout the year. The capacity of the Pinetree Place Improvement District System may also gradually decrease in the future, if the downward trend in water levels that is apparent in the nearby Provincial monitoring well continues.

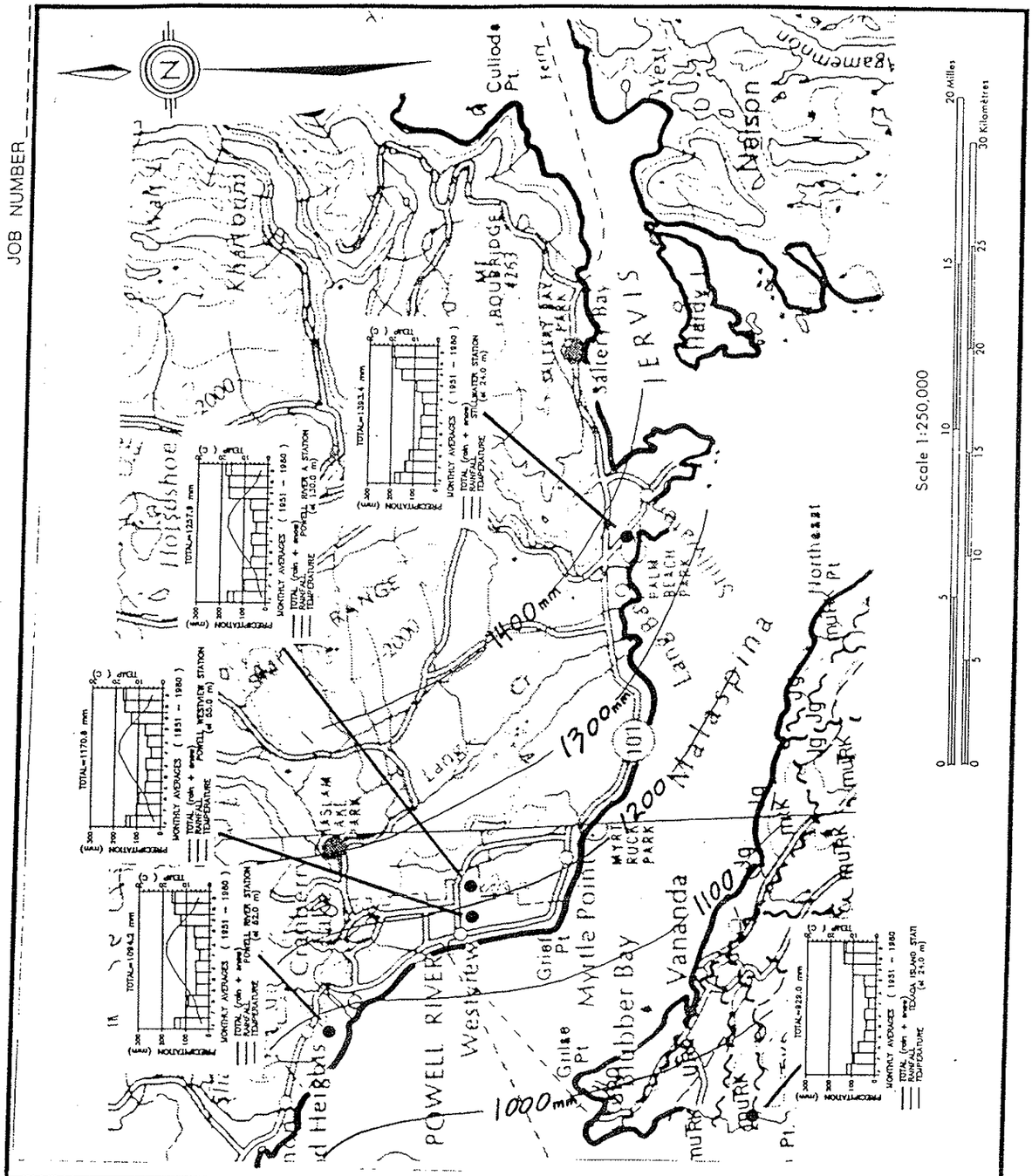
Respectfully submitted,

PITEAU ASSOCIATES ENGINEERING LTD.

Andrew T. Holmes, P.Eng.

FIGURES

JOB NUMBER



KERR WOOD LEIDAL ASSOCIATES LTD.	PITEAU ASSOCIATES GEOTECHNICAL CONSULTANTS VANCOUVER CALGARY
GROUNDWATER RESOURCE STUDY POWELL RIVER SOUTHERN REGIONAL DISTRICT BRITISH COLUMBIA	PLAN SHOWING CLIMATE DATA AND ISOHYETS
BY: ATH	DATE: NOV 88
APPROVED:	FIG. 1

HASLAM LAKE

MUNICIPAL PUMP STATION AND INTAKE

DUCK LAKE

FISHERIES INCUBATION FACILITY

HAMMIL LAKE (TO MUNICIPALITY)

HAMMIL LAKE

INSERT

SALTERY BAY

LOIS LAKE RESERVOIR

DAM

SILVER CREEK (SPRING SOURCE FOR LANG BAY)

LOIS RIVER

PENSTOCK

SEE INSERT

WINEGARDEN WELL

POWELL RIVER DISTRICT MUNICIPALITY

MYRTLE CREEK

HILLSIDE CREEK

KELLY CREEK

POWER HOUSE

LANG BAY WATER USERS COMMUNITY

FISHERIES SPAWNING CHANNEL

MANTOANI WELL

MYRTLE POND IMPROVEMENT DISTRICT

STANFORD WELL

BREW BAY IMPROVEMENT DISTRICT

STILLWATER WATERWORKS IMPROVEMENT DISTRICT

STELLA MARIS ESTATES (WELLS No. 1 and No. 2)

WOODLYNN IMPROVEMENT DISTRICT

PINE TREE PLACE IMPROVEMENT DIST.

