WASTE MANAGEMENT PLAN FOR ELECTORAL AREAS A, C, & D

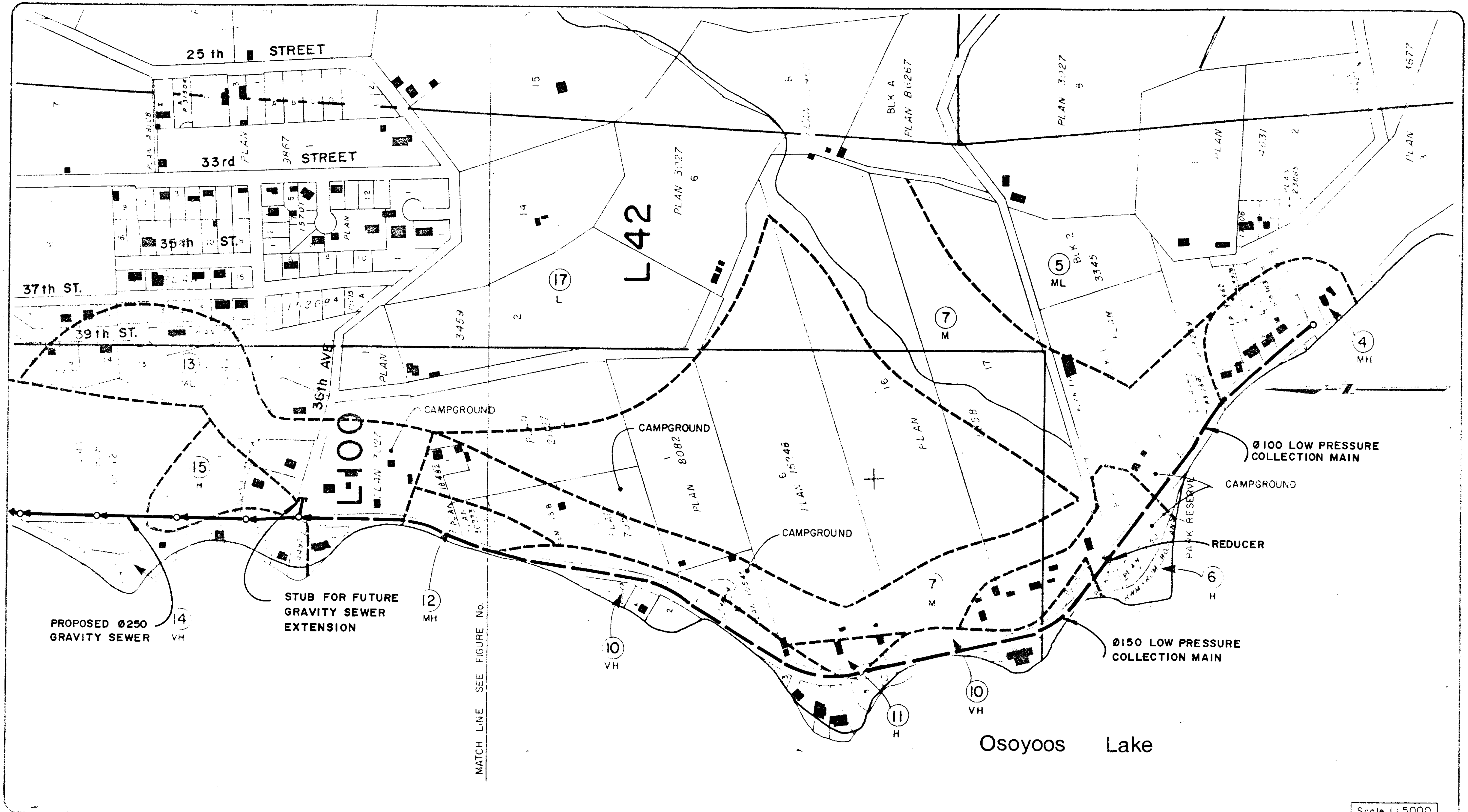
STAGE ONE REPORT

Part 2
Analysis of Alternatives

Regional District of Okanagan Similkameen

