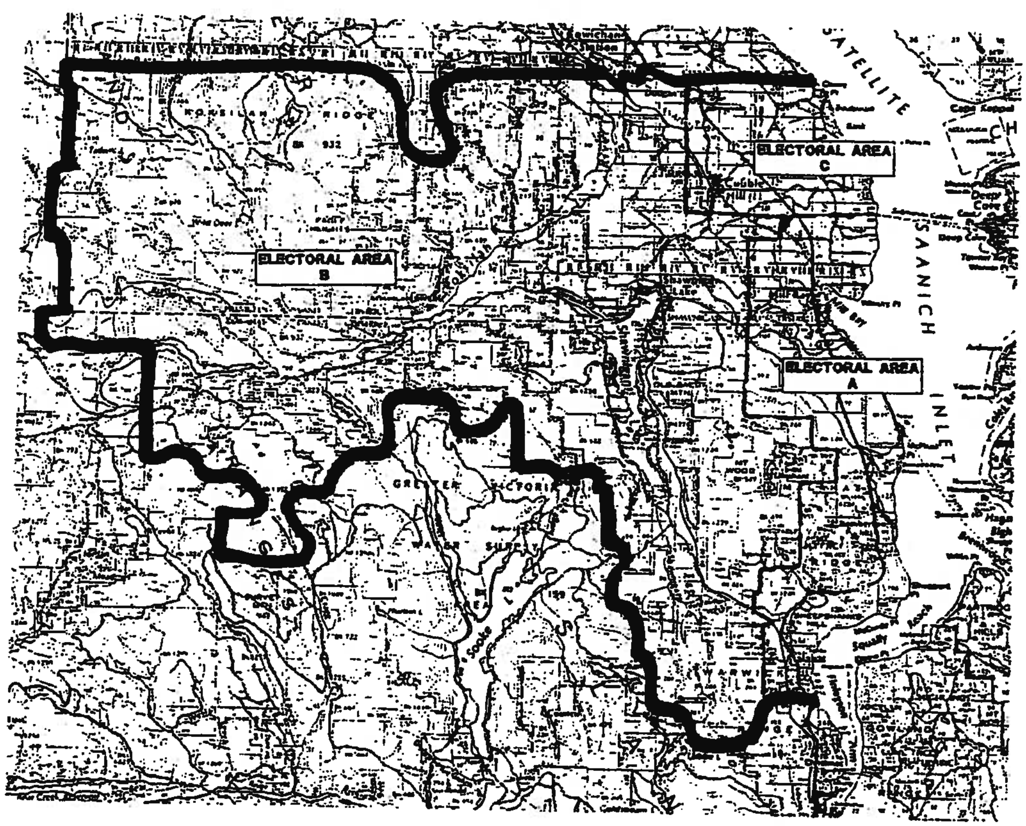
C·V·R·D

SOUTH SECTOR
LIQUID WASTE MANAGEMENT PLAN



Stanley
Consulting

MARCH 1998

This report was prepared by Stanley Consulting Group Ltd. for the account of the Cowichan Valley Regional District. The material in it reflects Stanley's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stanley accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Table of Contents

GLOSSARY AND ABBREVIATIONS

GLOSSARY AND ABBREVIATIONS

GLOSSARY

activated sludge	A suspended growth treatment process for biological removal of dissolved organic wastes.
activated sludge process	A biological wastewater treatment process in which a mixture of wastewater and activated sludge is agitated and aerated.
advanced waste treatment	Any physical, chemical or biological treatment process used to accomplish a degree of treatment greater than that achieved by secondary treatment.
aeration	The bringing about of intimate contact between air and a liquid by bubbling air through the liquid or agitating the liquid to promote surface absorption of air.
aeration tank	A tank in which wastewater or other liquid is aerated.
aerator	A device that brings air and a liquid into intimate contact.
aerobic	Requiring, or not destroyed by, the presence of free elemental oxygen.
aerobic digestion	The breakdown of suspended and dissolved organic matter in the presence of oxygen; usually associated with digestion of wastewater sludge.
algae	Photosynthetic microscopic plants which in excess can contribute taste and odour to potable water and deplete dissolved oxygen or decomposition.
algae bloom	Large masses of microscopic and macroscopic plant life, such as green algae, occurring in bodies of water.

alkalinity — The capacity of water to neutralize acids; a property imparted by carbonates, bicarbonates, hydroxides, and occasionally borates, silicates, and phosphates. It is expressed in milligrams of equivalent calcium carbonate per litre (mg $CaCO_3$/L).

ammonia nitrogen — The quantity of elemental nitrogen present in the form of ammonia (NH_3).

anaerobic — A condition in which no free oxygen is available.

anaerobic digestion — The degradation of organic matter brought about through the action of micro-organisms in the absence of elemental oxygen.

average dry weather flow (ADWF) — Sewage flow measured during periods of little or no rainfall.

average wet weather flow (AWWF) — Sewage flow during periods of extended or heavy rainfall. Inflow and infiltration may increase the wet weather flow to many times larger than the dry weather flow.

bacteria — A group of universally distributed, rigid, essentially unicellular microscopic organisms lacking chlorophyll. They perform a variety of biological treatment processes including biological oxidation, sludge digestion, nitrification, and denitrification.

Best Management Practices — Best Management Practices (BMPs) are practices which are currently regarded to improve the quality of urban stormwater runoff, including source control BMPs and treatment BMPs. Source control BMPs are designed to prevent pollutants from contacting rainfall and runoff waters. Treatment BMPs are constructed facilities that store, infiltrate, and/or treat urban runoff to reduce flooding and erosion, replenish groundwater reserves, remove pollutants, and provide other amenities.

biochemical oxygen demand (BOD)	The quantity of oxygen needed to satisfy biological oxidation of the degradable fraction of organic matter contained in sewage in a specific time, at a specified temperature and under specific conditions. BOD values (BOD_5) refer to the oxidation of organic wastes (carbon) only. Biochemical oxygen requirements for conversion of ammonia to nitrates is termed Nitrogenous Oxygen Demand and is not included in this BOD_5 value.
chlorination	The application of chlorine or chlorine compounds to water or wastewater, generally for the purpose of disinfection, but frequently for chemical oxidation and odour control.
chlorine residual	The amount of chlorine in all forms remaining in water after treatment to ensure disinfection for a period of time.
clarification	Any process or combination of processes whose primary purpose is to reduce the concentration of suspended matter in a liquid.
clarifier	Any large circular or rectangular sedimentation tank used to remove settleable solids in water or wastewater. A special type of clarifier, called an upflow clarifier, uses flotation rather than sedimentation to remove solids.
collection system	In wastewater, a system of conduits, generally underground pipes, that receives and conveys sanitary wastewater.
colour	Any dissolved solids that impart a visible hue to water.
commercial sewage	Sewage generated in areas predominantly commercial in business nature, includes sanitary wastes and waste resulting from the activities of the business itself. Typically, commercial sewage may include wastewaters from laundromats, restaurants, car washes, and garages.
compost	The product of the thermophilic biological oxidation of sludge or other materials.

constructed wetlands	Constructed wetlands may be of the surface flow or sub-surface flow type. In both cases, wetlands are lands transitional between terrestrial and aquatic systems, where the water level is maintained at or near the ground surface. In surface flow wetlands, water flows slowly through areas of open water 0.3 - 0.5 metres deep, which contain floating, submerged, or emergent aquatic plants. In sub-surface flow wetlands, effluent flows horizontally beneath the surface through a porous soils or gravel matrix, in which emergent aquatic plants are rooted.
conventional treatment	Well-known or well-established water or wastewater treatment process, excluding advanced or tertiary treatment; it generally consists of primary and secondary treatment.
dechlorination	The partial or complete reduction of residual chlorine by any chemical or physical process.
detention	Detention is the temporary storage of collected runoff waters.
dewater	To extract a portion of the water present in a sludge.
dewatered sludge	The solid residue remaining after removal of water from a wet sludge by draining or filtering. Dewatering is distinguished from thickening in that dewatered sludge may be transported by solids handling procedures.
digester	A tank or other vessel for the storage and anaerobic or aerobic decomposition or organic matter present in the sludge.
digestion	The biological decomposition of the organic matter in sludge, resulting in partial liquefaction, mineralization, and volume reduction.
disinfection	The killing of waterborne faecal and pathogenic bacteria and viruses in wastewater effluents with a disinfectant.

dissolved oxygen (OD) The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per litre (mg/L) or percent saturation.

domestic sewage Sewage principally derived from residential sources or produced by normal residential activities.

domestic wastewater Wastewater derived principally from dwellings, business buildings, institutions, and the like. It may or may not contain groundwater, surface water, or storm water.

effluent A liquid that flows out of a process. May be partially or completely treated.

eutrophication Nutrient enrichment of a lake or other water body, typically characterized by increased growth of planktonic algae and rooted plants. It can be accelerated by wastewater discharges and polluted runoff.

evaporation The process by which water becomes a vapour.

evapotranspiration Water withdrawn from soil by evaporation or plant transpiration.

evapotranspiration potential Water loss that would occur if there was never a deficiency of water in the soil for use by vegetation.

faecal coliform Aerobic and facultative, Gram negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5°C (112° F), and associated with faecal matter of warm-blooded animals.

filter strips Filter strips are designed for evenly distributed sheet flow of runoff water over a vegetated surface. Filter strips may be narrow (6 metre wide) turf strips or wider (30 metre wide) forested strips.

industrial sewage Wastewaters from manufacturing and industrial processes distinct from domestic or commercial sewage.

infiltration (I)	Entry of groundwater into the sewage collection system through leaking joints, cracks and breaks.
inflow (I)	In relation to sanitary sewers, the extraneous flow that enters a sanitary sewer from sources other than infiltration, such as roof leaders, foundation and basement drains or through manhole covers.
influent	Wastewater flow into a treatment plant, or treatment process.
intermittent filter	A natural or artificial bed of sand or other fine-grained material to the surface of which wastewater is applied intermittently in flooding doses and through which it passes; filtration is accomplished under aerobic conditions.
irrigation	The artificial application of water to lands to meet the water needs of growing plants not met by rainfall.
irrigation requirement	The quantity of water, exclusive of precipitation, that is required for crop production. It includes surface evaporation and other economically unavoidable water waste.
lagoon	Any large holding or detention pond, usually with earthen dikes, used to contain wastewater while sedimentation and biological oxidation occur.
land application	The recycling, treatment, or disposal of wastewater or wastewater solids to the land under controlled conditions.
nitrification	The oxidation of ammonia nitrogen to nitrate nitrogen in wastewater by biological or chemical reactions.
nitrogen (N)	An essential nutrient that is often present in wastewater as ammonia, nitrate, and organic nitrogen. Also present in some groundwater as nitrate and in some polluted groundwater in other forms.

nitrogen removal	The removal of nitrogen from wastewater through physical, chemical or biological processes, or by some combination of these.
nutrient	Any substance that is assimilated by organisms and promotes growth; generally applied to nitrogen and phosphorous in wastewater, but also to other essential and trace elements.
organic	Refers to volatile, combustible, and sometimes biodegradable chemical compounds containing carbon atoms (carbonaceous) bonded together with other elements. The principal groups of organic substances found in wastewater are proteins, carbohydrates, and fats and oils.
organic loading	The amount of organic material, usually measured as BOD_5, applied to a given treatment process; expressed as weight per unit time per unit surface area or per unit weight.
outfall	The point, location, or structure where wastewater or drainage discharges from a sewer, drain or other conduit.
parts per million (ppm)	The number of weight or volume units of a minor constituent present with each 1 million units of a solution or mixture. The more specific term milligrams per litre (mg/L) is preferred.
pathogens	Pathogenic or disease-producing organisms.
peaking factor	Ratio of the peak instantaneous flow to average dry weather flow.
pH	A measure of the hydrogen-ion concentration in a solution, expressed as the logarithm (base ten) of the reciprocal of the hydrogen-ion concentration in gram moles per litre (g/mole/L). On the pH scale (0 to 14), a value of 7 at 25°C (77°F) represents a neutral condition. Decreasing value indicate increasing hydrogen-ion concentration (acidity); increasing values indicate decreasing hydrogen-ion concentration (alkalinity).

phosphorous	An essential chemical element and nutrient for all life forms. Occurs in orthophosphate, pyrophosphate, tripolyphosphate, and organic phosphate forms. Each of these forms and their sum (total phosphorous) is expressed as milligrams per litre (mg/L) elemental phosphorous.
phosphorous removal	Refers to removal by the use of micro-organisms or by the precipitation of soluble phosphorous by coagulation and subsequent flocculation and sedimentation.
precipitate	To condense and cause to fall as precipitation, as water vapour condenses and falls as rain.
preliminary treatment	Unit operations, such as screening, comminution, and grit removal, that prepare the wastewater for subsequent major treatment.
primary settling tank	The first settling tank for the removal of settleable solids through which wastewater is passed in a treatment works.
primary treatment	The removal of a substantial amount of suspended matter, but little or no colloidal and dissolved matter.
pump stage	The number of impellers in a centrifugal pump.
raw wastewater	Wastewater before it receives any treatment.
receiving water	Wastewater used for some beneficial purpose usually after some degree of treatment.
rotating biological contactor (RBC)	A fixed growth treatment process that provides secondary wastewater treatment. Composed of closely packed plastic discs that are rotated about a horizontal shaft. Biological growth occurs on the discs.

sand filter	A bed of sand through which water is passed to remove fine suspended particles. They are used in tertiary wastewater treatment plants and sludge drying beds.
sanitary flow	Domestic, commercial and industrial sewage flows at the point of source and not including extraneous infiltration or inflow amounts.
secondary effluent	The liquid portion of wastewater leaving secondary treatment. An effluent that, with some exceptions, contains not more than 30 mg/L each (on a 30-day basis) of BOD_5 and suspended solids.
secondary settling tank	A settling tank following secondary treatment designed to remove by gravity part of the suspended matter. Also called a secondary clarifier.
sequencing batch reactor (SBR)	A fill and draw activated sludge system where biological reaction and clarification occur in the same tank.
sewage	A combination of water carried wastes generated by residences, institutions, and industrial and commercial establishments sources, together with any groundwater, surface and storm waters which may be present.
suspended solids	Insoluble solids that either float on the surface of, or in suspension in wastewater.
swales	Swales are natural depressions or wide, shallow ditches used to temporarily store, route, or filter stormwater runoff. Swales may or may not contain permanent standing water, and are lined with turf or emergent aquatic plants.
tertiary treatment	The treatment of wastewater beyond the secondary or biological stage. Term normally implies the removal of nutrients, such as phosphorous and nitrogen, and a high percentage of suspended solids. Term now being replaced by advanced waste treatment.

wastewater The spent or used water of a community or industry containing dissolved and suspended matter.

ABBREVIATIONS

REPORT UNITS		ALTERNATIVE UNITS	
cm	centimetre	in	2.54 inches
d	days	d	days
h	hours	h	hours
ha	hectare	acres	2.47 acres
Igpd	Imperial gallons per day		
Igpm	Imperial gallons per minute		
Kg/ha	kilogram per hectare	lb/acre	1.085lbs/acre
L/c/d	litres per capita per day	g/c/d	0.22 gallons/capita/day
L/ha/d	litres per hectare per day	g/acre/d	0.09 gallons/acre/day
L/s	litres per second	gal/min	13.2 gallons/minute
L/s/ha	litres per second per hectare	g/s/acre	0.09 gallons/second/acre
m	metre	ft.	3.280 feet
mm	millimetre	in.	0.039 inches
m^3/d	cubic metres per day	ft^3/d	35.3 cubic feet/day
mg/L	milligrams per litre		
USgpd	US gallons per day		
USmgd	US million gallons per day		

1.0 BACKGROUND

1.0 BACKGROUND

1.1 GENERAL

1.1.1 The Need for a Liquid Waste Management Plan

The South Sector of the Cowichan Valley Regional District comprises the Electoral Areas:

A. Mill Bay - Malahat;

B. Shawnigan Lake; and

C. Cobble Hill.

The study area shown on Figure 1.1.

Environmental problems attributable to sewage effluent have been identified on the foreshore at Mill Bay and in Shawnigan Lake. A rezoning moratorium is in place in Areas A, B and C until solutions for water supply and sewage collection and treatment have been found. The November 3, 1994 letter from John Finnie, P.Eng. Head Municipal and Environmental Safety Section MoELP, stated that they would refuse further permits until Liquid Waste Management Plan (LWMP) has been completed. In order to address these problems a LWMP was initiated under the Guidelines published by BC Environment under the Waste Management Act.

This Stage III Report is the culmination of the LWMP process and identifies the scope of the project, refines the estimated costs, identifies the location of the outfall and options for the treatment plant and makes recommendations for future studies.

1.2 PLAN DEVELOPMENT

The CVRD established a bylaw number 1680 dated June 28, 1995 to initiate the LWMP process. In order to direct the LWMP two committees are identified in the Guidelines. The Technical Liquid Waste Advisory Committee (TLWAC) and the Local Liquid Waste Advisory Committee (LLWAC). The two committees were combined for this study.

In August of 1995 Stanley Consulting Group Ltd. (SCGL) was commissioned to prepare the Stage I LWMP for the South Sector.

Stage I is to consist of the following:

- development of concepts of waste management options;
- include a provision for public input;
- culminate with a report on a set of realistic options;
- result in a detailed list of waste management options; and
- identify types of facilities that require operational certificates.