MINISTRY OF ENVIRONMENT OBSERVATION WELL No. 292

MALASPINA STRAIT

1000 500 0 1000 2000 3000

SCALE IN METRES

LEGEND

- INTAKE
- CHEMISTRY DATA (See Table II)
- HYDROGEOLOGIC SECTION (See Figs 4 and 5)

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VANCOUVER CALGARY

GROUNDWATER RESOURCE STUDY
POWELL RIVER SOUTHERN
REGIONAL DISTRICT
BRITISH COLUMBIA

PLAN SHOWING LOCATIONS OF GROUNDWATER CHEMISTRY DATA AND HYDROGEOLOGIC SECTIONS

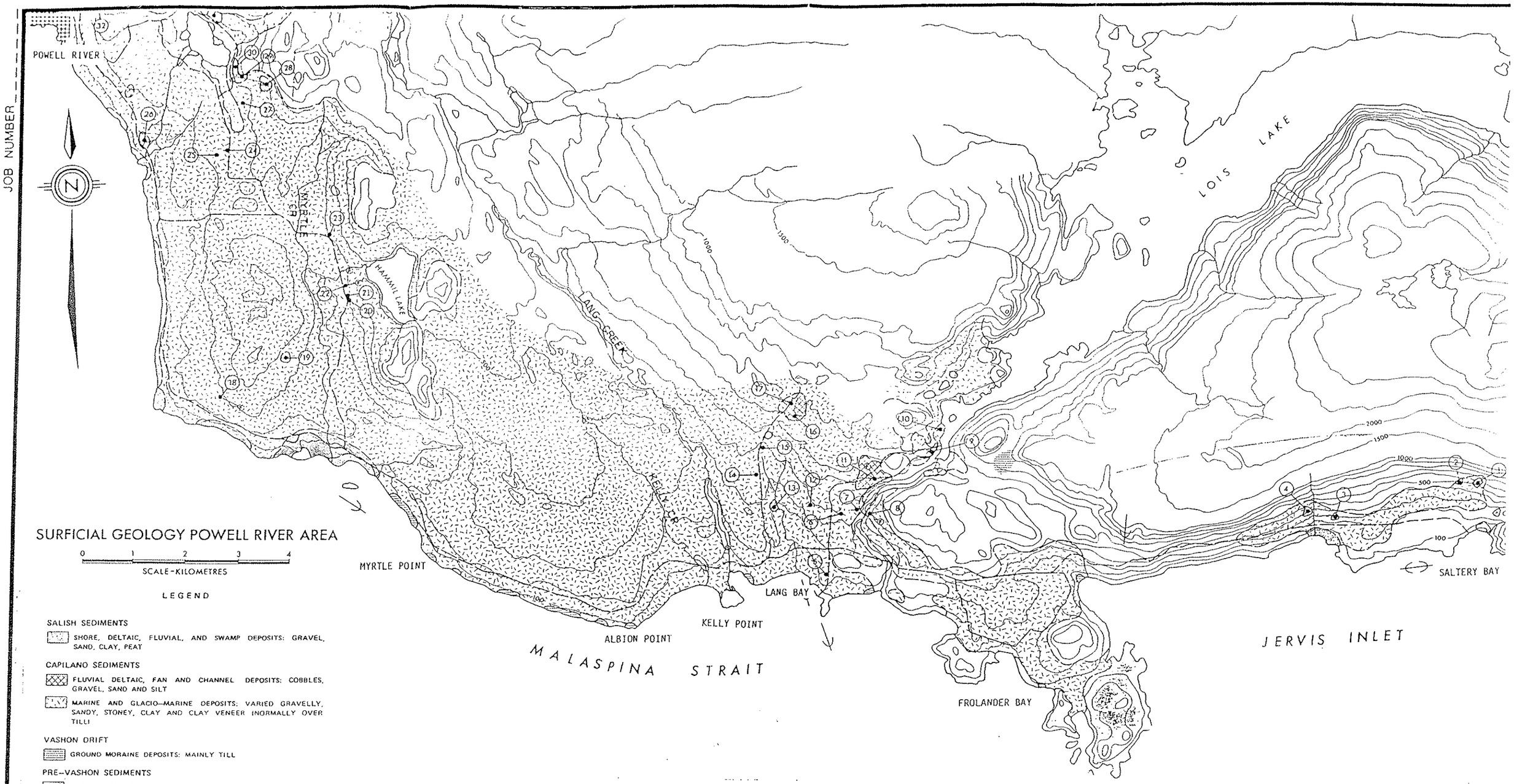
BY: BL

DATE: NOV. '88

APPROVED:

FIG. 2

JOB NUMBER



SURFICIAL GEOLOGY POWELL RIVER AREA

0 1 2 3 4
SCALE-KILOMETRES

LEGEND

SALISH SEDIMENTS
- SHORE, DELTAIC, FLUVIAL, AND SWAMP DEPOSITS: GRAVEL, SAND, CLAY, PEAT

CAPILANO SEDIMENTS
- FLUVIAL DELTAIC, FAN AND CHANNEL DEPOSITS: COBBLES, GRAVEL, SAND AND SILT
- MARINE AND GLACIO-MARINE DEPOSITS: VARIED GRAVELLY, SANDY, STONEY, CLAY AND CLAY VENEER (NORMALLY OVER TILL)

VASHON DRIFT
- GROUND MORAINE DEPOSITS: MAINLY TILL

PRE-VASHON SEDIMENTS
- GRAVEL, SAND AND SILT

BEDROCK OUTCROPS
- MOSTLY BARE ROCK WITH THIN PATCHES OF OVERBURDEN, USUALLY TILL OR MARINE VENEER

SYMBOLS
- GLACIAL STRIAE, GROOVES AND STOSS AND LEE SURFACES INDICATING DIRECTION OF ICE MOVEMENT
- FOSSIL LOCALITY
- GRAVEL PIT
- ROAD
- CONTOURS (100 FOOT INTERVALS)