TRUE T.R. Underwood Engineering

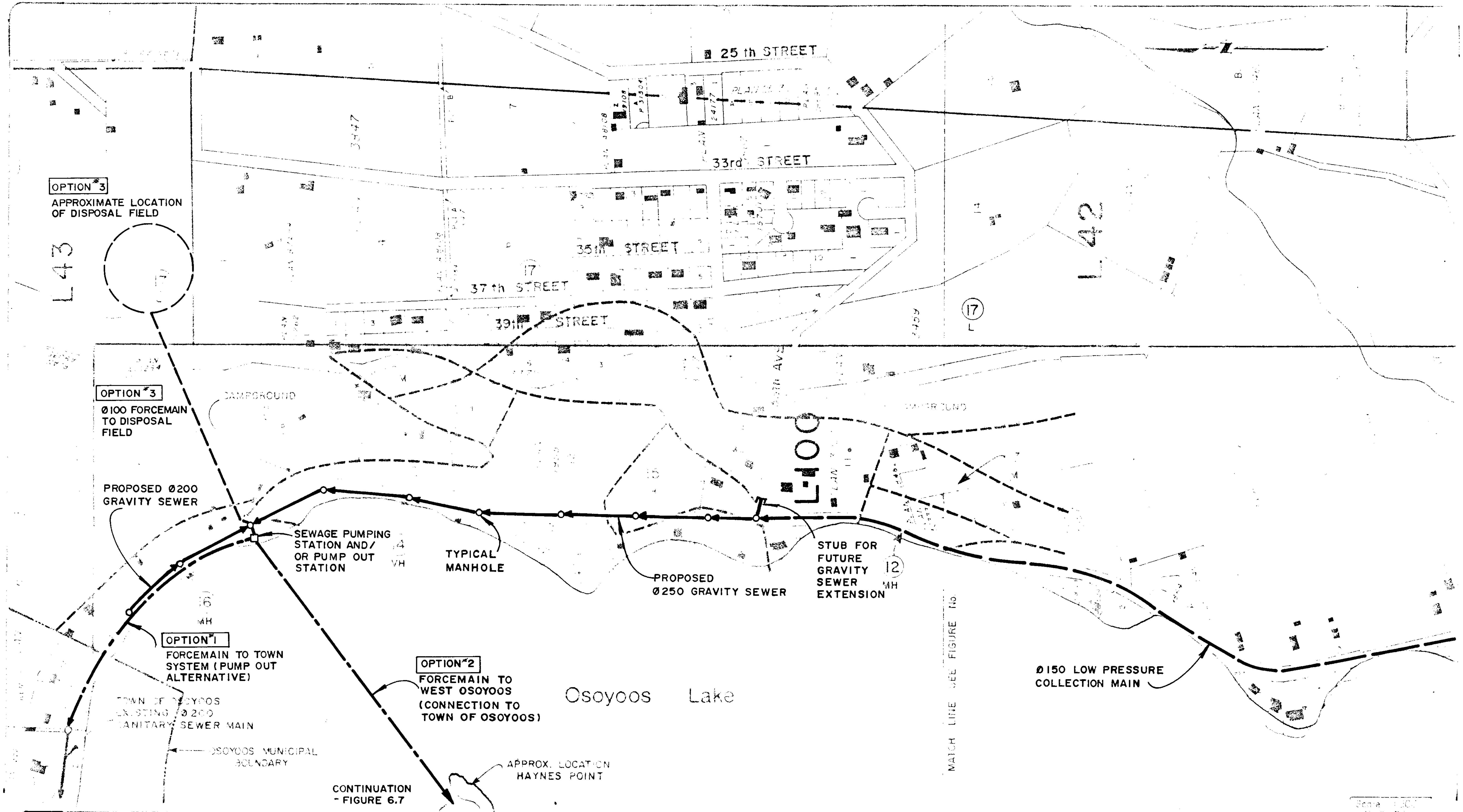
MARCH, 1988



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 6.5
South East Sector
Osoyoos Rural Area
Electoral Area A