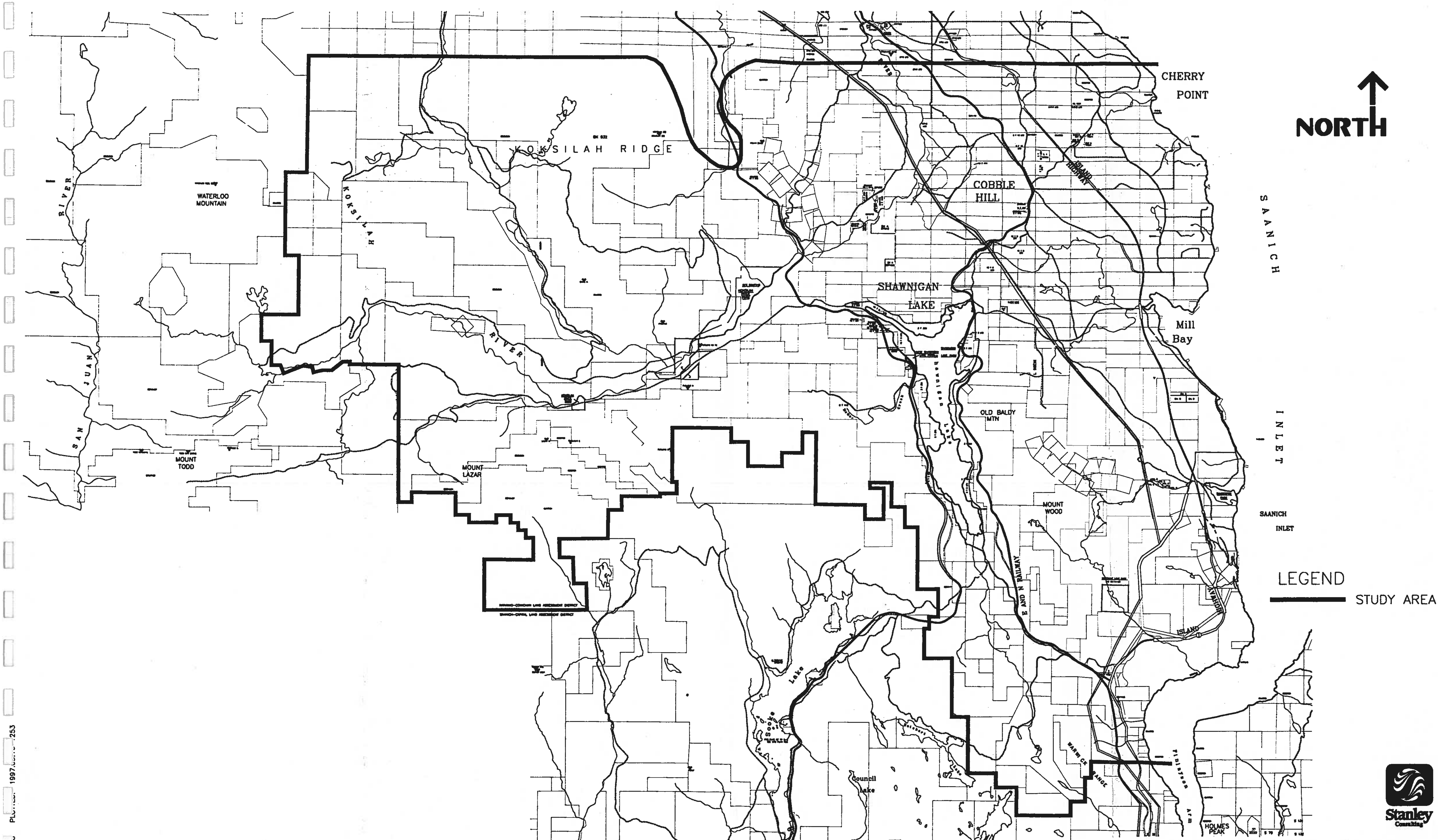
The draft Stage I plan was presented to the committee in January 1996 and public open houses were held at Mill Bay on January 20, 1996 and Shawnigan Lake on February 6, 1996 Three hundred and forty one (341) people attended the two presentations. The results are contained in the "Stage One Open House Report" dated February 29, 1996 by Woodward Environmental Management. In summary the public perception was that there is a problem with Liquid Waste Management and there was a high level of support to the presentation and process.

Approval to the Stage I plan was given by BC Environment on April 18, 1996 and Stanley were instructed to proceed to Stage II on June 12, 1996.

Stage II consists of the following:

- examine options and associated costs in detail;
- include provision for public input;
- result in a draft waste management plan; and
- identify requirements to be included in operational certificates for specific facilities.

The draft plan for Stage II was presented to the committee for review on October 4, 1996. Public meetings were held in Mill Bay on October 19, 1996, Shawnigan Lake on October 26, 1996 and Cobble Hill on November 2, 1996. A total of 149 people attended the open houses and the results were summarized in the "Stage Two Open House Report" dated November 1996 by Woodward Environmental Management. In summary the responses supported the two tier approach of improving the existing septic field treatment regime in the rural areas and implementing a collection,



COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
STUDY AREA
FIGURE 1.1

treatment and ocean outfall for the "urban" areas. Whilst concern was expressed over the costs these were generally accepted.

The Final Report was submitted in January 1997 and approval received February 21, 1997 from Ministry of Environment. Stanley were instructed to proceed to Stage III at the meeting of March 18, 1997.

The draft Stage III Liquid Waste Management Plan was presented to the committee for review on June 10, 1997. A public meeting was held at Francis Kelsey School on Saturday June 14, 1997. A total of 209 people attended and the results are summarized in the "Stage III Open House Report" dated July 1997 by Praxis Pacific. In summary there was continued support for the approach to the rural areas but mixed support for the implementation costs for the urban areas. The increased attendance reflected the interest in costs and treatment plant location. Further information on these issues is contained in the Praxis Pacific report.

Input and involvement from the First Nations has been a priority throughout the Plan development process. This has been sought by issuing three letters and several telephone calls to Chiefs Modeste and Daniels providing updates on Plan development and inviting participation by the Malahat Tribal Council. Also, all agenda packages and other written documents were copied to the Chief for his information. In a telephone conversation on May 27, 1997, Chief Daniels indicated that the Malahat Tribal Council had no interest, for the present time, in participating in the South Sector Liquid Waste Management Plan preferring to continue to use on-site systems under the jurisdiction of the federal government.

Stage III includes:

- The selected final option, complete with discharge standards, implementation schedule, cost estimates and proposed financing;
- Further public input;
- The completed waste management plan; and
- Draft Operational Certificates.

The Stage III Liquid Waste Management Plan was submitted to and approved by the CVRD Board on ---- and is submitted to the Minister of Environment, Lands and Parks for their approval.

The following document addresses the requirements of the Stage III plan.

1.3 IDENTIFICATION OF LIQUID WASTE RELATED ISSUES

The identification of wastewater contamination of the Mill Bay foreshore and Shawnigan Lake initiated the LWMP process. However, other major issues were identified in the study process which required analysis in the development of the plan.

Key issues associated with the present treatment and disposal practices in the South Sector are as follows.

Issue #1 Elevated coliform levels occur in surface water sources, an indication of the possible presence of pathogenic organisms. Specifically, shellfish waters, Saanich Inlet, near shore areas of Shawnigan Lake and Shawnigan Creek in the vicinity of Mill Bay.

Issue #2 Elevated nitrogen levels in groundwater. Nitrate has been associated with Methaemoglobinaemia in infants (inability of the blood to act as oxygen carrier) and with the formation of carcinogenic nitrosamines. Particularly sensitive are the groundwater supplies for Mill Bay Waterworks which originate from highly permeable sands.

Issue #3 Continued nutrient (nitrogen and phosphorous) loading to the surface waters will accelerate the process of eutrophication in surface waters. This will lead to overall poor quality, fish toxicity, increased cost of treating drinking water, and a loss of recreational use.

Issue #4 The population growth in the Cowichan Valley and in particular the South Sector is causing increased pressure on the treatment and disposal of liquid wastes.

Issue #5 The publication of the Saanich Inlet Study identified non-point sources are at present the primary source of contaminants to Saanich Inlet.

> *"Non-point sources (NPS) to Saanich Inlet include: stormwater, ineffective septic systems; runoff from residential, agricultural and residential lands; atmospheric deposition; and spills and leaks from boats and marinas. These are likely the primary sources of contaminants to Saanich Inlet. A treated sewage discharge in Mill Bay is the only point-source discharge in Saanich Inlet. Very little information about non-point pollution has been collected in coastal British Columbia, including Saanich Inlet."*

1.4 DEVELOPMENT OF WASTEWATER MANAGEMENT STRATEGIES

During the early stages of the plan, the division between rural and urban problems became apparent. The plan identified different plans for each. The definition of rural and urban areas was made on the following basis.

Urban or Sewer Specified Areas:

Mill Bay and Cobble Hill Village: All lands presently identified in the OCP with a zoning of R-3 (single family lots) or greater.

Shawnigan Lake: Due to the contamination problems of the Lake the criteria was increased to all lands presently zoned R-2 or greater around the perimeter of the lake.

All other lands were identified as rural.

The plan identified that urban areas are to have sewer service and rural areas can continue to be adequately treated by ground disposal.

Rural

In the rural areas it is generally recognized that the existing standards of treatment and disposal as required by MoE and MoH are acceptable. However, there are problems in ensuring that the standards are maintained.

There are two levels of development in the rural areas, defined by the criteria for a MoE permit, i.e. in excess of 15 homes and smaller MoH permit development. The study identified treatment options which can be used to retrofit existing projects to ensure compliance. However, as there are no lands presently zoned for the larger developments within the study area although alternatives were examined the plan did not identify treatment options.

However for single family and smaller developments septic tank treatment and ground disposal is considered a satisfactory option for large lot sizes. It is recognized that improvements must be made in the level of public awareness of the requirements of maintenance of the septic system. The CVRD should initiate an education program to encourage good operation and maintenance of septic systems. A program of implementing a system of financial incentives to maintain efficient systems should be instituted.

Urban

Due to the concentration of ground disposal systems in the urban areas, the dangers of contamination of the groundwater, the impact on untreated sewage waste and the desire of the public to improve the situation, a system of collection, treatment and disposal is to be implemented. A number of options for treatment and disposal were analyzed and presented to the committee for review in Stage II.

The key options were:

- Two or more small treatment plants. This was indicated to be more expensive.
- Discharge to a variety of land applications, i.e. forest irrigation, groundwater recharge. The land required was considered excessive and was unavailable coupled with concern over water supply contamination, both were rejected.
- Surface water discharge to area lakes, creeks and the Saanich Inlet were rejected.

The most effective system will include the following major components.

- A collection system as a combination of conventional gravity sewers, low pressure mains and septic tank effluent pumping (STEP) systems to service Shawnigan Lake, Mill Bay and Cobble Hill Village.

- A treatment plant be located in Mill Bay to provide secondary treatment, nutrient reduction, to an effluent quality of < 10 mg/l BOD_5, < 10 mg/l TSS, < 2.2 faecal coliforms/100 ml, and non-toxic.

- The effluent is to be pumped via a force main to an ocean outfall at Hatch Point.

- The effluent is to be suitable for and made available for agricultural irrigation and other suitable re-use.

2.0 LIQUID WASTE MANAGEMENT PLAN

2.0 LIQUID WASTE MANAGEMENT PLAN

2.1 GENERAL

The LWMP developed through Stages I and II reached the following recommendations.

1. The collection and treatment system should be designed to serve an immediate population of 6,000 and ultimately 12,000.

2. Flow reduction should be encouraged in all forms and that other options including composting toilets and dual plumbing systems should be encouraged, however, all applicable regulations must be met. These options were not considered to have a major impact on the ultimate designs.

3. Wastewater collection, treatment and disposal systems were reviewed with respect to urban and rural alternatives.

2.2 RURAL

- Single private on-site systems are acceptable in rural residential areas but monitoring of systems should be initiated by the CVRD to ensure adequate operation.

- Cluster systems are relevant for retrofitting existing systems that are showing signs of failure as identified by the Ministry of Health or the CVRD.

- New cluster systems are subject to the following requirements:

    1. The discharge shall meet the MoELP Draft Municipal Regulations Draft 3.1, dated November 5, 1996, or subsequent revisions, to Schedule 4 "Effluent Quality: Drinking Water source within 300 m". In addition to this standard in the Shawnigan Lake catchment area phosphorous removal will also be required. Phosphorous limit shall meet Schedule 5.

    2. Layout and design of the collection, treatment and disposal system shall be reviewed and approved by the CVRD prior to construction.

    3. The collection, treatment and disposal system shall be subject to take-over by the CVRD at its option. If the CVRD exercises the option to take-over a

given system it will be provided access to security bonds as set out in Section 45 of the MoELP Draft Municipal Sewage Regulations, or subsequent revisions.

4. All systems which may, in the opinion of the CVRD, feasibly connect to the central system must do so when the central system has been established.

Regulation and Control

The ultimate goal of this LWMP is to ensure that the wastewater discharged from the South Sector service area is collected, treated and disposed of in an environmentally acceptable manner.

- Implement the LWMP as a series of CVRD bylaws so that they are legally enforceable. Separate bylaws may be required for cluster systems and individual septic tanks.
- Systems to be regulated by either the MoH or the MoE, with CVRD being the permittee. This will ensure that funds are available to rehabilitate failed systems. The CVRD may have to establish a bond or a trust fund to recover the cost.
- Routine system inspection and maintenance be implemented by requiring monitoring on a regular basis by an approved inspector. (Tax incentives may be used to encourage monitoring and submission of inspection reports.)
- An operation or security deposit may be collected and held in reserve to cover the cost of system repairs recommended during inspection.

2.3 URBAN

2.3.1 Collection System

The sewer specified areas are indicated on the plans in Appendix A.

A central sewer system should be installed to service:

- Shawnigan Lake Village;
- Shawnigan Lake Shoreline;
- Mill Bay Core;

- Mill Bay Shoreline; and
- Cobble Hill Village.

A common treatment plant should be located in Mill Bay with an outfall to Satellite Channel located north of Hatch Point.

- The wastewater conveyance system should be essentially a conventional gravity system using low pressure mains and STEP systems as required.

2.3.2 Treatment Plant

The proposed treatment facility will treat wastes from a service area population of 6,000 persons and capable of later expansion to serve 12,000 persons would be constructed near Mill Bay.

Parameter	Phase I	Phase II
Flow, m3/d		
Average Dry Weather	2,500	5,000
Peak Day	6,500	12,000
Average Wet Weather	4,000	7,500
Annual Average Day Flow	3,000	6,000
Biochemical Oxygen demand, mg/L	200	200
Total Suspended Solids, mg/L	200	200
Total Phosphorous, as P, mg/L	10	10
Total Nitrogen, as N, mg/L	15	15
Ammonia Nitrogen, as N, mg/L	25	25

The treatment plant is shown in Appendix A and will consist of the following:

- screening;
- grit removal;
- aerobic biological treatment;
- effluent filtration;
- disinfection by UV;
- sludge digestion;
- sludge dewatering;
- back up power generation;

- administration building for laboratory control and monitoring;
- all treatment vessels shall be enclosed; and
- effluent quality < 10 mg/L BOD_5, < 10 mg/L TSS, < 2.2 fecal coliforms/100 mL, and a non-toxic effluent.

The plant buildings shall be designed to blend into the selected location. The site shall be fully landscaped to minimize visual impacts. Every attempt shall be made to minimize odour.

Costing has been based on a Sequencing Batch Reactor (SBR) process.

2.3.3 Septage and Sludge Disposal

The Wastewater Treatment Plant will be designed to accept and treat septage and sludge from the South Sector.

The treatment of sludges would require the following elements in a Phase I treatment plant:

- sludge thickener, 4 m dia.;
- aerobic digester, 20 x 20 x 4 m tank; and
- sludge dewatering.

After processing, about 4,500 m^3/year of digested semi-solid sludge (4% solids) will be available, when the plant is operating at Phase I capacity.. The plan identifies the beneficial re-use of the treated sludge by land application or composting.

2.3.4 Disposal

The LWMP identifies an outfall location off Hatch Point. Previous studies of this site provided adequate data to confirm that this is a suitable location. The outfall will extend approximately 200 m long 350 mm Ø discharging through diffusers at a depth of 30 m below chart datum.

The quality of the treated effluent and the routing of the effluent main will provide an opportunity for the provision of irrigation water to the agricultural area of Cobble Hill.

Previous oceanographic studies indicate that there are three main mechanisms driving ocean currents in the vicinity of Hatch Point. The most dominant mechanism is caused by tidal forces, followed by estuarine circulation and the most variable is currents caused by winds. Tidal currents are causing oscillation of currents north and south past Hatch Point at average velocities of 10 to 20 cm/s. Estuarine circulation resulting from the flow of Cowichan River freshwater into Hatch Point is probably the main cause of net flows at the surface toward the south off Hatch Point and toward the North at depths greater than 10 to 20 metres off Hatch Point. The magnitude of net flow at the depth of the proposed outfall site is not known, but is expected to be in the order of 3 to 10 cm/s and toward the North. Deployment of a current meter for at least a month at the proposed outfall site would confirm this.

Assuming that significant residual or non-tidal flows occur in the study area, the expected extent of the environmental impact of the proposed Hatch Point outfall on benthic infauna would be restricted to an area within 1 m of the discharge in terms of infauna community change, and within 70 m of the discharge in terms of infauna biomass change.

Comprehensive marine biological surveys have already been carried out by Woods and Shaw (1981) at both Boatswain Bank and Patey Rock. Additional marine biological surveys in the vicinity of Hatch Point were also carried out by Austin, Leys and Durance (1996) for the Saanich Inlet Study.

2.4 MONITORING PROGRAM

System monitoring is the only means available for ensuring that adequate treatment is being provided. Monitoring also provides an opportunity to determine the need for implementing corrective measures so that greater and more costly problems are not encountered down the road.

Private on-site systems should be monitored on a regular basis by a certified inspector. An inspection report, signed by the inspector, should be submitted to the local government regulating authority.

It is also necessary to set up a series of monitoring wells critically located to monitor the impact on groundwater. The cooperation of the local Water District's will greatly assist in this program. A method of review and analysis should be set up to provide an early warning of any problems.

A monitoring program was established for Shawnigan Lake by the CVRD in association with MoE. This program assisted in identifying the major areas of pollution in the Lake. The CVRD should encourage this program to continue to identify further areas of concern and the impact of the implementation of a collection and treatment system on this major water supply resource.

Some monitoring is presently carried out by MoE and the Department of Fisheries and Oceans (DFO) in order to define possible shellfish contamination. This program should be continued and a system initiated to ensure transfer of data to the CVRD.