From McCammon, 1977

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VANCOUVER CALGARY

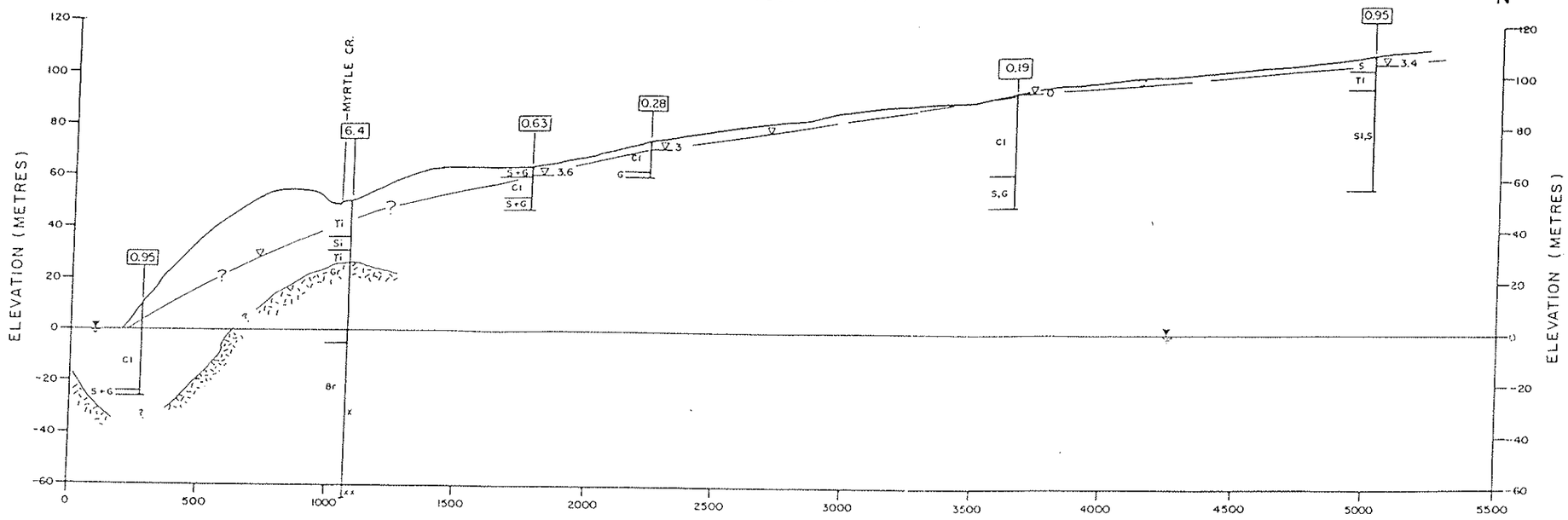
GROUNDWATER RESOURCE STUDY
POWELL RIVER SOUTHERN
REGIONAL DISTRICT
BRITISH COLUMBIA