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 6.6
South East Sector
Osoyoos Rural Area
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STAGE ONE REPORT
WASTE MANAGEMENT PLAN
FOR ELECTORAL AREAS A, C, & D

REGIONAL DISTRICT OF OKANAGAN SIMILKAMEEN

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5.1 General

The preceding sections describe wastewater related concerns, with emphasis on phosphorus loading, in Electoral Areas A, C, and D. In many cases, specific problem areas have been described. A major objective of this Waste Management Plan is the analysis of options to resolve these concern areas. In general, two categories of possible "solutions" will be assessed to address wastewater related problems.

One category of solutions involves feasibility evaluations of alternative sewerage systems. The objective is to describe an alternative sewerage system which will eliminate concerns related to existing septic tank systems by the construction of an alternative system to replace the septic tanks. The alternative system will involve a type of community collection system which will convey wastewater to a connection to a municipal system or a new community treatment and disposal system. The alternative system strateqies will usually apply to areas of concentrated development having a history of unsatisfactory septic tank performance and/or an unacceptably low phosphorus removal efficiency.

Alternative system strategies will not be universally applicable to Electoral Areas A, C, and D. In rural areas, the population density is not sufficient to make an alternative system involving collection mains feasible. In these areas, general policies are proposed which are intended to, at a minimum, maintain the status quo in terms of phosphorus removal efficiencies and loadings. Application of these wastewater related policies in many instances may result in a gradual reduction of phosphorus loading with time. These policy-type strategies would also apply to concentrated development areas where alternative systems prove to be economically or technically unfeasible.

The following sections describe in more detail the type of solutions which will be addressed by this Waste Management Plan.

5.2 Alternative Sewerage Systems

5.2.1 Alternative Sewerage System Options

Components of any alternative sewerage system proposal will include collection, treatment and disposal systems. While there is an interrelationship among these components, there are options available for each. These options or general design approaches are briefly described in sections following.

5.2.1.1 Collection Systems

(1) Conventional Gravity Collection System

The conventional gravity collection system is the standard design approach used by municipalities. The system usually comprises 200 mm or larger diameter pipes in road rights of way and manholes for maintenance access at intervals averaging 120 m. Conventional gravity sewer systems are designed to provide a down gradient to the treatment plant with minimum slope criteria being established to minimize solids settlement in the collection system.

Wherever possible, conventional gravity sewer systems are preferred for the following:

- system collects raw wastewater from each house. A 100 mm diameter pipe connects directly from in-house plumbing to the collection main. Homeowner operation and maintenance requirements are minimal.
- systems generally need little or no maintenance by the operating utility. System flushing at one to three year intervals represents the only major maintenance requirement.
- systems are energy efficient by virtue of the gravity flow design.
- systems are preferred by members of the public because on-property components simply consist of a gravity flow pipe requiring minimal maintenance.

The primary limitation affecting the feasibility of conventional gravity sewer systems is capital cost. Conventional systems are feasible where the density of housing development is at least urban density residential and where sufficient natural "topography" is available. Conventional system costs become uneconomic when the service area is essentially flat, where there is a rural housing density and/or when bedrock, existing utilities including pavement and high groundwater table conditions impact construction costs.

Relative to this Waste Management Plan, conventional gravity collection systems are evaluated when one or more of the following is applicable:

- the service area adjoins a municipal system presently serviced by a conventional gravity collection system
- service area comprises urban density residential development
- adequate topography is available to minimize lift station requirements
- road restoration costs will be comparable to other collection system options.

(2) Low Pressure Sewers

Low pressure sewerage systems comprise a forcemain in the street into which individual or groups of homeowners pump their wastewater. Low pressure systems ideally are designed to collect septic tank effluent and thereby minimize solids related problems in the collection mains and wastewater pumps. The collection system simply consists of a pipeline in the street following the natural topography. Low pressure collection mains may be laid flat, uphill, etc. providing the total system operating head is within the operating characteristics of the pumps at individual connections.