2.5 NON-POINT SOURCE POLLUTION (NPS)

The LWMP identifies that NPS is a major issue in the control and treatment of pollution in the study area. Identified in the plan are two primary sources of NPS.

2.5.1 Rural NPS

These sources are mostly related to agricultural activities. Agricultural pollutants have their origin in the application of chemical fertilizers, pesticides as well as sediment. While the primary cause is the agricultural practice of disturbing soils, several other factors also affect pollution loading such as soil type, climate, topography, and the management practices in effect.

Land uses that are prime candidates of NPS are:

- animal feedlot operations;
- farming on steep slopes; and
- failed septic systems.

2.5.2 Urban NPS

Urbanization and related hydrologic modifications may cause increased pollution loadings that are significantly higher than the original or background levels. The sources of urban NPS in the South Sector varies considerably and depend on:

- failed septic systems;
- bird and pet populations;
- street litter accumulation;

- gardening practices;
- traffic density;
- street salting practices;
- construction activity; and
- drainage management practices.

Within the South Sector land uses include residential, commercial, industrial and institutional (i.e. schools, colleges, utilities). The least pollution originates from low density residential zones, parks and recreation areas. Higher pollution loadings are likely to occur from commercial centres and construction sites. The Liquid Waste Management Plan addresses the primary source of coliform contamination from failed septic systems.

2.5.3 Control Strategies

The control strategies proposed in the plan are divided into two, source control which is the reduction of the production of pollutants, or minimization of contact between pollutants and stormwater runoff. The two major control points for pollutants in stormwater runoff are urban road surfaces and the pollutant point of origin. Examples of source control strategies are:

- Minimizing use of pesticides and fertilizers and/or using environmentally friendly materials and methods.
- Use of erosion and sediment control techniques around construction areas.
- Proper storage and disposal of household wastes. In particular, toxic chemical should be stored and disposed of separate from other household wastes.
- Commercial activities such as transportation, fuelling stations, truck and auto repair stations should implement specific Best Management Practices (BMPs).
- The reduction of street litter through programs of education.

2.5.4 Collection and Control

Collection and control BMPs involve the use of methods and structures for removing pollutants from runoff after they leave the source area. These include:

- Detention ponds;
- Constructed wetlands;
- Vegetated swales;
- Filter strips;
- Rip rap; and
- Sediment traps.

2.5.5 Further Action

In the short term, the CVRD will address this issue through the educational programs identified in Section 2.6. It is understood that the Ministry of Environment will be able to assist through supply of informational materials.

In the intermediate term, the CVRD will work to acquire the authority necessary to impose NPS management practices on new developments.

In the long term, the CVRD commits to working with the Ministry of Environment, Lands and Parks to determine effective solutions to resolve existing problems.

2.6 PUBLIC EDUCATION PROGRAM

Public education and participation is essential to the success of the LWMP and will be an integral part of the plan. The program will highlight the purpose of the LWMP and the potential negative impacts of discharging untreated or poorly treated wastewater to the receiving environment as well as the impact on long-term sustainability of resources.

The public education program will encompass the following groups:

- private citizens;
- government agencies;
- local businesses;
- environmental groups;

- First Nations; and
- news media.

The following is a list of potential resources and methods available to disseminate information to the public:

- Brochures, flyers, fact sheets and newsletters;
- Field trips organized to educate and inform the public of problems and solutions;
- Displays at public functions, conferences and in schools;
- Meetings, workshops and open houses may be organized to solicit public feedback and input;
- Local news media (TV, newspaper, etc.) involvement is critical to the success of the program;
- The public library could be used as a source of information including videos and relevant literature; and
- Projects involving school children could be arranged to address specific problems and influence activities at home.

The public will be educated on the following topics:

- Negative impacts of discharging untreated or poorly treated wastewater;
- Common methods of treatment with capital and operating cost;
- Step by step approval procedure;
- Common problems encountered with septic tank systems and remedial methods;
- Routine maintenance of septic tank systems;
- Source control methods to control discharge of toxic and/or harmful material to the sewer system or to the septic tank; and
- Benefits of water conservation practices. Flow reduction techniques available, expected reduction of water consumption associated with each device and cost recovery information.

- The option of covenanting water conservation for new developments.
- Encouraging commercial, industrial and institutional developers to implement a two pipe plumbing system to reduce water usage and waste generation.
- Encourage the agricultural community to follow the best management practices to reduce NPS.
- Inform the public of the impact of NPS and methods to reduce NPS due to public activity.

3.0 IMPLEMENTATION

Page

3.0 IMPLEMENTATION

3.1 GENERAL

The Stage I plan identified an option of individual community systems for the areas of Shawnigan Lake, Mill Bay and Cobble Hill Village. These systems would be operational until the development and population pressures initiated a centralized collection, treatment and disposal system. The committee considered that these levels have been reached and with the severe limitation of available land for disposal the centralized system could be initiated as soon as possible. At some point some or all of the study area may consider incorporation as a municipality. The LWMP can be implemented by either corporate body.

In order to provide service to the urban areas opportunities to stage construction are limited. The construction must include the outfall and treatment plant before any service areas can be connected as there are no opportunities available to discharge effluent to another receiving environment. The staging proposed reflects these limitations and identifies a construction time frame of 5 years. This however could be compressed to a minimum of 2 years but the same sequencing would apply. The service area connections have been based on the major areas of environmental and health concerns. Staging is shown on Figure 3.1.

The Stage III public input program results indicate that there is a moderate support for implementation of the central collection, treatment and disposal system at a cost of $570 per connected user which reflects a 50% level of funding from senior government, but less than one-half of the participants indicated support at a cost of $890 per year which reflects no funding. Consequently implementation of the central system is dependent on funding availability and the above discussed phasing schedule would not commence until such funding has been provided.

3.1.1 Staging

In the interim period before installation of the central sewage system, cluster type sewage systems are acceptable within the proposed service area provided that they meet the requirements stipulated under Section 2.2, and

- are designed to be readily incorporated within the central system, and

- are incorporated within the central system once it has been established.

3.1.1.1 Siting

The siting of the wastewater treatment plant is to be selected based on technical criteria, input from the public and the ability of the CRD to purchase the site. On approval of the CVRD Board to proceed, the purchase of the site will be negotiated or if this is unsuccessful expropriation will be required. The selected sites are indicated on Figure 10 as sites A, B, and C. The preferred site is Site C with Sites B and C as alternate sites.

3.2 COST ESTIMATE CRITERIA

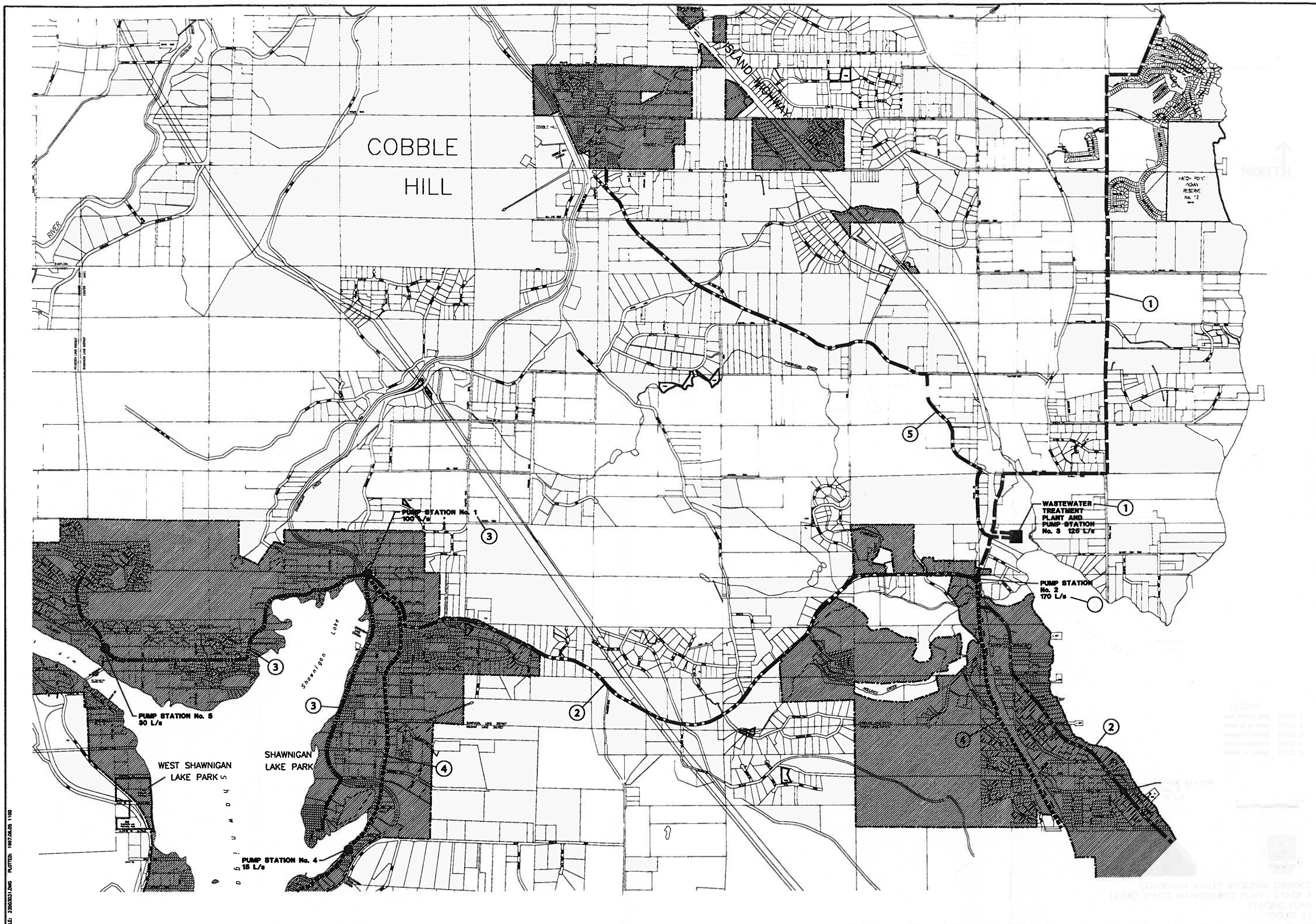
The basis for the cost estimates is as follows:

- sanitary sewer service to property line;
- connection from residence to the sewer will be the home owners cost;
- gravity service where possible;
- all costs are in 1997 dollars;
- number of initial participating units 3,500;
- number of development units 1,000;
- total system design 4,500;
- number of initial connections 1,700; and
- development at 50 units/year.

3.2.1 DCC's

DCC's or Development Cost Charges are indicated in Table 3.1. In order for these to be applied to specific areas which may have some items of servicing in place they will be broken down to the following:

- collection system;
- treatment;


FILE: 23503031.DWG PLOTTED: 1997.06.05 1100
COBBLE HILL
ISLAND HIGHWAY
RIVER
NORTH
HATCH POINT INDIAN RESERVE No. 12
WASTEWATER TREATMENT PLANT AND PUMP STATION No. 3 125 L/s
PUMP STATION No. 2 170 L/s
PUMP STATION No. 1 100 L/s
PUMP STATION No. 5 30 L/s
PUMP STATION No. 4 15 L/s
Shawnigan Lake
SHAWNIGAN LAKE PARK
WEST SHAWNIGAN LAKE PARK
1
2
3
4
5

- effluent transmission; and
- disposal.

This will provide opportunity to apply realistic costs to developments. This breakdown may also be applicable to Parcel Tax and User Fee.

3.2.2 Rural Areas

It is proposed that the Septic System Program for the rural areas be self-financing such as an annual charge of an estimated $50/year/household with a $100 credit to be applied for the presentation of a system evaluation every 3 years.

Table 3.1
Estimated Base Case System Costs and Financial Impacts Estimate of Annual Costs

Item	Description		Stage I Capital Costs
1.	Collection Sewer Systems		
	Shawnigan Lake	$2,250,000	
	Mill Bay	$1,300,000	
	Cobble Hill Village	$448,000	
	Subtotal	$3,998,000	$3,998,000
2.	Pump Stations & Forcemains and Trunk Sewers		
	Shawnigan Lake		
	Mill Bay		
	Cobble Hill Village		
	Subtotal	$9,198,350	$9,198,350
3.	Treatment Facilities		
	Shawnigan Lake		
	Mill Bay		
	Cobble Hill Village		
	Combined	$3,220,000	$3,220,000
	Filtration and UV Disinfection	$700,000	$700,000
4.	Disposal Facilities		
	Shawnigan Lake		
	Mill Bay		
	Cobble Hill Village		
	Combined	$2,370,800	$2,370,800
Subtotal			$19,487,150
Engineering and Contingencies 30%			$5,846,145
Land Requirements			$720,000
Total Capital Costs, Stage I			**$26,053,295**
	Debt Created	$26,053,295	
	Annual Debt Retirement Costs		$2,873,122
	Annual Operating & Maintenance Costs		$425,000
Total Annual Costs for Utility			**$3,298,122**
	No. of Initial Participating Units	3500	
	No. of Development Units	1000	
	Total System Capacity	4500	
	Annual Tax or Parcel Charge [1]	$640	$2,240,000
	User Fee for Service [2]	$250	$425,000
	Subtotal, Existing Parcels	$890	$2,665,000
	Development Cost Charges		
	Lot/year	50	
	50 Lots/year @	$12,700	$635,000
TOTAL ANNUAL REVENUE FOR UTILITY			**$3,300,000**
Extra Income over Expenditure			$1,878

Notes: 1. Based on 3,500 existing units.
2. Based on 1,700 connections.

Table 3.2 Estimated Base Systems Costs and Revenue		
Cost Element	Level of Government Participation % *	
	0	50
Capital Cost, $ x Million	26.1	26.1
Debt Created, $ x Million	26.1	13.1
Annual Debt Retirement, $ x Million	2.4	1.4
O & M Cost, $ x 1,000	425	425
Total Annual Cost, $ x Million	3.3	1.9
Parcel Tax, $/year	640	320
User Rate, $/year	250	250
Total Cost/Lot, $/year	890	570
Development Cost Charge, $/unit	12,700	6,300

3.3 PLAN AMENDMENTS

The LWMP provides options and recommendations for managing wastewater generated in the CVRD South Sector. The strategies outlined are based on anticipated population growth over a 40-year planning horizon.

This Liquid Waste Management Plan (LWMP) is targeted at forecasting the long-term liquid waste management needs for the South Sector of the Cowichan Valley. It is meant to be a workable document that serves the community and is designed to be amendable in order to meet the community's needs as they evolve over time. The land use decisions made by the Cowichan Valley Regional District (CVRD) will continue to take precedence and the LWMP will be amended to follow that direction. To facilitate this relationship, applications to amend this LWMP will be considered concurrently by the CVRD when a land use decision is under consideration.

This LWMP should be reviewed and updated under the following conditions:

1. If the actual growth in the urban areas exceed the anticipated levels reported in the Stage I report.
2. If a minimum land area of 0.5 ha with soil suitable for absorption field is not available at one location.
3. If the sewage discharge regulations become more stringent with respect to effluent parameters considered in this LWMP or if new parameters are introduced.
4. Any application which requires an MoE permit, i.e. a flow in excess of 22.7 m^3/d, the CVRD may require a plan revision at the applicants cost.
5. Changes to an OCP and subsequent amendment of the service areas.

3.4 PLAN MONITORING

The CVRD will set up a Plan Monitoring Advisory Committee to ensure the ongoing implementation of the plan. The CVRD Board will ensure that the committee will have adequate representation of the public, Ministry of Environment, Lands and Parks, Ministry of Health, CVRD regional directors and staff. In order to monitor the rural component and the operation and maintenance of the private on-site systems the CVRD will institute a self financing program. The estimate for this program is a cost of $25,000 per year.

4.0 DRAFT OPERATIONAL CERTIFICATE

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

Vancouver Island Region
Pollution Prevention
2080-A Labieux Road
Nanaimo, British Columbia
V9T 6J9
Telephone: (250) 751-3100
Fax: (250) 751-3103

DRAFT

OPERATIONAL CERTIFICATE
ME-XXXXX

Under the Provisions of the Waste Management Act

Cowichan Valley Regional District

137 Evans Street

Duncan, British Columbia

V9L 1P5

is authorised to discharge effluent to Satellite Channel and to the land from a municipal wastewater collection and treatment system serving Shawnigan Lake, Mill Bay and Cobble Hill, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

The effluent quality requirements in Subsection 1.1.3 are for reclaimed water reuse with unrestricted public access. Any reuse of reclaimed wastewater shall be in accordance with the "Health and Safety Criteria for Use of Reclaimed Wastewater".

1. AUTHORISED DISCHARGES

1.1 This subsection applies to the discharge of effluent from **SHAWNIGAN LAKE, MILL BAY AND COBBLE HILL.** The site reference number for this discharge is E????????.

1.1.1 The maximum authorised rate of discharge is 6.500 m^3/d in Stage I and 13,000 m^3/d in Stage II.

1.1.2 The average daily rate of discharge based on an annual averaging period is 2,500 m^3/d in Stage I and 5,000 m^3/d in Stage II.

J.O. Finnie, P.Eng.
Assistant Regional Waste Manager

1.1.3 The average of septage anticipated for Stage I is 4,000 m^3/year rising to 4,600 m^3/year for Stage II.

1.1.4 The characteristics of the discharge shall not exceed:

5 day biochemical Oxygen Demand	-	10 mg/L
Total Suspended Solids	-	10 mg/L
Faecal Coliform	-	median less than 2.2/100 mL and not to exceed 14/100 mL
Turbidity	-	average less than 2 NTU based on a 24 hour time period and not to exceed 5 NTU at any time
Toxicity (LC_{50}, 96 hr.)	-	100% (non-acutely toxic).