PLAN SHOWING SURFICIAL GEOLOGY AND BEDROCK OUTCROP LOCATIONS

BY: AHH
DATE: Nov. 88
APPROVED: AHH
FIG. 3

JOB NUMBER

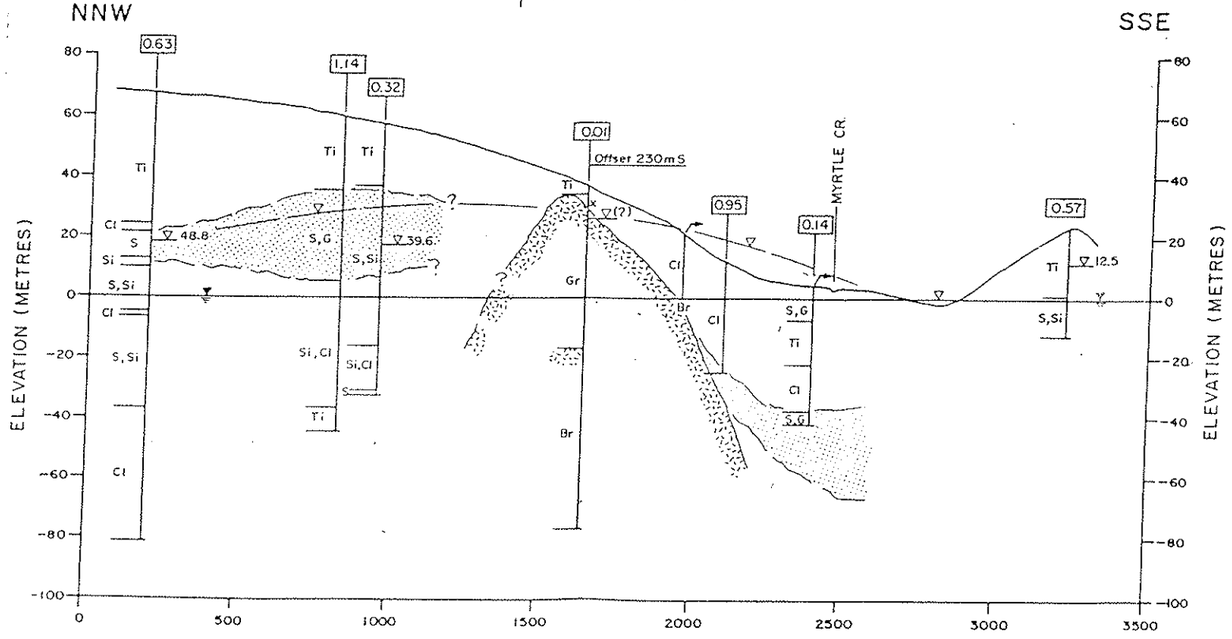
SECTION A - A



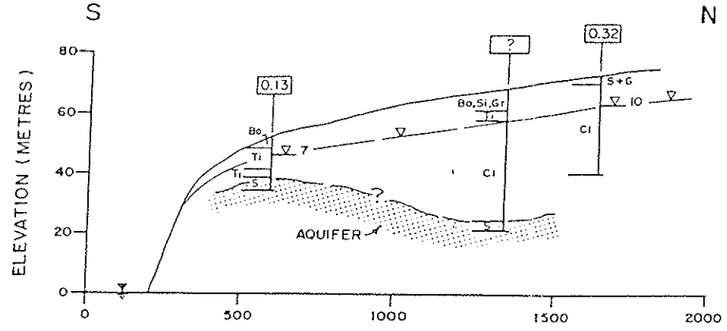
SYMBOLS

- Bedrock
- Aquifer
- Well
- 0.1 Well Yield (L/s)
- Artesian Flow
- Water Table/Piezometric level
- Static Water Level in Well (depth in m)
- Mean Sea Level
- Water Producing Fracture in Bedrock Well

SECTION H - H



SECTION B - B



LITHOLOGY LEGEND

Bo	Boulders
G	Gravel
S	Sand
Si	Silt
Cl	Clay
Ti	Till (Vashon Advance)
Br	Bedrock, unclassified
Ss	Sandstone
Sh	Shale
Gr	Granite

Horizontal Scale 1:20000
Vertical Scale 1:2000

Notes: 1. See Fig.2 for Locations of Sections

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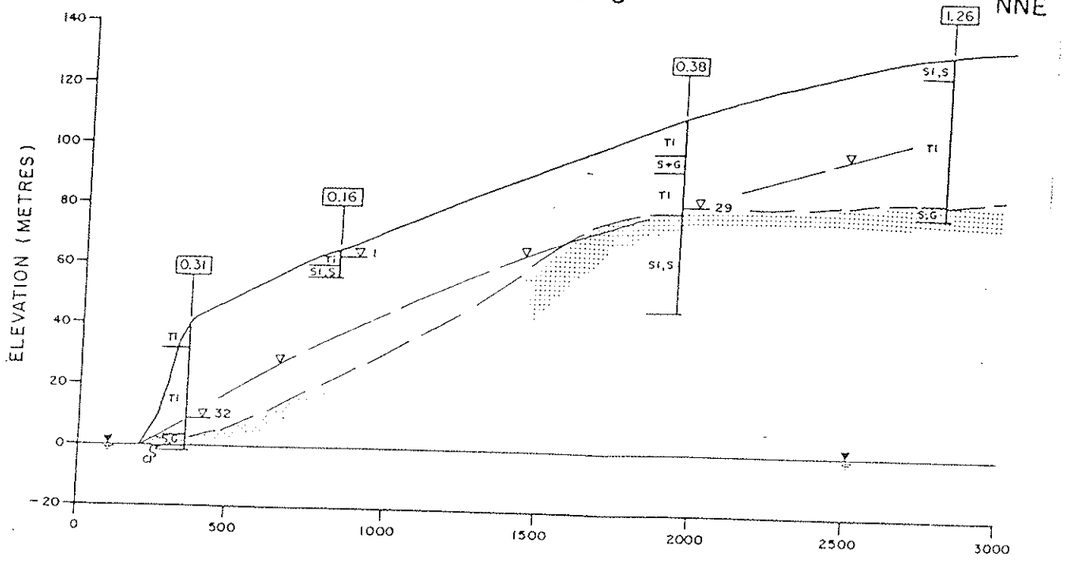
GROUNDWATER RESOURCE STUDY
POWELL RIVER SOUTHERN
REGIONAL DISTRICT
BRITISH COLUMBIA

HYDROGEOLOGICAL SECTIONS
IN MYRTLE POINT AREA

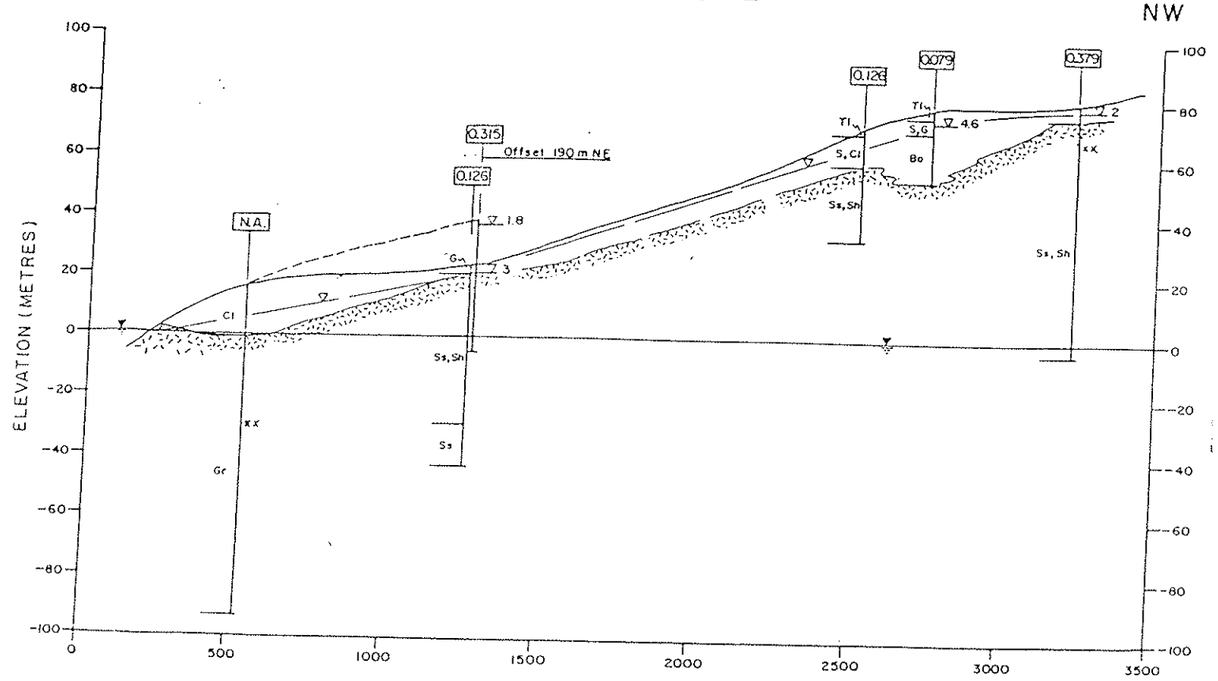
BY AH DATE Nov 88
APPROVED
FIG 4

JOB NUMBER

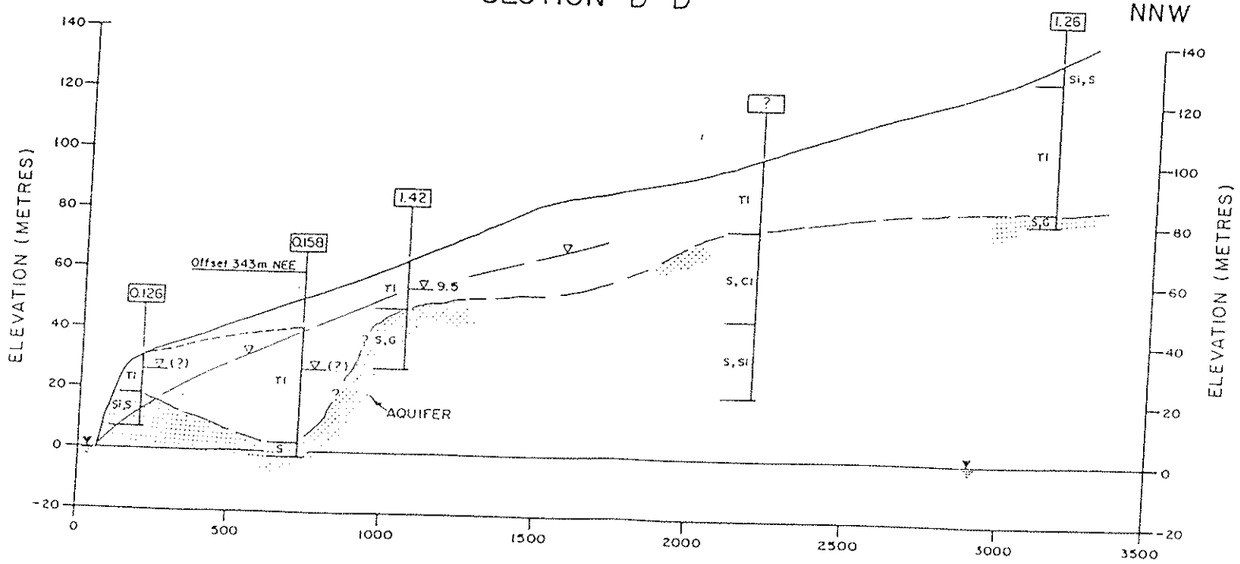
SECTION C-C



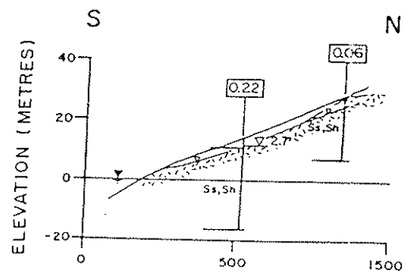
SECTION E-E



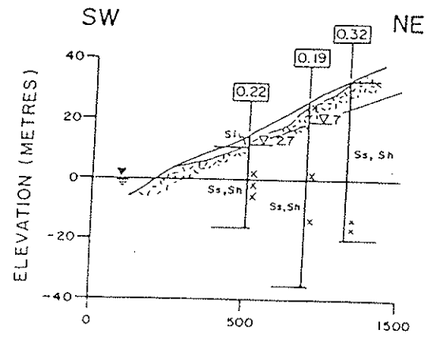
SECTION D-D



SECTION F-F



SECTION G-G



Notes:
1. See Fig.4 for Symbols and Legend
2. See Fig.2 for Locations of Sections