1.1.5 The authorised works are a treatment plant consisting of the following:

- screening;
- grit removal;
- aerobic biological treatment;
- effluent filtration;
- disinfection by UV;
- sludge digestion;
- sludge dewatering;
- back up power generation;
- administration building for laboratory control and monitoring;
- all treatment vessels shall be enclosed and related appurtenances approximately located as shown on attached Site Plan.
- the plant buildings shall be designed to blend into the selected location. The site shall be fully landscaped to minimize visual impacts. Every attempt shall be made to minimize odour; and
- 350 mm Ø, 200 m long outfall discharging through diffuser to a depth of 30 m below chart datum.

and related appurtenances approximately located as shown on attached Site Plan A.

1.1.6 The authorised works must be complete and in operation when discharge commences.

1.1.7 The location of the facilities from which the discharge originates is the Mill Bay Wastewater Treatment Plant.

1.1.8 The location of the point of discharge is Satellite Channel.

2. GENERAL REQUIREMENTS

2.1 General

The Cowichan Valley Regional District shall prepare an Operational Plan that provides details on (but is not limited to) the design, operation, and maintenance of the sewage collection, treatment and disposal system (including the reclaimed wastewater distribution system), the source control strategy, biosolids management details, and contingency plans. The plan shall be submitted to the Regional Waste Manager for approval.

The facility shall be operated in accordance with the Cowichan Valley Regional District South Sector Liquid Waste Management Plan as approved by the Minister and the Operational Plan as approved by the Regional Waste Manager.

Written authorisation from the Regional Waste Manager shall be obtained prior to implementing any changes to the Operational Plan. Based on any information obtained in connection with the facility, the Operational Plan requirements may be extended or altered by the Regional Waste Manager.

2.2 Maintenance of Works and Emergency Procedures

The discharger shall inspect the authorised works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the discharger which prevents effective operation of the approved method of pollution control, the discharger shall immediately take appropriate remedial action and shall notify the Regional Waste Manager or an Officer designated by the Regional Waste Manager:

a) By telephone if the condition occurs between the hours of 08:00 and 16:30, Monday to Friday;

b) by facsimile transmission if the condition occurs at any other time.

In addition to any reporting requirements under the Spill Reporting Regulation, notification of any occurrence under this section must be reported to the Regional Waste Manager within 24 hours of such occurrence.

2.3 Bypasses

The discharger shall ensure that no waste is discharged without being processed through the authorised works unless prior written approval is received from the Regional Waste Manager.

2.4 Process Modifications

The discharger shall have prior written approval from the Regional Waste Manager, prior to implementing changes to the authorised works or to any process that may affect the quality and/or quantity of the discharge.

2.5 Plans - New Works

Plans and specifications of the works authorised in Subsection 1.1.4 shall be certified by a qualified professional licensed to practice in the Province of British Columbia, and submitted to the Regional Waste Manager for review before discharge commences. A qualified professional licensed to practice in the Province of British Columbia must certify that the works have been constructed in accordance with the submitted plans.

2.6 Outfall Inspection

The discharger shall conduct a dye test on the outfall line (or inspect by another method approved by the Regional Waste Manager) every five years or as may otherwise be required by the Regional Waste Manager.

2.7 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be treated and used in a manner allowable under the "BC Municipal Organic Matter Recycling Regulation".

2.8 Odour Control

Should objectionable odours, attributable to the operation of the sewage treatment plant, occur beyond the property boundary, as determined by the Regional Waste Manager, measures or additional works will be required to reduce odour to acceptable levels.

2.9 Facility Classification and Operator Certification

The discharger shall have the works authorised by this permit classified (and the classification shall be maintained) by the Environmental Operators Certification Program Society (Society). The works shall be operated and maintained by persons certified within and according to the program provided by the Society. Certification must be completed to the satisfaction of the Regional Waste Manager. In addition, the Regional Waste Manager shall be notified of the classification level of the facility and certification level of the operators, and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorised by this permit shall be operated and maintained by persons who the discharger can demonstrate to the satisfaction of the Regional Waste Manager, are qualified in the safe and proper operation of the facility for the protection of the environment.

2.10 Effluent Upgrading

Based on receiving environment monitoring data and/or other information obtained in connection with this discharge, the discharger may be required to provide additional treatment facilities.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Sampling And Analyses

The discharger shall install a suitable sampling facility and obtain a sample of the effluent and carry obtain analyses of the samples in accordance with the following schedule:

Parameter	Frequency	Type
5-day Biochemical Oxygen Demand	twice per week	24-hr. composite
Total Suspended Solids	twice per week	24-hr. composite
Faecal Coliform	twice per week	grab
Toxicity	twice per year	grab

3.1.2 Flow Measurement

Provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.2 Receiving Environment Monitoring

A receiving environment monitoring program shall be carried out by the discharger. The program shall be established in consultation with the Regional Waste Manager, who will advise the discharger in writing of the program requirements. Based on the results of this monitoring program, the operational certificate monitoring requirements may be extended or altered by the Regional Waste Manager.

3.3 Monitoring Procedures

3.3.1 Sampling and Analytical Procedures

Flow Measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989, or by suitable alternative procedures as authorised by the Regional Waste Manager.

Copies of the above manual are available from the Pollution Prevention Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $20.00 and are also available for inspection at all Pollution Prevention offices.

Sampling shall be carried out in accordance with the procedures described in the latest version of "British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples. 1996 Edition (Permittee)", or by suitable alternative procedures as authorised by the Regional Waste Manager.

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (March 1994 Permittee Edition)", or by suitable alternative procedures as authorised by the Regional Waste Manager.

Copies of the above manuals may be purchased from Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Gov't. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-4609), and are also available for inspection at all Pollution Prevention offices.

3.4 Reporting

Maintain data of analyses and flow measurements for inspection and every quarter submit the data, suitably tabulated, to the Regional Waste Manager for the previous quarter. The first report is to be submitted by ???. Based on the results of the monitoring program, the operational certificate monitoring requirements may be extended or altered by the Regional Waste Manager.

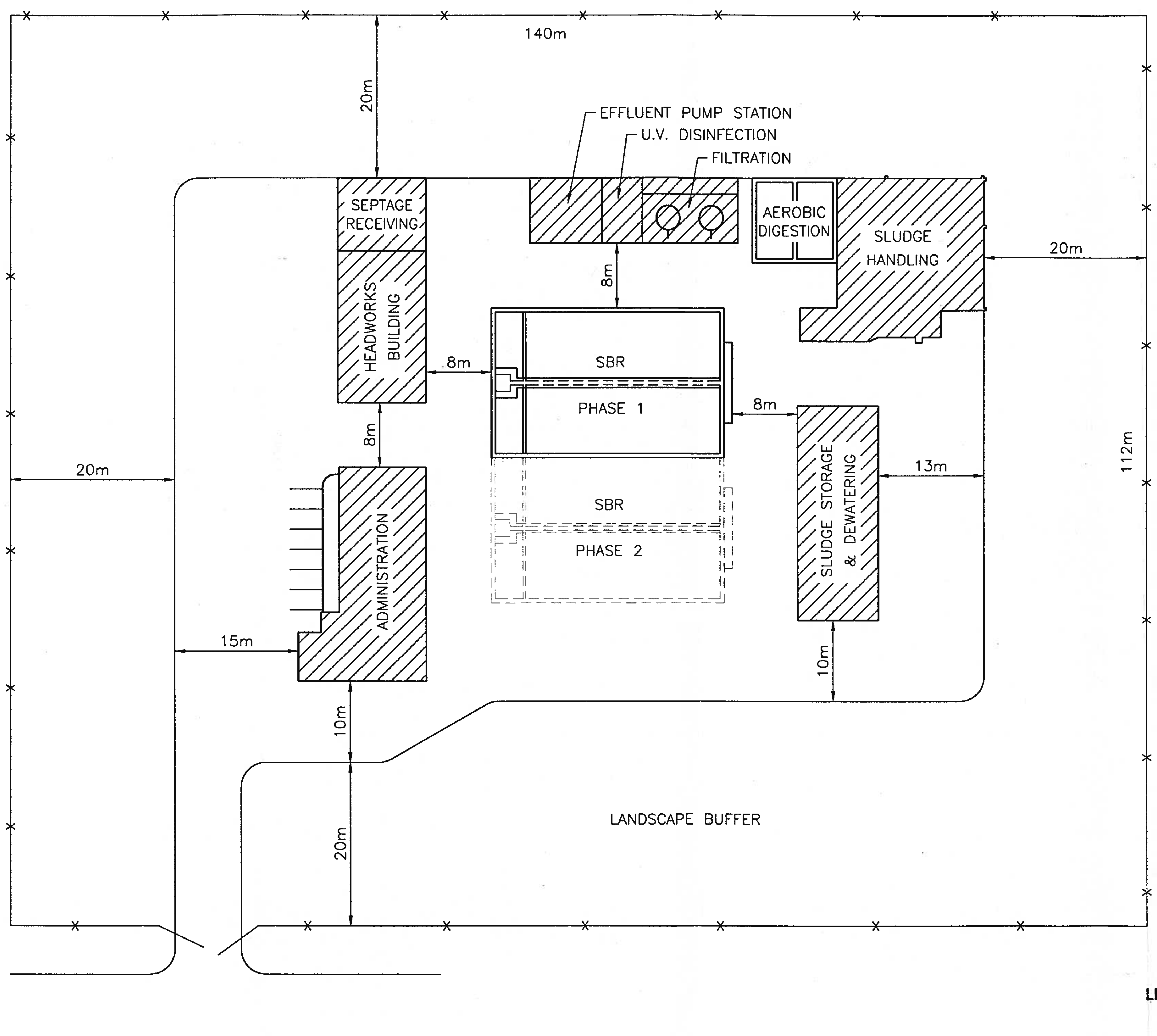
APPENDIX A FIGURES

SEWER SPECIFIED AREAS

SERVICE AREA KEY PLAN AND PROFILES

TREATMENT PLANT LOCATIONS

TREATMENT PLANT LAYOUT



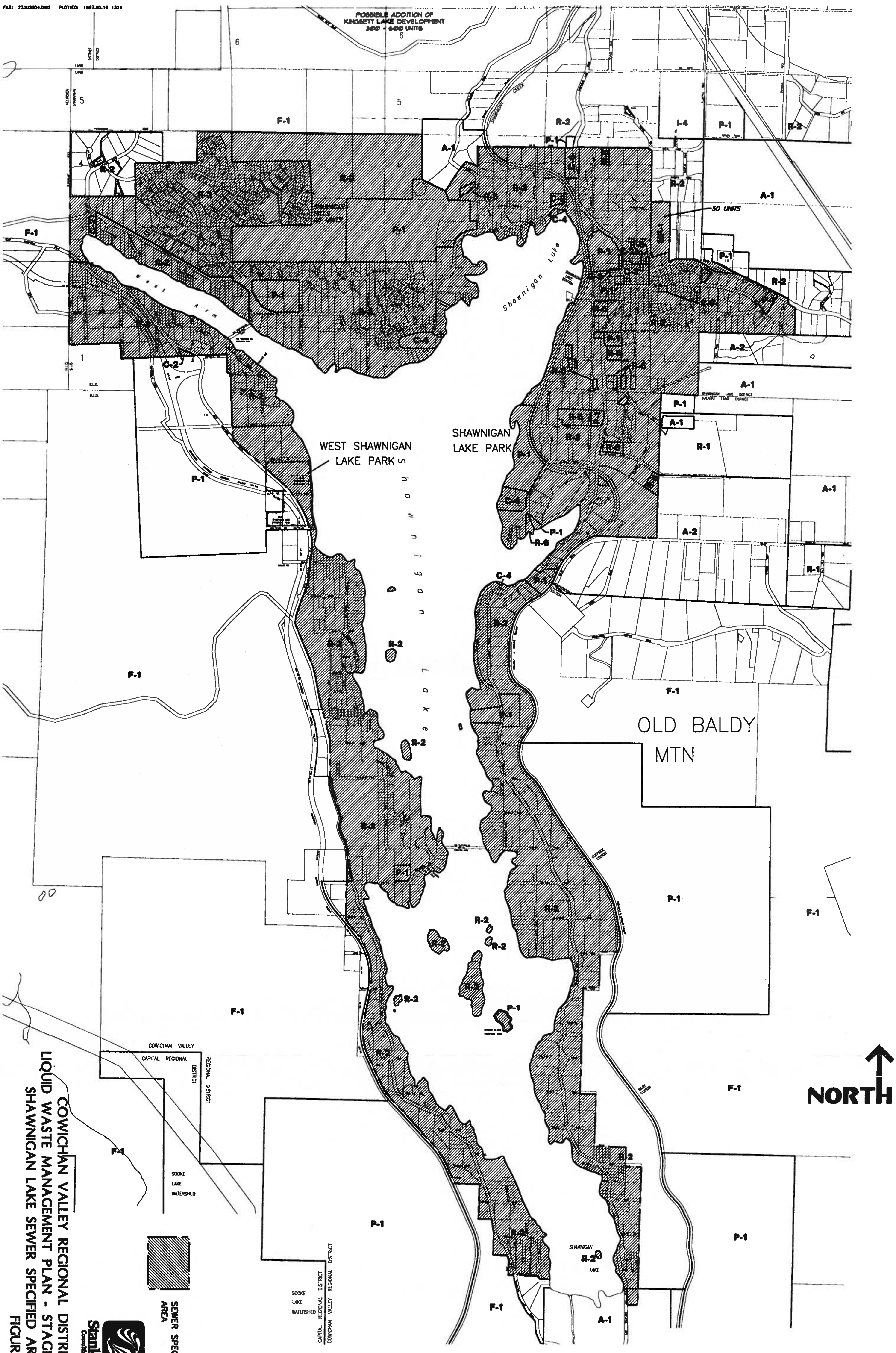
TOTAL AREA ±1.6ha

SCALE 1:500

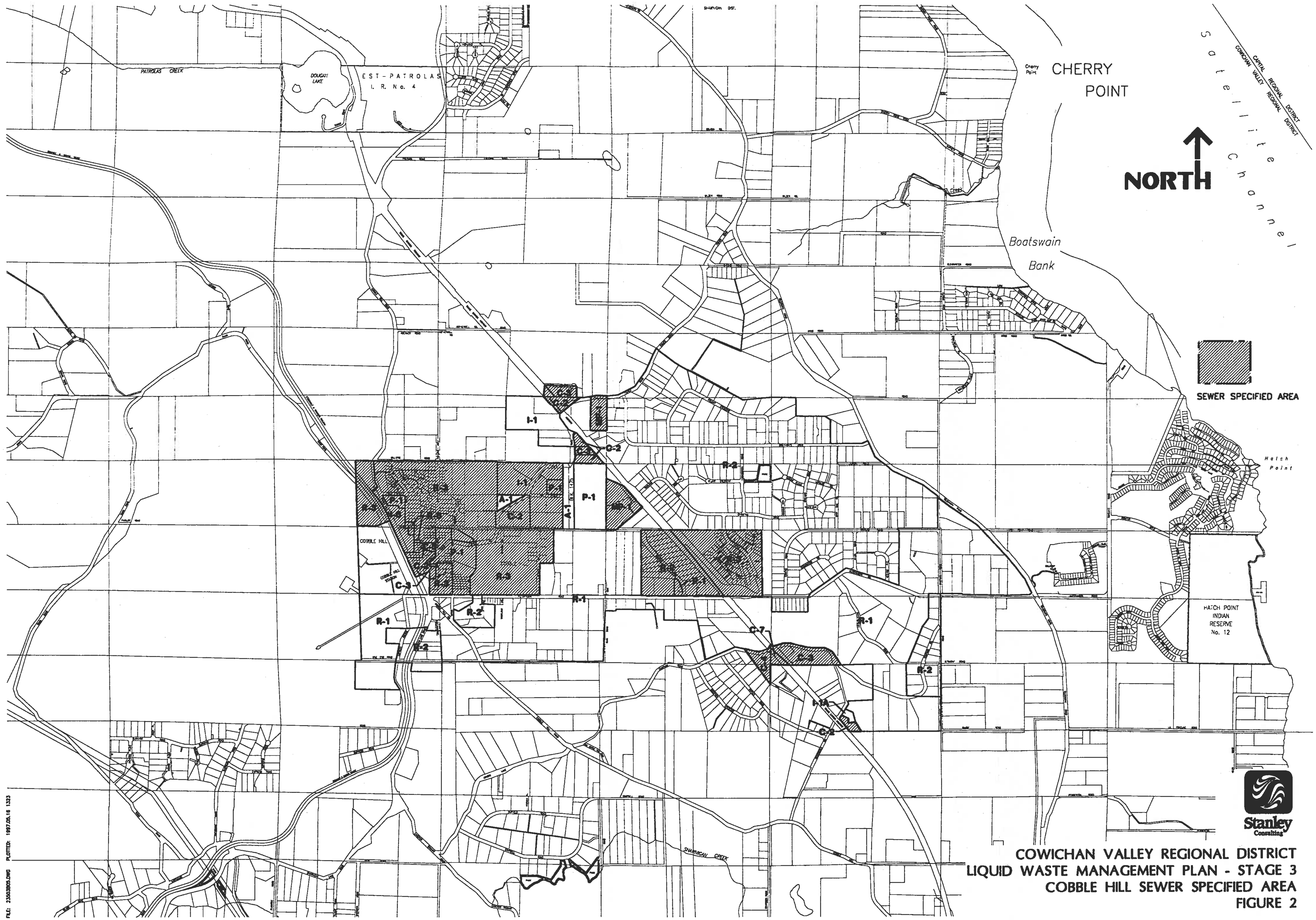
Stanley Consulting

COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
PROPOSED MILL BAY
WASTEWATER TREATMENT PLANT

FILE: 23503D21.DWG PLOTTED: 1997.06.05 1514

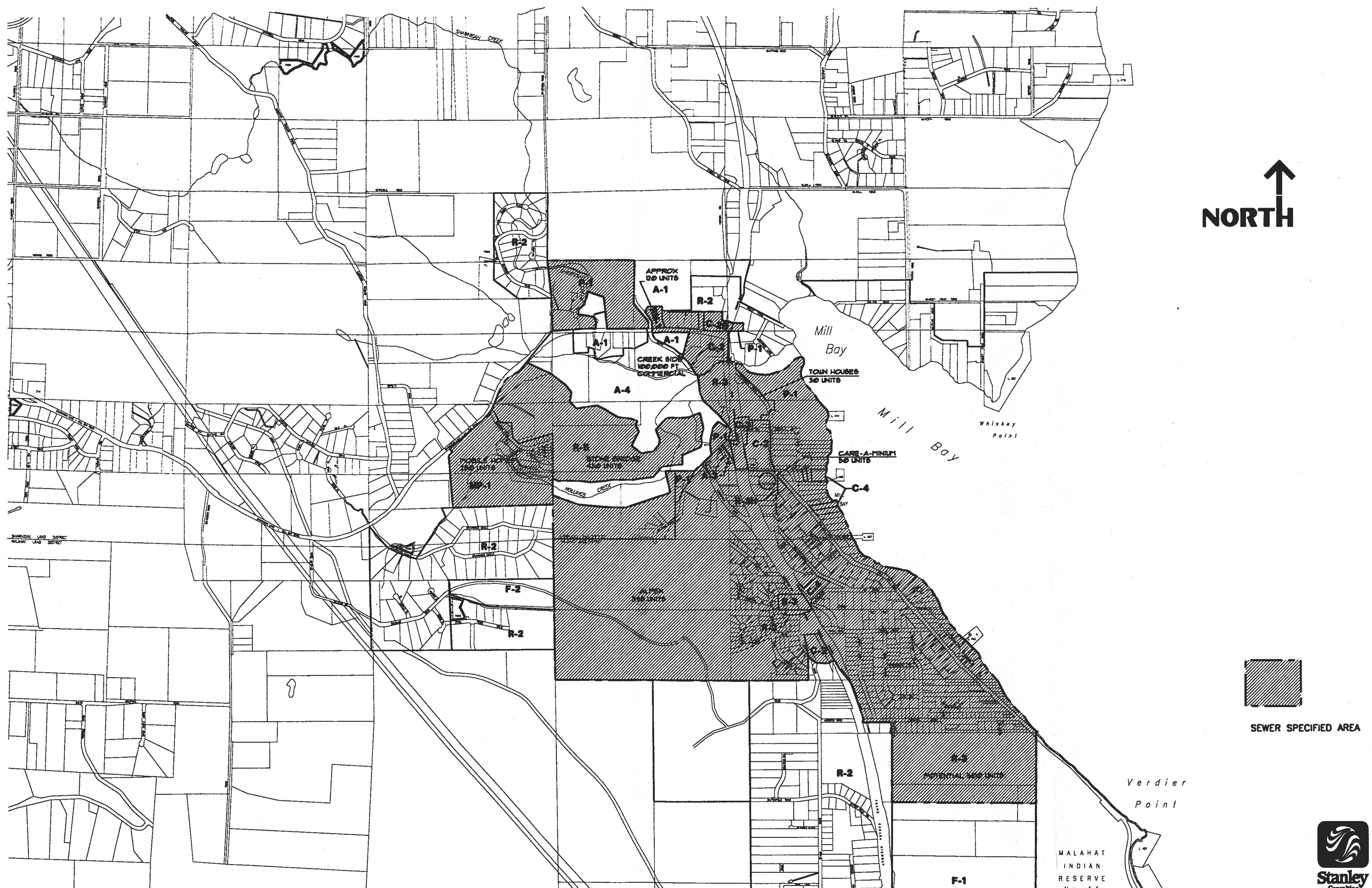


COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
SHAWNIGAN LAKE SEWER SPECIFIED AREA
FIGURE 1

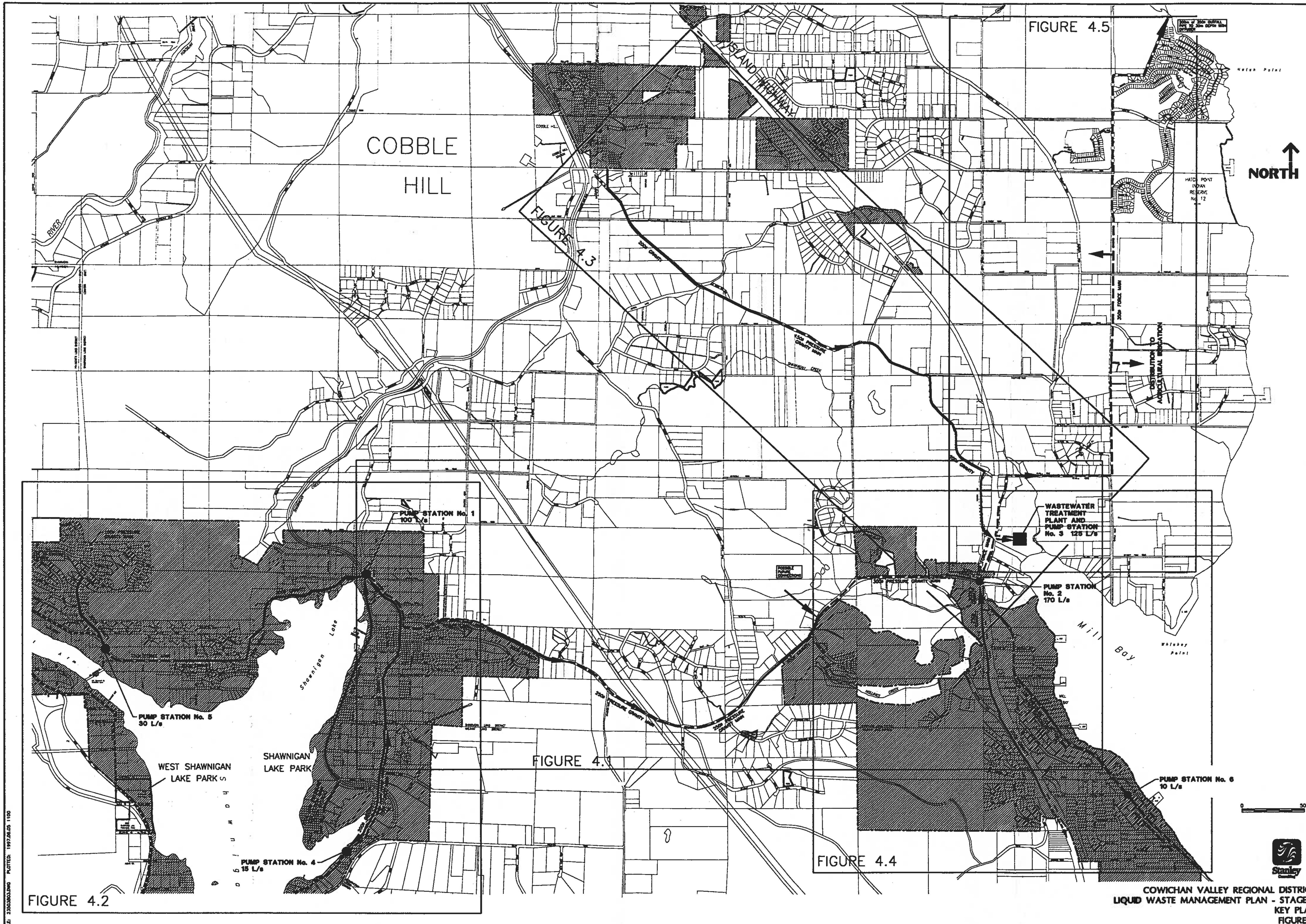


Stanley Consulting

COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
COBBLE HILL SEWER SPECIFIED AREA
FIGURE 2



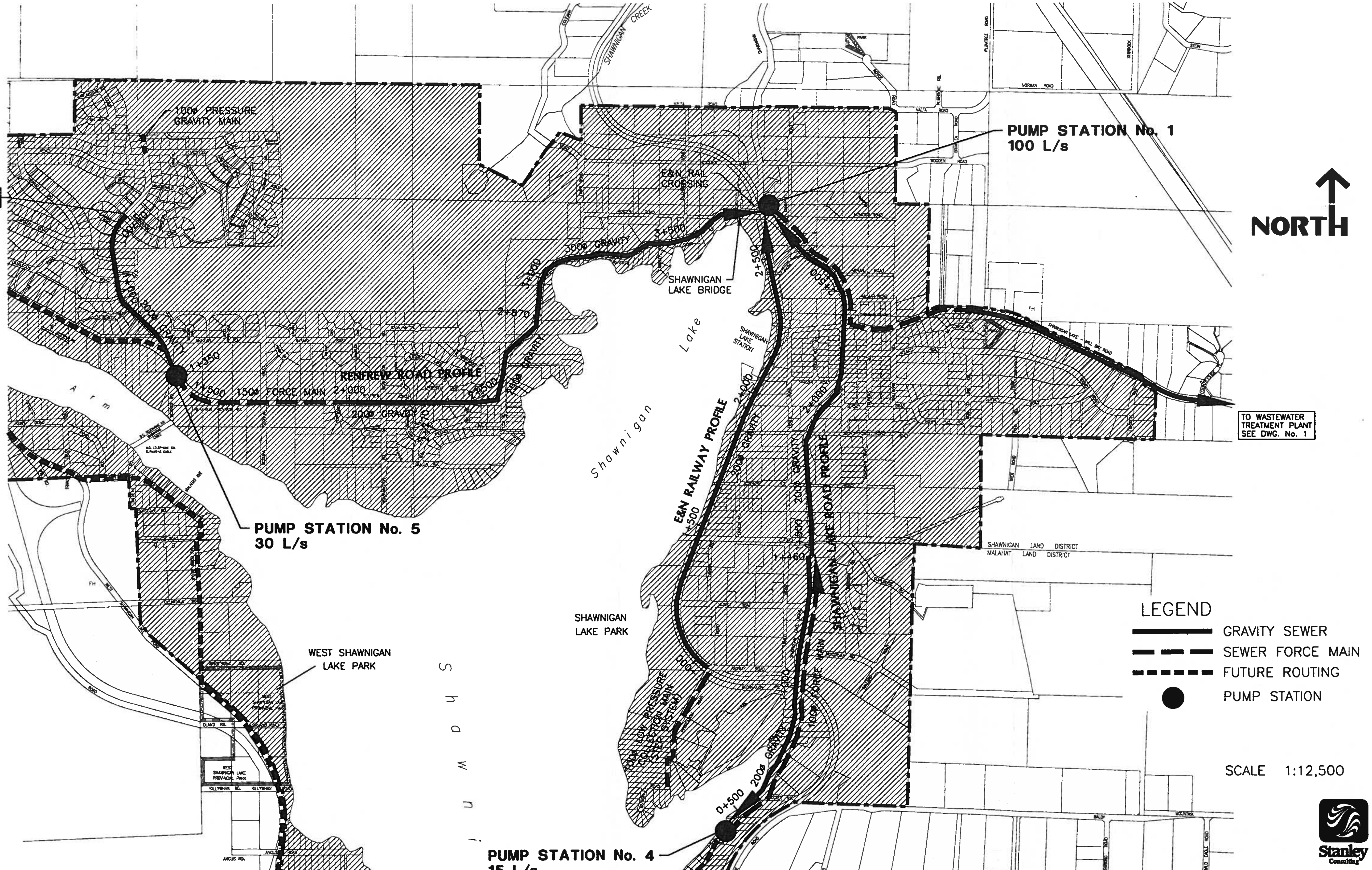
COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
MILL BAY SEWER SPECIFIED AREA
FIGURE 3



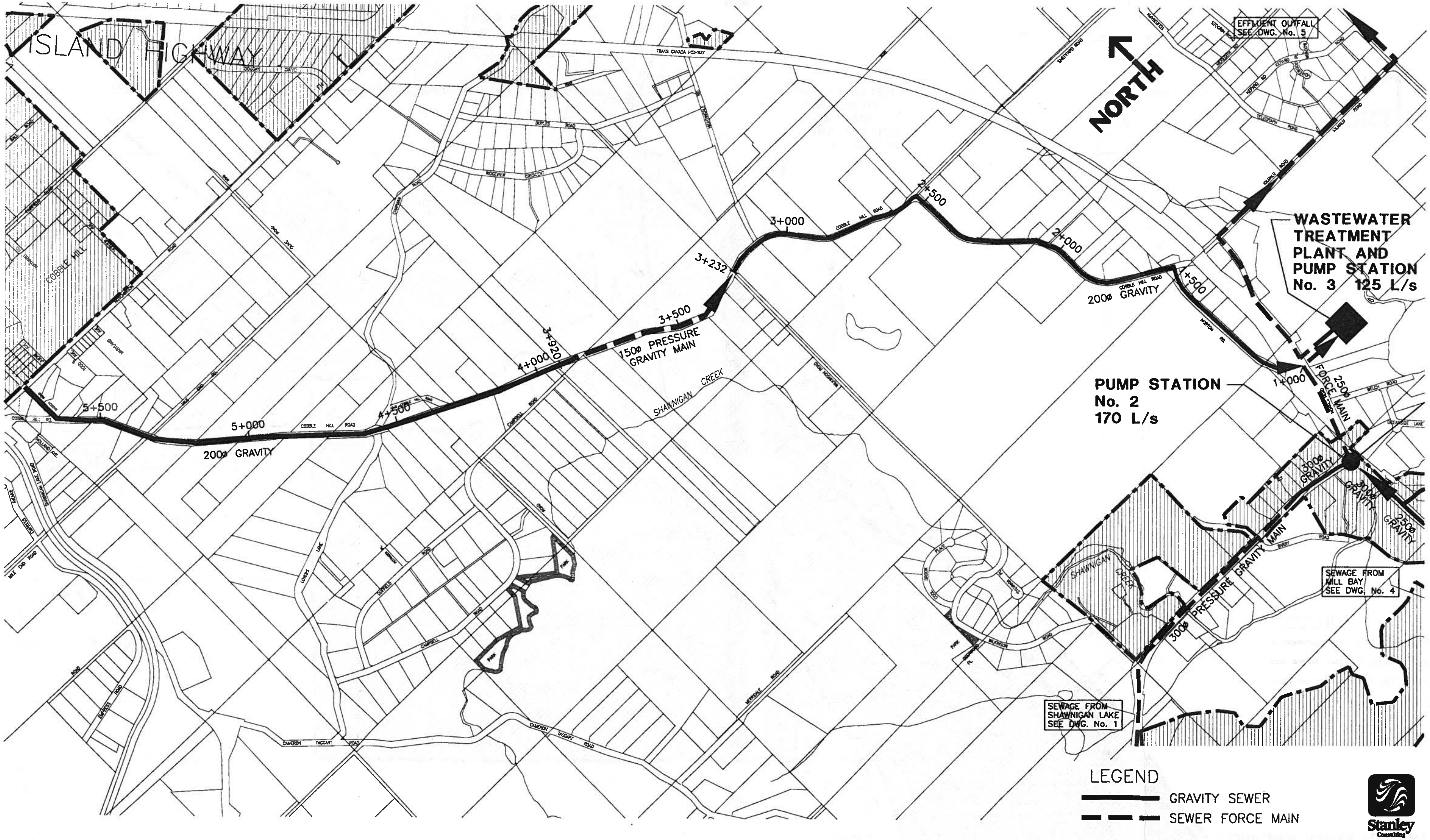
COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
KEY PLAN
FIGURE 4

COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
CONNECTOR MAIN
FIGURE 4.1

FILE: 23503D01.DWG PLOTTED: 1997.06.05 1024



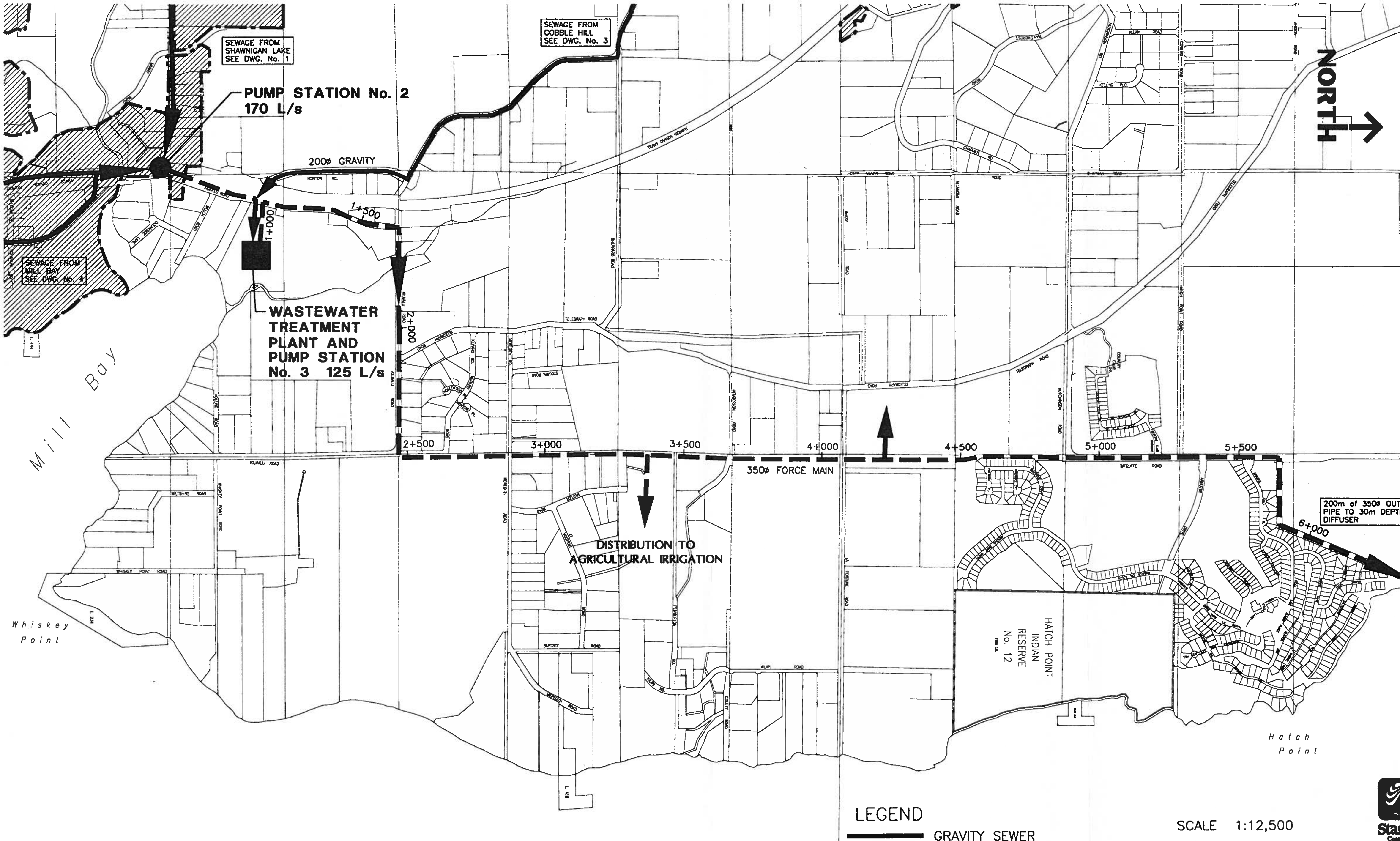
COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
SHAWNIGAN LAKE CATCHMENT MAIN
FIGURE 4.2