Horizontal Scale 1:20000
Vertical Scale 1:2000

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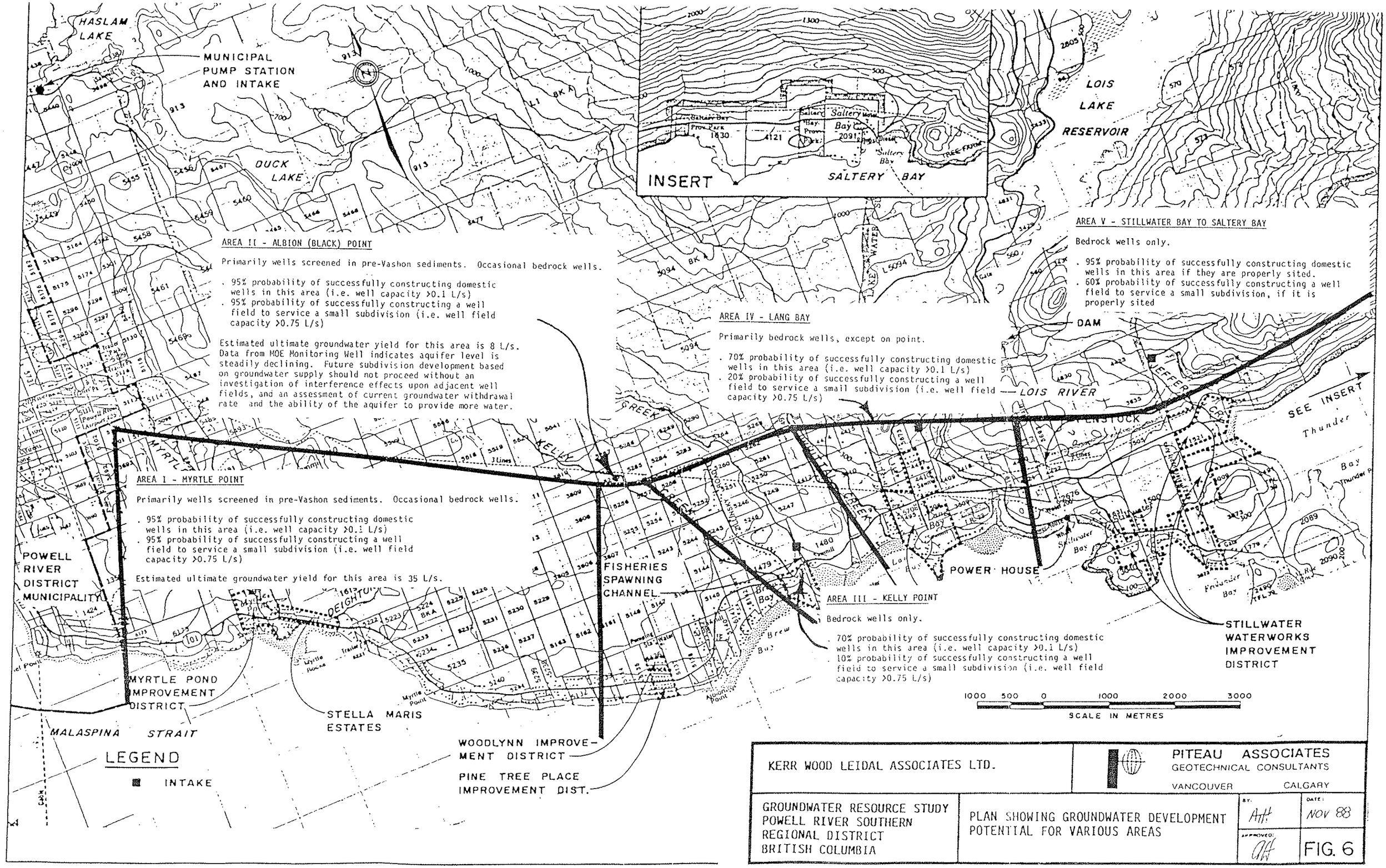
GROUNDWATER RESOURCE STUDY
POWELL RIVER SOUTHERN
REGIONAL DISTRICT
BRITISH COLUMBIA

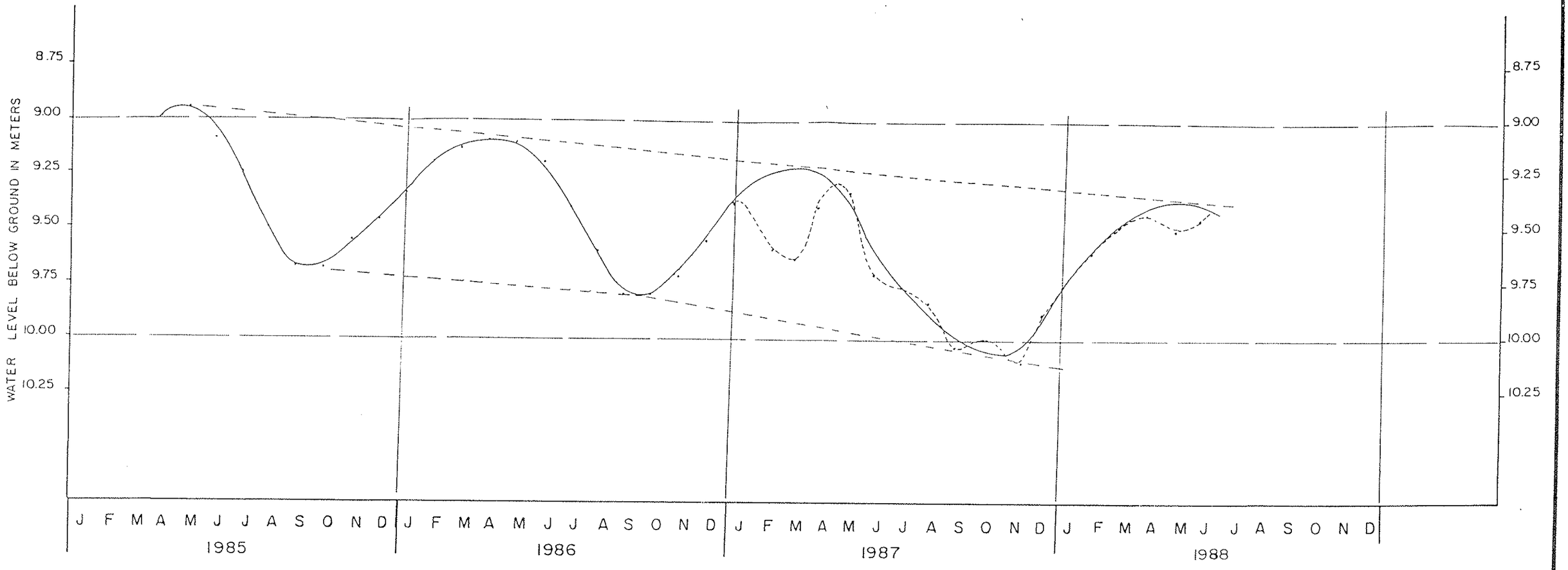
HYDROGEOLOGICAL SECTIONS IN
ALBION POINT, KELLY POINT
AND SALTERY BAY AREAS

BY AHH DATE NOV 88
APPROVED AHH FIG 5



KERR WOOD LEIDAL ASSOCIATES LTD.	PITEAU ASSOCIATES GEOTECHNICAL CONSULTANTS VANCOUVER CALGARY		
GROUNDWATER RESOURCE STUDY POWELL RIVER SOUTHERN REGIONAL DISTRICT BRITISH COLUMBIA	PLAN SHOWING GROUNDWATER DEVELOPMENT POTENTIAL FOR VARIOUS AREAS	BY: AH	DATE: NOV 88
		APPROVED: AH	FIG. 6

JOB NUMBER



LEGEND

Average long term trend

Deviation from trend

NOTES: 1) Data obtained from Groundwater Section, MOE, Victoria
2) Ground elevation is about 64m-asl
3) See approximate well location on Fig. 2

KERR WOOD LEIDAL ASSOCIATES LTD.	PITEAU ASSOCIATES GEOTECHNICAL CONSULTANTS VANCOUVER CALGARY		
GROUNDWATER RESOURCE STUDY POWELL RIVER SOUTHERN REGIONAL DISTRICT BRITISH COLUMBIA	HYDROGRAPH FOR OBSERVATION WELL NO. 292 POWELL RIVER	BY: PRM	DATE: NOV. 1988
		APPROVED:	FIG. 7

TABLES

SUMMARY OF COMMUNITY WATER SYSTEMS BASED ON GROUNDWATER SUPPLY

The following is a summary of data collected during the survey. The names of people contacted who provided data are given in brackets.

MYRTLE POND IMPROVEMENT SYSTEM (Glen Calvert)

- Single well rated at 1.8 L/s (23.8 igpm) with 7.3m (24 ft) of drawdown.
- Current water level not known (could not get cover off)
- System set up to provide for 7.9m (26 ft) of drawdown before low level switch shuts off pump (based on static level measured in February, 1982).
- Pump evidently set at 1.3 L/s (17 igpm) flow rate, which provides for some factor of safety.
- One 12m (40 ft) long and one 6.1m (20 ft) long screen assembly are installed in the well.
- Well currently supplies about 35 homes, and has run at 1.9 L/s (25 igpm) for three days when filling tank.
- Water has high iron and manganese concentrations, but is not intolerable or untreatable.

STELLA MARIS ESTATES (Ugo Gallo)

- Supplied by one 36.6m (20 ft) deep, 250mm (10 in) I.D. well
- Two zones screened between 14.9 to 16.2m, and 17.7 to 18.3m (49 to 53 ft, 58 to 60 ft) with 150mm (6 in) 190 slot screen.
  Screen is gravel packed in 250mm (10 in) hole.
- Initial static level approximately 12.2m (40 ft).
- Well originally rated at 9 gal/min (about 0.6 L/s)
- Pumping water level was approximately 17.1m (56 ft) on August 31, 1988; hence, no factor of safety. Pump on at approximately 9 gpm all the time.
- Evidently well level fluctuates with the tides as well as seasonally.
- System currently supplies only 26 of possible 41 homes in subdivision, and cannot meet demand in summer.
- Well was initially constructed in 1968 and would probably benefit from some redevelopment, following an assessment of aquifer and well hydraulics.

GARNET ROCK MOBILE HOME PARK

- 137m (448 ft) deep well, screened in medium sand and gravel, from depths 124 to 130m (407 to 426 ft).
- Yields steadily at 0.75 L/s (10 igpm), based on owners estimate.
- Pumped occasionally during periods of heavy demand.
- Supplies mobile home park plus four additional homes.

SUMMARY OF COMMUNITY WATER SYSTEMS
BASED ON GROUNDWATER SUPPLY

WOODLYNN IMPROVEMENT DISTRICT (Doug Ruff)

- Supplied by one 150mm (6 in) I.D. well.
- No well log available but thought to be 76m (250 ft) deep.
- Sealed well, could not get water level.
- No problems with supplying 12 to 14 homes from this well.

PINE TREE PLACE IMPROVEMENT DISTRICT (Don Silvester)

- Supplied by two 150mm (6 in) I.D. wells.
- Both have approx. 2.5m (8 ft) of screen installed.
- Well #1 screened between 34.1 and 36.6m (112 and 120 ft) depth
- Well #2 screened between 30.6 and 33.4m (100.5 and 109.5 ft) depth
- Well #1 reported to have static level of 18.3m (60 ft), yield of 1.26 L/s (16.7igpm). Measured water level of 27.7m (91 ft) on August 31, 1988, approximately 5 min. after pumps shut off; therefore, must draw down close to pump intake when pumping.
- Well #2 reported to have static level of 14.9m (49 ft), yield of about 0.76 L/s (10 igpm).
- Two additional wells at site have been abandoned.
- Pumps in both wells run coincidentally, typically from early morning until noon hour, and then from about 5 PM to 11 PM.
- System currently supplies about 48 homes.

LANG BAY WATER USERS COMMUNITY

- Uses filtered spring water.
- Currently supplies about 120 homes.
- Based on 1972 quality analysis, water is of excellent quality (see Table II), except for coliform (12 MPN/100 ml).
- Estimated spring flow of 10 L/s (132 igpm) on August 31, 1988.
- Labour intensive system but could be improved by intake reconstruction.
- Rock well 72m (236 ft) deep located at spring - rated at 3.4 L/s (54 USpgm) - back up source. Would have to be properly tested to verify safe yield.