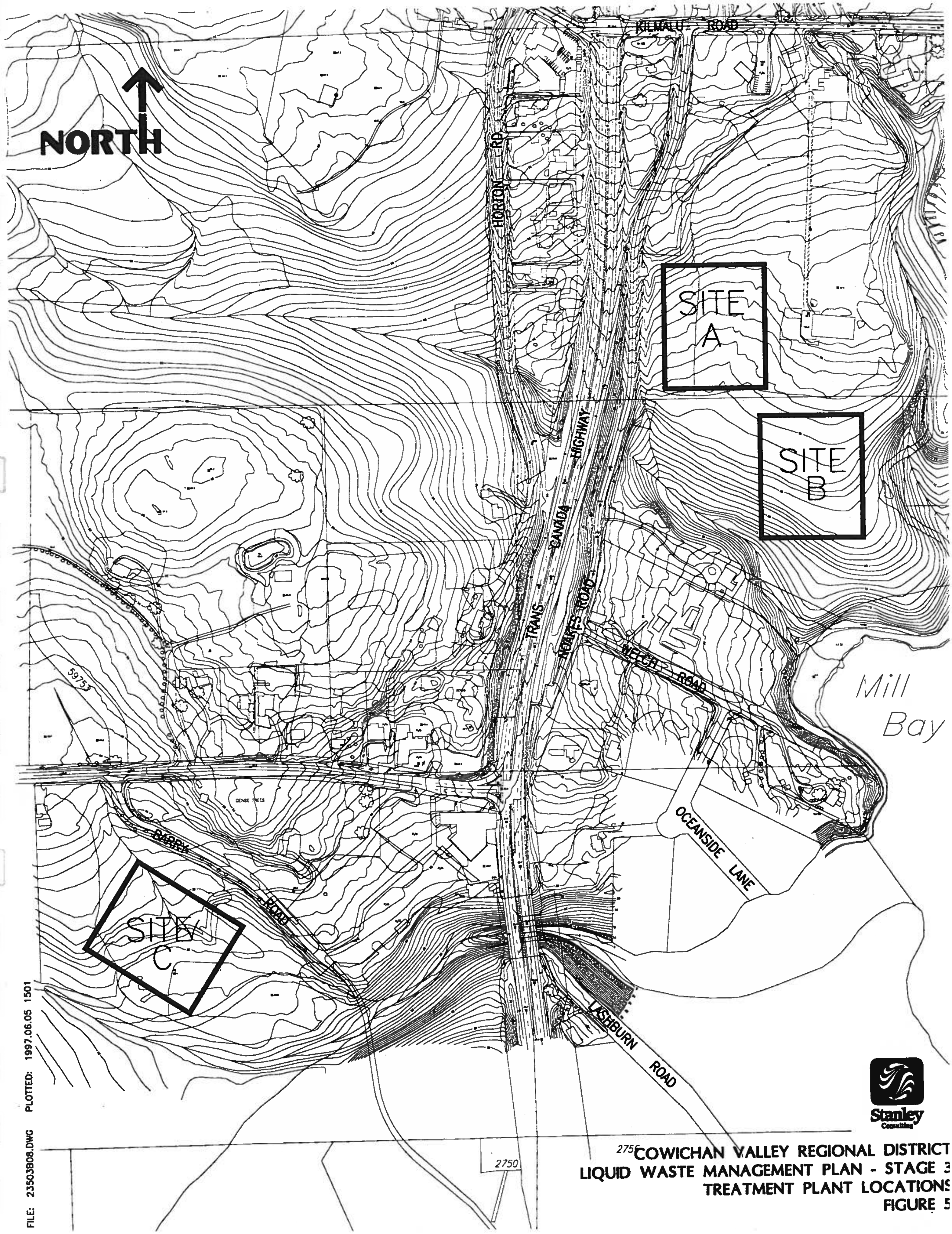
COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
COBBLE HILL CATCHMENT MAIN
FIGURE 4.3

FILE: 23503D03.DWG PLOTTED: 1997.06.05 1349

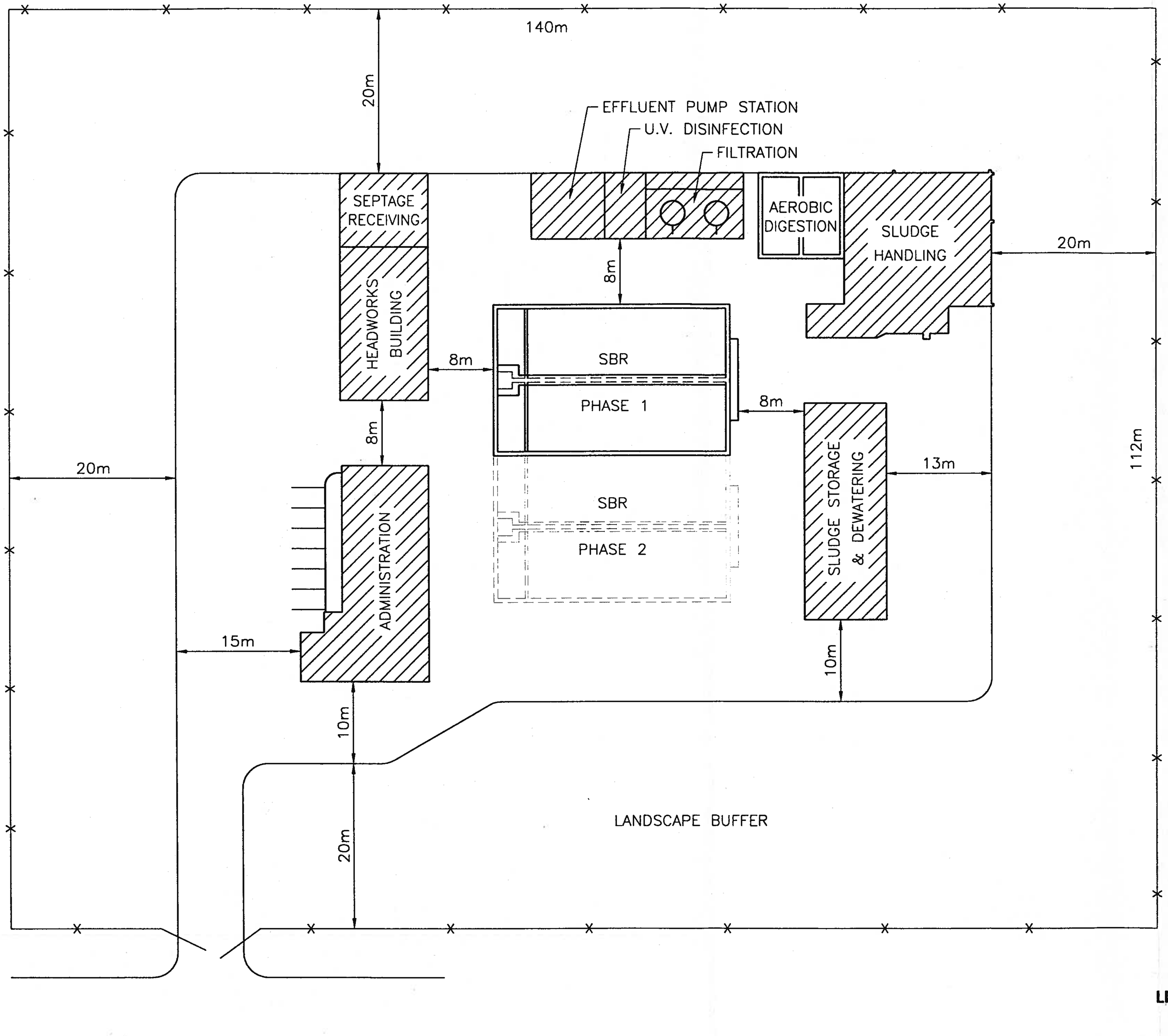
FILE: 23503D05.DWG PLOTTED: 1997.06.05 1337



COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
EFFLUENT OUTFALL MAIN
FIGURE 4.5



COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
TREATMENT PLANT LOCATIONS
FIGURE 5



TOTAL AREA ±1.6ha

SCALE 1:500

Stanley Consulting

COWICHAN VALLEY REGIONAL DISTRICT
LIQUID WASTE MANAGEMENT PLAN - STAGE 3
PROPOSED MILL BAY
WASTEWATER TREATMENT PLANT
FIGURE 6

FILE: 23503D21.DWG PLOTTED: 1997.06.05 1514

APPENDIX B COST ESTIMATES

COWICHAN VALLEY REGIONAL DISTRICT
SANITARY SEWER - INITIAL PHASE

SOUTH SECTOR - LIQUID WASTE MANAGEMENT PLAN
PRELIMINARY COST ESTIMATE - SUMMARY

ITEM NO.	DESCRIPTION OF WORK	UNIT OF MEASURE	ESTIMATED QUANTITY	UNIT PRICE	EXTENDED AMOUNT
	SECTION A - SANITARY SEWER MAINS				
A.1	TRUNK SEWER				
A.1.1	TRUNK SEWERS				$4,244,750.00
A.1.2	Trench Excavation - Rock	m3	18,810	$130.00	$2,445,300.00
A.1.3	Imported Backfill	m3	41,400	$20.00	$828,000.00
A.1.4	Surface Restoration	m2	61,300	$22.00	$1,348,600.00
A.1.5	Manholes	each	115	$2,500.00	$287,500.00
A.1.6	Pump Stations	L.S.			$1,650,000.00
A.1.7	Highway / Railway & Creek Crossings	m	480	$500.00	$240,000.00
A.1.8	Ocean Outfall	L.S.			$525,000.00
	Trunk Sewer Total				$11,569,150.00
B.1.	COLLECTION SYSTEMS				
B.1.1	Shawnigan Collection System	units	750	$3,000.00	$2,250,000.00
	Shawnigan STEP Systems		40	$3,000.00	$120,000.00
B.1.2	Mill Bay Collection System	units	500	$2,600.00	$1,300,000.00
	Mill Bay STEP Systems		100	$3,000.00	$300,000.00
B.1.3	Cobble Hill Village Collection System	units	140	$3,200.00	$448,000.00
	Collection System Total				$4,418,000.00
C.1	TREATMENT PLANT				
C.1.1	Treatment plant	L.S.			$3,920,000.00
	Treatment Plant Total				$3,920,000.00
	SUBTOTAL SECTIONS A, B & C				$19,907,150.00
	ENGINEERING & CONTINGENCIES (30%)	L.S.			$5,972,145.00
	TOTAL LAND REQUIREMENTS	ha	4	$60,000.00	$240,000.00
	Total				$6,212,145.00
	SUBTOTAL				$26,119,295.00
	GST NOT INCLUDED				
	GRAND TOTAL COST				$26,119,295.00

PROPOSED CONSTRUCTION PHASING

Year	Section	Total Cost	Contingency	Total
1.	Treatment Plant	$3,920,000		
	Effluent Main and Outfall	$2,370,800		
	Subtotal	$6,290,800	$1,887,200	$8,178,000
	Land			$240,000
	Total			$8,418,000
2.	Mill Bay - Lashburn	$1,819,200		
	Connector Main	$2,855,150		
	Total	$4,674,350	$1,402,305	$6,076,655
3.	Shawnigan Lake			
	Renfrew	$2,606,200		
	E & N	$1,205,200		
	Total	$3,811,400	$1,143,445	$4,954,845
4.	Shawnigan Lake			
	Lake Road	$2,119,300		
	Mill Bay - TCH	$719,350		
	Total	$2,838,650	$851,595	$3,690,245
5.	Cobble Hill	$490,450		
		$1,801,500		
	Total	$2,291,950	$687,600	$2,979,550
TOTAL		**$19,907,150**	**$5,972,145**	**$26,119,295**

APPENDIX C MARINE OUTFALL ANALYSIS

REVIEW OF OCEANOGRAPHIC INFORMATION RELEVANT TO THE CONSTRUCTION OF A MARINE WASTE WATER OUTFALL NEAR HATCH POINT, SAANICH INLET

By
Randolph Kashino, BSc., R.P.Bio.
Axys Environmental Consulting Ltd.
P.O. Box 2219, 2045 Mills Road
Sidney, B.C., V8L 3S8
For
Stanley Associates Engineering Ltd.
701-1803 Douglas St.
Victoria, B.C., V8T 5C3

1.0 Relevant Oceanography

A review of oceanographic information relevant to the proposed construction of a marine waste water outfall off Hatch Point at the mouth of Saanich Inlet was done. We found that several studies have been done in the vicinity.

A review of environmental information for the Cowichan Bay area was done by Bell and Kallman (1976) which includes information on geology, climatology, hydrology, water quality, oceanography, marine biology, fisheries, wildlife, land and water use and the effects of development in the area to 1975.

Previous Oceanographic studies which have been done in the area include Herlinveaux (1962), Coastal Zone Oceanography (1980), Narayanan (1981), Woods and Shaw (1981), Stucchi and Giovando (1984), Kashino (1991) and Cross and Chandler (1996). The most recent Saanich Inlet study by Cross and Chandler (1996) as some water structure data relevant to seasonal temperature/salinity profiles near the area. The Cowichan Bay Physical Oceanographic Study by Kashino (1991) has water structure data relevant to changes in temperature/salinity profiles over tidal phases and some ocean circulation patterns in the area. The most relevant and comprehensive studies were done for the Chevron Canada Limited Hatch Point Marine Environment Assessment by Narayanan (1981) and Woods and Shaw (1981) which respectively dealt with Physical and Biological Oceanography.

Combined with the unique topography/bathymetry of the study area there are basically three mechanisms which are driving ocean circulation.

The most dominant mechanism is tidal circulation which is caused primarily by the gravitational forces of the moon and sun. As a result currents ebb and flow based on tidal height oscillations with about 12 hour, 24 hour and 29 day periods. Tidal current flows were summarized for the vicinity of Hatch Point by Narayanan (1981) and are shown in Figures 2.0 and 3.0. Kashino (1991) further summarized currents in the study area and the derived circulation patterns are shown in Figures 4.0, 5.0 and 6.0. On a flood tide surface currents flow westward through Satellite Channel toward Sansum Narrows. At Hatch Pt. flood tide surface currents flow northward toward Cowichan Bay and Sansum Narrows at a speed of 10 to 15 cm/s. On an ebb tide currents reverse and at Hatch Point surface currents flow southward into Saanich Inlet at a speed of about 10 to 20 cm/s. Kashino (1991) further examined circulation patterns in the area and found that on some ebb tides currents continue to flow out of Saanich Inlet, northward off Hatch Point and toward Saltspring Island.

The second most dominant mechanism is Estuarine Circulation which is caused by the outflow of freshwater from the Cowichan River at the head of Cowichan Bay. The outflow of freshwater on the surface must be physically replaced to conserve mass by a resulting inflow of deeper saltier water. In addition the freshwater outflow appears to be under the influence of the Coriolis Effect which causes the freshwater to hug the south side of Cowichan Bay and the West side of Saanich Inlet. See Figure 7.0. The strength of Estuarine Circulation currents will vary with ebb and flow of tidal currents and with the seasonal variation of the volume of freshwater flowing from the Cowichan River. Figure 8.0 shows the typical variation in Temperature-Salinity profiles between Winter and Summer near Hatch Point. Figure 9.0 shows the typical variation in Temperature-Salinity profiles that can occur at the end of Ebb and Flood tides near Hatch Point. These typical Temperature-Salinity profiles show that the Thermoclines, Haloclines and therefore Pycnocline are strongest from the surface to a depth of 10 to 20 meters. This would indicate that Estuarine Surface currents will tend to flow to the south off Hatch Point and that currents just below the Pycnocline depth, i.e. 10 to 20 meters, will tend to flow north off Hatch Point. The Temperature-Salinity profiles also imply that a plume from a waste water outfall will likely be trapped below the pycnocline depths of 10 to 20 meters.

The third mechanism is caused by winds blowing on surface waters which will impart a current of about 3 % of the wind speed. Generally only the top few centimeters of water will be affected by winds, but during strong or prolonged wind events the effect can be deeper. Storm events usually occur primarily during the winter in the study area. Southeasterly storm events will have the greatest effect on the study area because the longest fetch is from the south along the length of Saanich Inlet. Northwesterly wind events will generally blow out of Cowichan Bay and strong winter Northeasterly winds will approach from Satellite Channel. In general winds will have the strongest effect on surface circulation during periods of slack tidal currents and winds with easterly components will drive surface water onto the shore in the vicinity of Hatch Point. Narayanan (1981) noted that "depending on the state of the tides and the prevailing winds, it was found that surface waters in the Hatch Point area may be driven in any of three directions, north towards Cowichan Bay and Sansum Narrows, south into Saanich Inlet or east through Satellite Channel".