TABLE II

SUMMARY OF CHEMISTRY RESULTS

FOR SELECTED WELLS IN POWELL RIVER AREA[2,3]

PARAMETER[1]	UNITS	REGIONAL MONITORING WELL	WINEGARDEN WELL	STANFORD WELL	MANTOANI WELL	STELLA MARIS ESTATES LTD.		LANG BAY WATER USERS COMMUNITY SPRING	PAUL WELL	GOERITZ WELL	FRIESEN WELL
						No. 1 Well	No. 2 Well		These three wells located in Wildwood Area		
DATE OF SAMPLING		15/03/85	11/04/85	05/04/82	02/04/82	30/10/68	23/10/68	25/07/72	15/03/83	25/02/81	17/08/84
pH		8.1	6.7	6.9	8.3	7.5	6.55	7.4	6.8	6.5	8.6
Residue Filterable	mg/L	120	90	106	136	-	-	37.0	31	88	306
Turbidity	NTU	-	1.8	0.3	0.5	trace	0	0.5	0.3	0.3	0.5
EC	µmhos/cm	155	122	161	200	-	-	-	46	138	541
Alkalinity -t	mg/L	68.5	48.0	45.4	97.2	54.0	53.0	20.0	16	17.4	96.2
Hardness -t	mg/L	57.6	39.5	36.4	36.5	46.0	45.0	14.0	13.9	22.7	15.4
Fluoride -d	mg/L	0.10	-	-	0.12						1.32
Hardness -d	mg/L	54.0									
Silicon Reactive -d	mg/L	19.2				8.0	6.0	15.0			
Sulfate -d	mg/L	3.1				8.0	9.0	2.0			
Arsenic -t	mg/L	0.002									
Boron -t	mg/L				0.05						
Calcium -t	mg/L	15.5	12.8	8.12	7.89						0.78
Copper -t	mg/L	-	0.12	0.33	0.03			3.4			4.31
Iron -t	mg/L	0.02	0.22	0.04	0.21	0	0.03		4.26		
Magnesium -t	mg/L	4.58	1.83	3.92	4.09	9.0	14.0	0.25	0.13		
Manganese -t	mg/L	0.13			0.05	0		1.3	0.07		1.12
Zinc -t	mg/L	0.02	0.01	-	0.03				0.8		
Arsenic -d	mg/L	0.002							0.29		
Calcium -d	mg/L	14.3								7.1	
Potassium -d	mg/L	2.0								1.2	
Magnesium -d	mg/L	4.45									
Manganese -d	mg/L	0.13									
Zinc -d	mg/L	0.01									
TKN	mg/L	0.08						0.4			
Nitrogen Ammonia -d	mg/L	0.075						0.15			
Phosphorous -t	mg/L	0.191						0.3			
Phosphorous -d	mg/L	0.190						0.11			
Sodium -d	mg/L	10.5						2.5			
Chloride -d	mg/L	6.8						1.8			
NO_3+NO_2 -d	mg/L	-	0.12			25.0	18.0				
NO_3 -d	mg/L	-	0.12					0.55	0.46	0.75	

NOTES: 1. Additional tests were run in some wells; however, results did not exceed detection limits.
2. See Fig. 2 for location of wells
3. All data provided by Groundwater Section MOE.

APPENDIX B

WATER QUALITY DATA FOR SURFACE SOURCES

CHEMICAL ANALYSIS REPORT

ASL

Date: October 17, 1988

File No. 6334A

Report On: Powell River Regional District
Water Resources Study 355.88.1

Report To: Kerr Wood Liedel
139 West 16th Street
North Vancouver, B. C.
V7M 1T3

Attention: E. W. Steel, P.Eng.

DATE OF SUBMISSION:

September 21, 1988

SAMPLE IDENTIFICATION

The samples were labelled as noted in RESULTS section.

METHODOLOGY

Analysed in accordance with "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, 1985.

RESULTS OF ANALYSIS

Results are presented in the table(s) attached.

ASL ANALYTICAL SERVICE LABORATORIES LTD.

(per) A. W. Maynard, M.Sc.
Senior Partner

B. Szczachor, B.Sc.
Barbara Szczachor, B.Sc.

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ASL

RESULTS OF ANALYSIS

		Lang Ck Sept 1/88	Lois Lk Sept 1/88	1987 Canadian Drinking Water Guidelines	
				Maximum Acceptable	Aesthetic Objective
Physical Tests					
pH		6.52	6.54		6.5 - 8.5
Conductivity		26.8	16.1		
Colour		13.0	8.0		< 15
Turbidity	NTU	<1.0	1.0	1	< 5
Dissolved Solids		15.2	8.9		< 500
Anions and Nutrients					
Alkalinity	CaCO3	7.00	5.00		
Sulphate	SO4	<1.0	<1.0	500	< 150
Chloride	Cl	1.5	<0.5		< 250
Fluoride	F	0.045	0.038	1.5	
NO3/NO2	N	0.056	0.028		
Total Metals					
Antimony	T Sb	<0.0001	<0.0001		
Arsenic	T As	<0.0001	0.0008	.05	
Barium	T Ba	<0.010	<0.010	1.0	
Boron	T B	<0.10	<0.10		
Cadmium	T Cd	<0.0002	<0.0002	.005	
Chromium	T Cr	0.002	<0.001	.05	
Copper	T Cu	<0.001	<0.001		< 1.0
Iron	T Fe	0.07	0.11		< .3
Lead	T Pb	0.007	<0.001	.05	
Manganese	T Mn	<0.005	<0.005		< .05
Mercury	T Hg	<0.00005	<0.00005	.001	
Selenium	T Se	<0.0005	<0.0005	.01	
Silver	T Ag	<0.0001	<0.0001		
Zinc	T Zn	<0.005	<0.005		< 5.0
Dissolved Metals					
Iron	D Fe	0.04	<0.03		
Manganese	D Mn	<0.005	<0.005		
Silicon	D Si	2.30	1.49		
Calcium	D Ca	2.62	1.80		
Magnesium	D Mg	0.51	0.24		
Potassium	D K	0.28	0.24		
Sodium	D Na	1.66	0.68		

< = Less than
Results expressed as milligrams per litre except for pH, Conductivity (μmhos/cm) and Turbidity (NTU)