The net result of the three mechanisms for ocean circulation off Hatch Point will interact to either inhibit or enhance current velocities depending on each of their current vectors and phases. During the Narayanan (1981) study a current meter was deployed to the east of Hatch Point and recorded currents at a depth of 60 meters from April 15, 1981 to June 9, 1981. The results of this deployment showed that the net current was 2.9 cm/s to the Northwest. The results also showed that 85% of the time velocities were less than 15 cm/s and that only 4% of the time were velocities greater than 25 cm/s. The maximum velocity that was observed was on the order of 40 cm/s. Net currents at depths between 60 meters and the surface are not directly known but we expect they will be in the order of 10 to 15 cm per second. If the current meter is deployed below the pycnocline depth then we would expect the net flow would be to the north. A current meter deployed for at least a month at the proposed outfall site would confirm this.

2.0 Scale of Environmental Impact

The primary effect of untreated sewerage waste water on the inter and subtidal ecosystems would be that of nutrient enrichment that may cause an increased growth of marine algaes. The organic and nutrient enrichment may complicate the assemblages of marine algaes and invertebrates and cause spatial competition. The large algaes and sponges may become overgrown with diatoms and filamentous algaes and thus decrease in production. The coraline algaes may also become overgrown and die. High levels of suspended solids may affect the sponge and anemonae communities by causing increased stress on there cleaning mechanisms. Secondary effects of untreated sewerage waste water may be caused by the attraction of more birds and fish to the area, which would also feed in the nearby inter and subtidal zones, thereby causing an ecosystem perturbation by increased foraging in the area.

Mearns and O'Connor (1984) quantified the effects of sewage suspended solids discharge with areal response of benthic infauna for several outfalls in Southern California. The rate of suspended solids discharge is a function of volume discharge.

$$\text{SUSPENDED SOLIDS (mt/yr)} = \text{VOLUME DISCHARGE (m}^3\text{/day)} * 0.59935$$

Therefore the areal response of benthic infauna is quantifiable in terms of volume discharge. Mearns and O'Connor (1984) found that the area of changed infauna had the approximate relationship:

$$\text{INFAUNA CHANGE AREA (km}^2) = [\text{SUSPENDED SOLIDS (mt/yr)} * 8.42e\text{-}5]^{2.16}$$

By using estimated volume discharge rate for the proposed Hatch Point outfall of 2500 m^3/day for average flow and 6500 m^3/day for peak flow, the estimate of benthic infauna change by the above formula were calculated to be 79 m^2 based on average flow and 14 m^2 based on peak flow. This would be less than 0.25 meter radius around the proposed outfall discharge based average flow and less than 0.70 meter radius around the proposed outfall discharge based on peak flow.

Mearns and O'Connor (1984) also found that the area of excess biomass of infauna had the approximate relationship:

$$\text{EXCESS BIOMASS AREA (km}^2) = [\text{SUSPENDED SOLIDS (mt/yr)} * 4.11e\text{-}4]^{0.96}$$

Applying this formula to Hatch Point, the affected areas based on average flow would be 68,847 m^2 an area approximately 148 meters in radius around the proposed outfall. Based on peak flow the affected areas would be 172,290 m^2 an area approximately 234 meters in radius around the proposed outfall. However, it should be noted that representation of area of impact in terms of circular radius around the proposed outfalls may not be realistic because of the rectilinear nature of the tidal currents in the study area. The actual areas of impact would be more oblate in appearance with the long axis paralleling tidal current major axis, and offset toward the direction of residual current flows.

It should also be stressed that the Mearns and O'Connor (1984) formulae are based on Southern California infauna and for Sewage Outfalls with no treatment: therefore, application to Hatch Point should be taken as approximate and a worst case scenario.

However, the proposed Hatch Point outfall is to be designed to meet the Suspend Solid Criteria of less than 10 mg/l, therefore the Mearns and O'Connor (1984) Suspend Solids Estimate must be modified to:

$$\text{SUSPENDED SOLIDS (mt/yr)} = \text{VOLUME DISCHARGE } (m^3/\text{day}) * 0.00365$$

Therefore, based on average flow the estimated Infauna Change Area will be 0.1847 m^2 or an area less than 0.25 m in radius. Based on peak flow the estimated Infauna Change Area will be 1.4761 m^2 or an area less than 0.68 m in radius. The Excess Biomass Area based on average flow will be 4,689 m^2 or an area less than 39 m in radius. The Excess Biomass Area based on peak flow will be 11,735 m^2 or an area less than 62 m in radius.

3.0 Summary

Previous oceanographic studies indicate that there are three main mechanisms driving ocean currents in the vicinity of Hatch Point. The most dominant mechanism is caused by tidal forces, followed by estuarine circulation and the most variable is currents caused by winds. Tidal currents are causing oscillation of currents north and south past Hatch Point at average velocities of 10 to 20 cm/s. Estuarine circulation resulting from the flow of Cowichan River freshwater into Hatch Point is probably the main cause of net flows at the surface toward the south off Hatch Point and toward the North at depths greater than 10 to 20 meters off Hatch Point. The magnitude of net flow at the depth of the proposed outfall site is not known, but is expected to be in the order of 3 to 10 cm/s and toward the North. Deployment of a current meter for at least a month at the proposed outfall site would confirm this.

Assuming that significant residual or non-tidal flows occur in the study area, the expected extent of environmental impact of the proposed Hatch Point outfall on benthic infauna would be restricted to an area within 1 m of the discharge in terms of infauna community change, and within 70 m of the discharge in terms of infauna biomass change.

Comprehensive marine biological surveys have already been carried out by Woods and Shaw (1981) at both Boatswain Bank and Patey Rock. Additional marine biological surveys in the vicinity of Hatch Point were also carried out by Austin, Leys and Durance (1996) for the Saanich Inlet Study.

REFERENCES

Austin, W.C., S.P. Leys and C. Durance. 1996. Saanich Inlet Study. Sensitive habitats and biota. Prepared for Water Quality Branch, Environmental Protection Department, B.C. Ministry of Environment, Lands and Parks. February 1996.

Bell, L.M. and R..J. Kallman. 1976. The Cowichan-Chemainus River Estuaries - Status of Knowledge to 1975. Report of the Estuary Working Group, Department of Environment, Regional Board Pacific Region. Special Estuary Series No. 4. January 31, 1976.

Coastal Zone Oceanography. 1980. Salinity/Temperature Profiles in Saanich Inlet, B.C. Part 1: April 1976 - December 1977; Part 2: 1978. Pacific Marine Science Report 80-5(1); 80-5(2), Institute of Ocean Sciences, Sidney, B.C. Unpublished Manuscript.

Cross, S.F. and P.C.P. Chandler. 1996. Saanich Inlet Study - Surface Circulation Patterns. Prepared for Water Quality Branch, Environmental Protection Department, B.C. Ministry of Environment, Lands and Parks. January 1996.

Dobrock SEATECH Ltd. 1981. Hatch Point Marine Environmental Assessment - Overview. Prepared for Chevron Canada Limited by Dobrocky SEATECH Limited, August 1981.

Herlinveaux, R.H. 1962. Oceanography of Saanich Inlet in Vancouver Island British Columbia. J. Fish. Res. Board Can. 19:1-37.

Kashino, R.K. 1991. A Physical Oceanographic Study of Cowichan Bay, Vancouver Island, British Columbia. Prepared for Dayton & Knight Ltd. by Axys Environmental Consulting Ltd.

Mearns, Allan J. and Thomas P. O'Connor. 1984. Biological Effects Versus Pollutant Inputs: The scale of Things. *In* Concepts in Marine Pollution Measurements. Edited by Harris H. White. Maryland Sea Grant College. pp 693-722.

Narayanan, S. 1981. Hatch Point Marine Environmental Assessment - Physical Oceanography. Prepared for Chevron Canada Limited by Dobrocky SEATECH Limited, August 1981.

Stucchi, D.J. and L.F. Giovando. 1984. Deep Water Renewal in Saanich Inlet, B.C. in Proceedings of a Multidisciplinary Symposium on Saanich Inlet, 2nd February, 1983. Can. Tech. Rep. Hydrog. Ocean Sci. : No. 38: 104 pp. edited by S.K. Juniper and R.O. Brinkhurst.

Thomson, R.E. 1981. Oceanography of the British Columbia Coast. Can. Spec. Publ. Fish. Aquat. Sci. 56: 291 p.

Woods, S.M. and D.P. Shaw. 1981. Hatch Point Marine Environmental Assessment - Biological Oceanography. Prepared for Chevron Canada Limited by Dobrocky SEATECH Limited, August 1981.

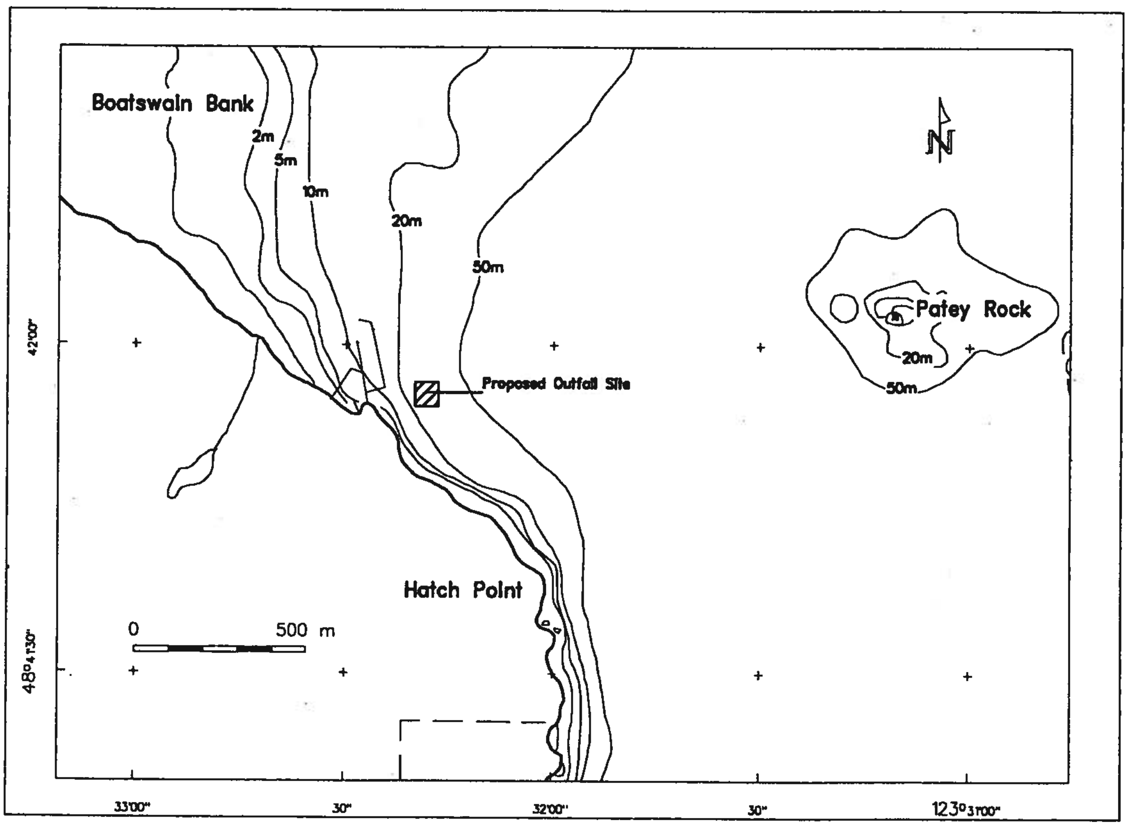


Figure 1.0. Proposed Hatch Point outfall site showing bathymetry of area.

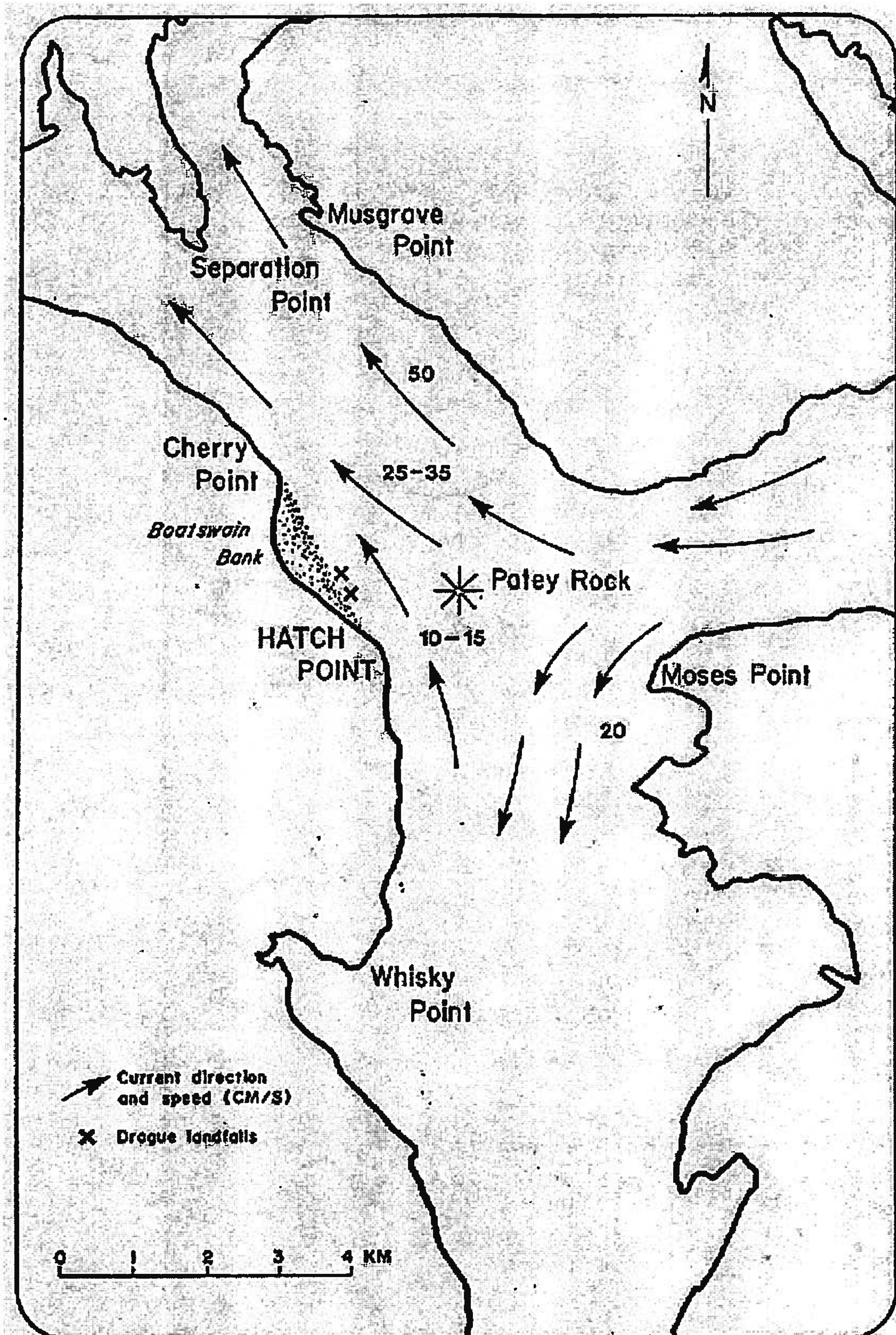


Figure 2.0 General flood tide water movements in the vicinity of Hatch Pt. (after Dobrocky Seatech Ltd., 1981)

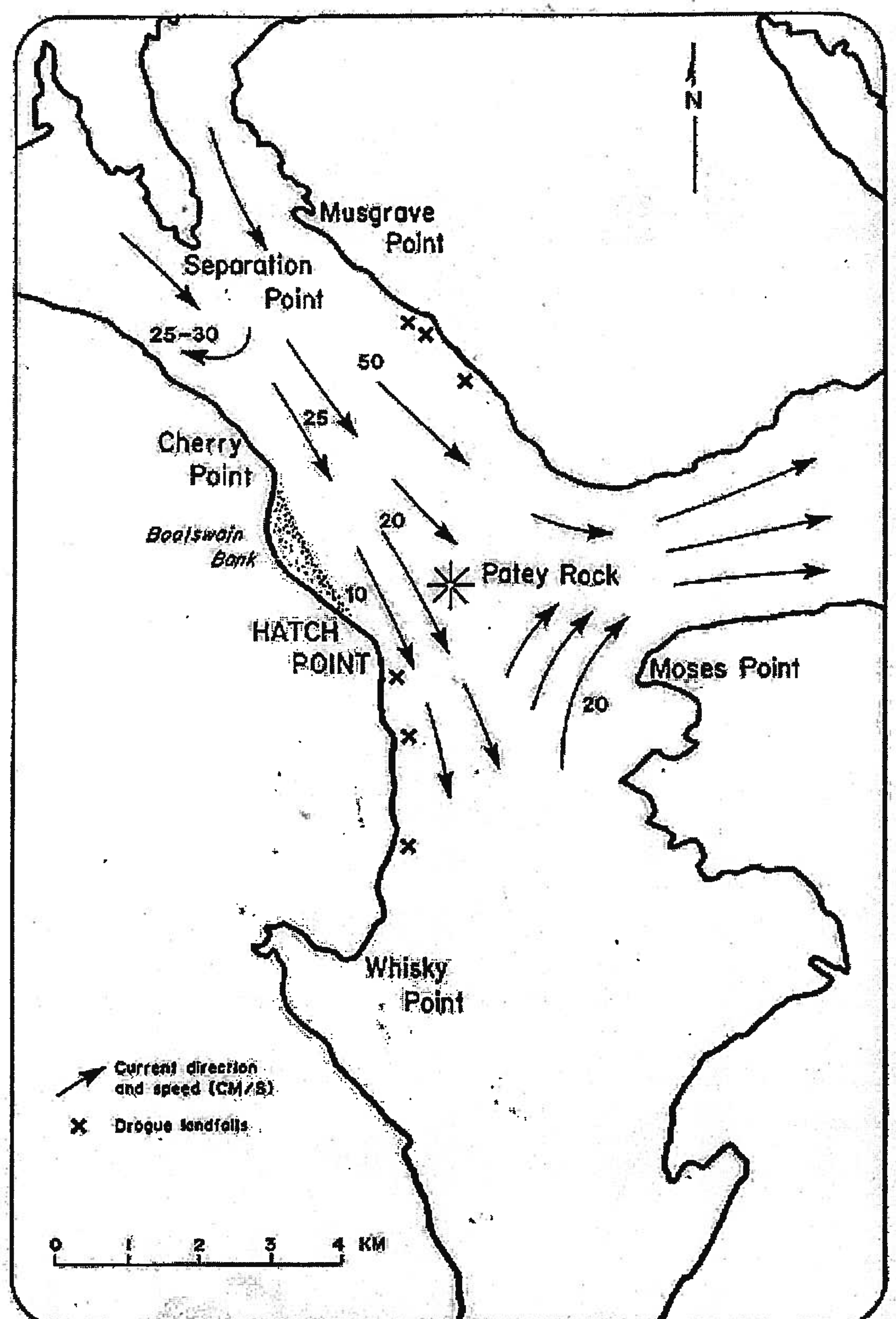


Figure 3.0 General ebb tide water movements in the vicinity of Hatch Pt. (after Dobrocky Seatech Ltd., 1981)

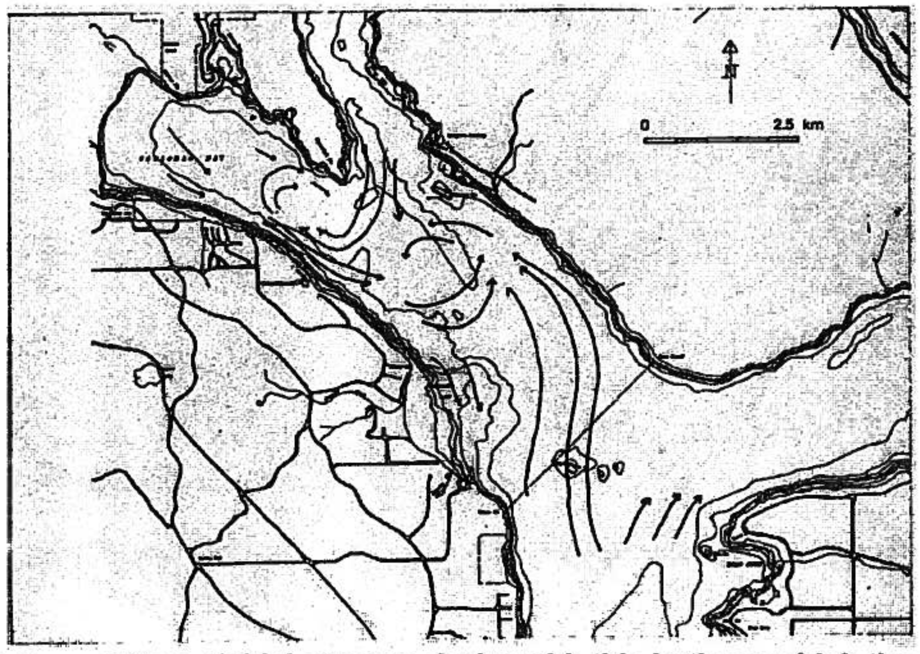


Figure 4.0. Interpretation of tidal streams during ebb tide in times which the ebb current from Saanich Inlet flows north into Satellite Channel. Arrows indicate direction only and not magnitude. (after Kashino, 1991)

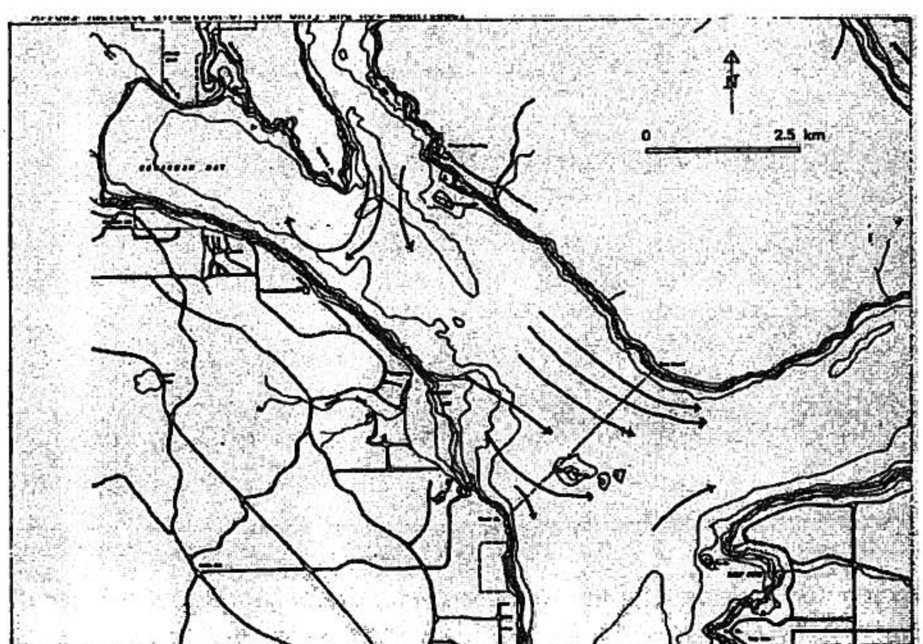


Figure 5.0. Interpretation of tidal streams during ebb tide in times which the ebb current from Saanich Inlet flows east into Satellite Channel. Arrows indicate direction only and not magnitude. (after Kashino, 1991)

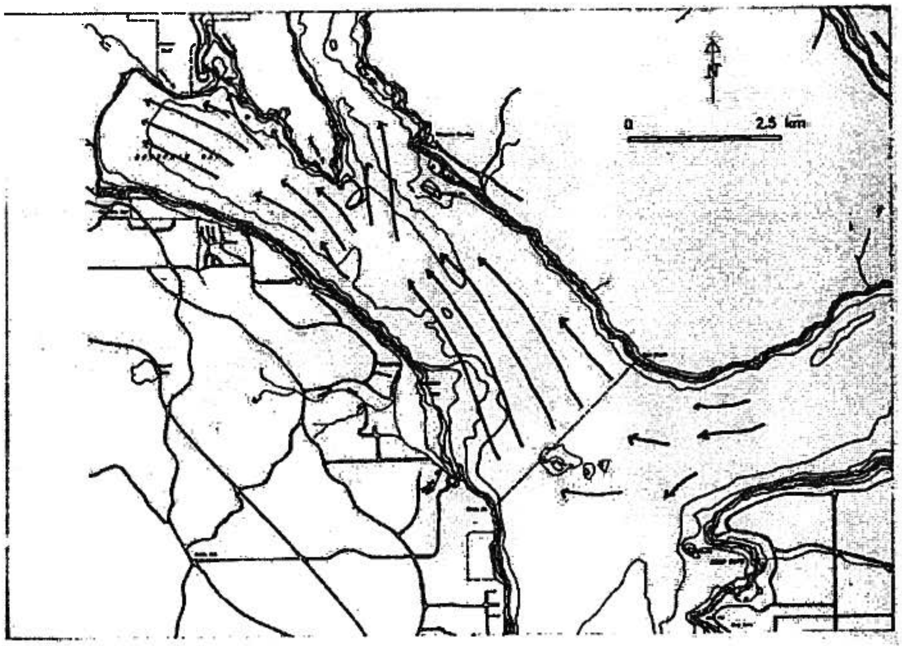


Figure 6.0. Interpretation of tidal streams during flood tide. Arrows indicate direction only and not magnitude. (after Kashino, 1991)

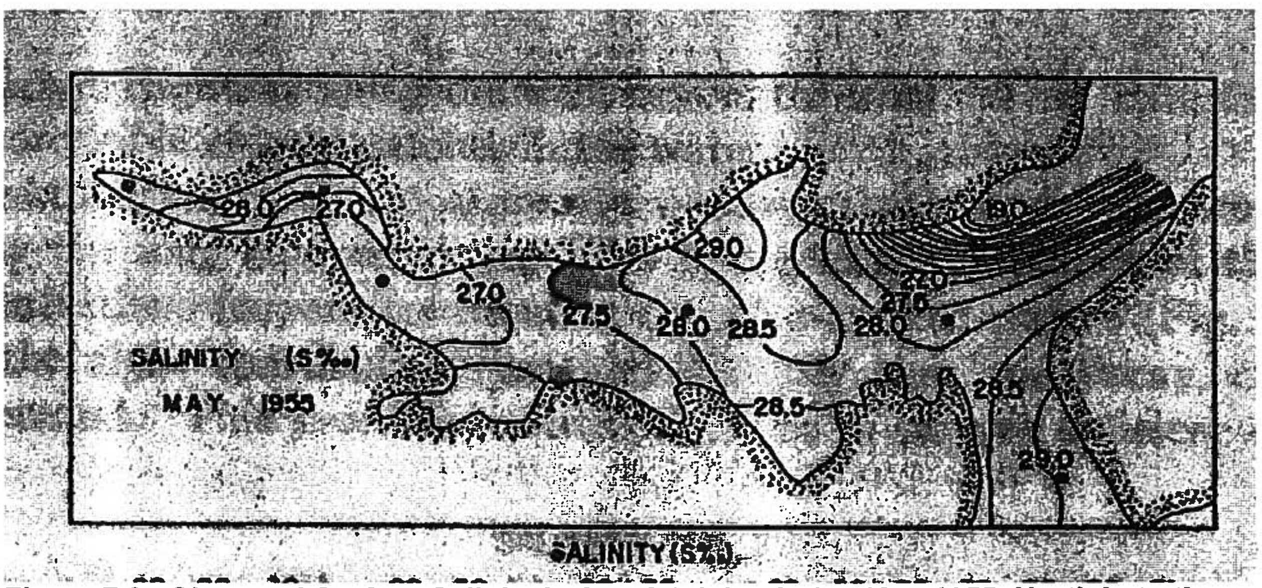


Figure 7.0. Observed Surface Salinity in Saanich Inlet during May 1955. North is to the right. Note that freshwater from Cowichan Bay hugs the Western shore of Saanich Inlet as a result of Coriolis Effect. (after Herlinveaux, 1962).

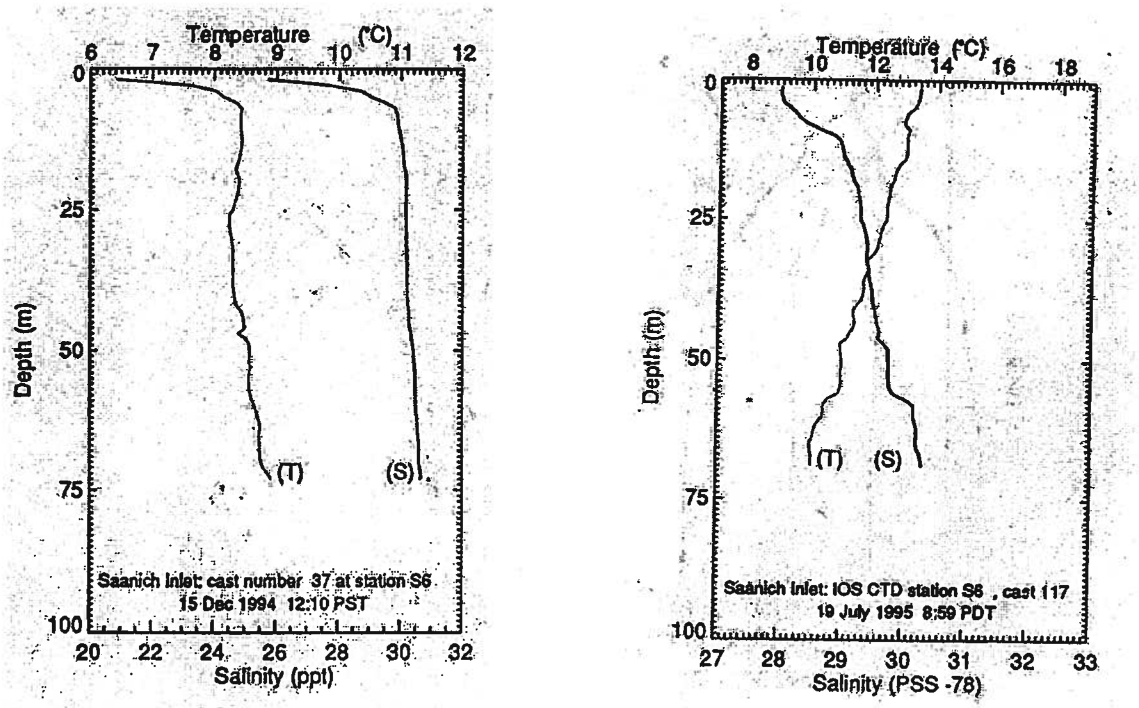


Figure 8.0. Temperature-Salinity Profiles near Hatch Point for Winter (left) and Summer (right). (after Cross and Chandler, 1996).

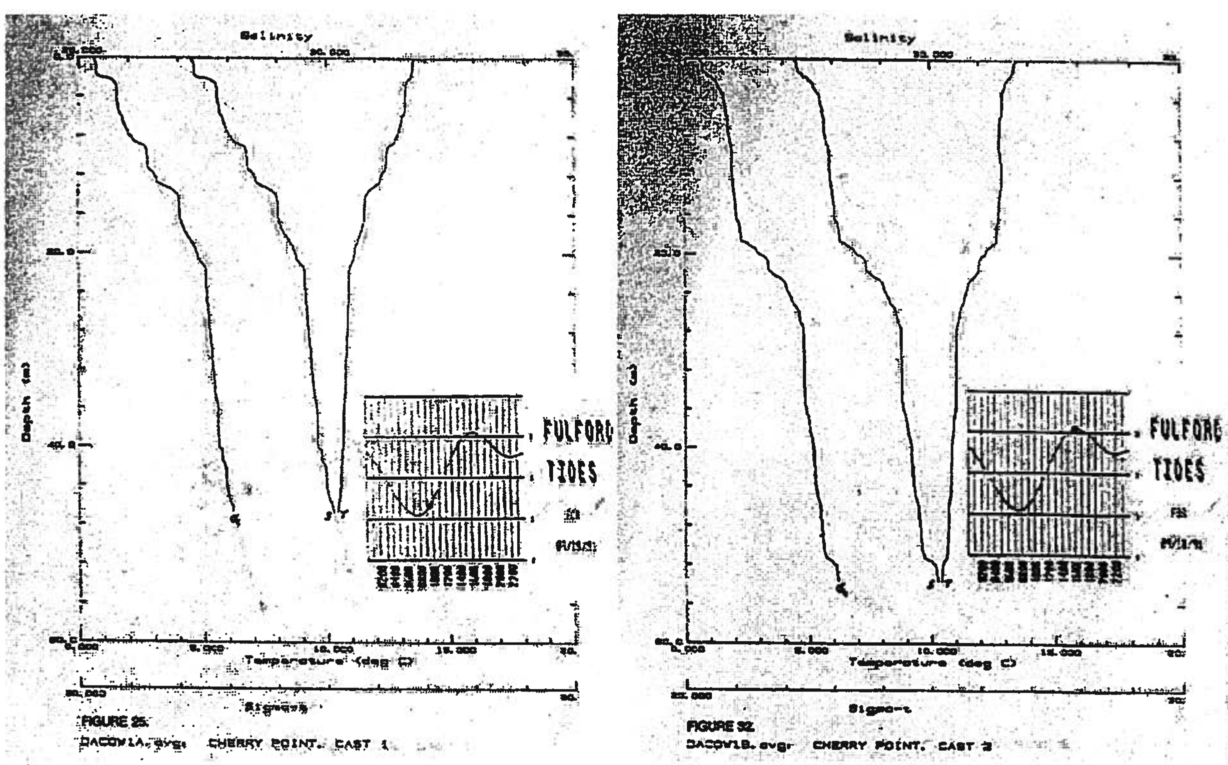


Figure 9.0. Temperature-Salinity Profiles near Hatch Point during Summer Ebb Tide (left) and Summer Flood Tide (right). (after Kashino, 1991)

APPENDIX D ACKNOWLEDGMENTS

APPENDIX D ACKNOWLEDGMENTS

The following members of the combined Technical Liquid Waste Advisory Committee and the Local (Public) Liquid Waste Advisory Committee have been influential in the preparation of this report.

Director Charlie Boas, (E.A. "A")
Director Bill Davies, (E.A. "B")
Director Richard Hughes, (E.A. "C")
Tom Anderson, Manager, Development Services
Katie Tompkins, Planner, Development Services
Andrew McTaggart, Ministry of Municipal Affairs
Glen Smith, Ministry of Health
John Finnie, Ministry of Environment
Duncan McLaren, Ministry of Environment
Eric Bonham, Ministry of Municipal Affairs
Rick Calder, Brentwood College
Mark Hardy, Shawnigan Lake
Ray Hollings, Shawnigan Lake School
Phil Wong, Environment Canada
Bob Lye, P.Eng.
Michael Renning
David Towner
Michael Skene
Jim Taggart
Gerald Farrow
Neil Stuart
Gordon Martin
Gerald Patterson
Malcolm Oakes
Peter Cotsworth
Earl Brown, Earl's Septic
Sarah Middleton
Stu Ring
Graham Bradley, School District 65
Brian W. D. Dennison, P.Eng., Project Engineer, CVRD
Derek S. York, P.Eng., Manager, Engineering Services, CVRD

The following representatives of Provincial Government Ministry's and specific facilities provided valuable input and data.

G.E. Oldham, Ministry of Environment, Lands and Parks, Nanaimo
Lloyd Erickson, Ministry of Environment, Lands and Parks, Nanaimo
Duncan McLaren, Ministry of Environment, Lands and Parks, Nanaimo
Russ Liborion, Ministry of Environment, Lands and Parks, Nanaimo
Dale Wetter, Ministry of Environment, Lands and Parks, Victoria
Bill Kangasniemi, Ministry of Environment, Lands and Parks, Victoria
Glen Smith, Ministry of Health
Gerald Acorn, Ministry of Health
Bob Lye, Arbutus Ridge
Ralph Cleasby, Sherwood Waterworks
Miles Ferry, Bahai School