Low pressure systems are generally an economical option for wastewater collections when one or more of the following apply:

- proposed service area is essentially flat, i.e., little or no elevation difference
- service area comprises low density development

- high groundwater table conditions may be present
- boulevard areas may be sufficient to install low pressure main without major interference with paved surface.

The primary advantage of low pressure collection systems is capital cost. As compared to conventional gravity collection systems, low pressure systems have higher operation and maintenance costs. Users of the system require individual pumps and a septic tank, which are components not necessary with a conventional gravity system.

With respect to this Waste Management Plan, a low pressure system is most applicable to lakeshore areas having low or rural density development. High groundwater conditions will also be a construction complication in these areas. In lakeshore areas as described, low pressure systems may be 50% of the capital cost of conventional gravity systems. Low pressure systems are less applicable to areas where construction constraints include bedrock, pavement restoration and other utilities. In these areas, low pressure systems may represent about a 20% capital cost reduction as compared to conventional gravity systems.

(3) Gravity Septic Tank Effluent Collection System

This collection system design approach is essentially the same as a conventional gravity system except that septic tank effluent is collected. With collection septic tank effluent, manholes used in a conventional system are deleted and pipeline sizes are reduced. Collection mains in these systems may be installed at a constant or variable grade. In some instances, short sections of adverse or uphill grade can be accommodated providing all connected septic tanks are above the hydraulic grade line of the collection main. Gravity septic tank effluent collection systems can generally be constructed for 75% to 85% of the cost of a conventional gravity system. Homeowners have to continue to operate septic tanks with this collection system.

Gravity flow septic tank effluent collection systems are most applicable to small scale systems within the R.D.O.S. Waste Management Planning area. With collection of septic tank effluent, no additional treatment prior to disposal to ground is required. By eliminating the need for a community treatment system, a significant capital cost saving is realized as compared to conventional gravity flow systems.

(4) Other Collection System Alternatives

The preceding sections describe three major collection system design alternatives which are considered most applicable to the R.D.O.S. Waste Management Plan area. Other collection system options include grinder pumps and vacuum systems. Grinder pump systems are essentially the same as the low pressure system except that raw sewage is pumped into the collection main by a grinder pump. Grinder pumps have proven to be expensive to the homeowner to purchase and maintain. Recognizing that all homes potentially serviced in the R.D.O.S. rural areas have septic tanks, grinder pump systems represent no benefit over more straightforward septic tank effluent pump systems.

Vacuum collection systems represent a complex technology both from the point of view of design and operation. The complexity of the system effectively precludes its application in the R.D.O.S. Plan area.

The concept of collection of wastewater to an individual or community tank with removal to a suitable disposal site by tank truck was mentioned at technical review meetings as an option warranting consideration. While the option of pump and haul is technically feasible, operating costs will be significant. An average single family house will generate about 1.1 cubic metres of wastewater per day or 35 cubic metres per month. From discussions with pump-out contractors, the minimum charge per 9.0 cubic metre load will be about $40. Operating costs for a pump and haul system will, therefore, be $160 per month. The monthly cost of $160 effectively eliminates pump and haul as a feasible option. The feasibility of pump and haul may be enhanced if it is combined with in-house water conservation systems to reduce wastewater volumes. Conservation systems are appropriate for new house construction but would represent a major refit capital cost in an existing dwelling unit. All factors considered, pump and haul is not concluded to be a reasonable long term wastewater collection option.

5.2.1.2 Treatment and Disposal Options

(1) Connection to an Existing Municipal System
The concept of a connection to an existing municipal system is generally preferred over alternatives involving a separate treatment and disposal system. Consolidation with a municipal system reduces overall operation and maintenance costs, avoids duplication of Public Works functions, and eliminates the requirement for a separate administrative system. Consolidation with an existing municipal system generally represents a lower risk of a major malfunction occurring.

With respect to the R.D.O.S. Waste Management Plan, there are three existing municipal-type sewerage systems in the planning area. Servicing rural areas bordering these municipal systems by a connection to the system is a preferred alternative.

(2) Septic Tank Effluent Disposal to a Community Field
This alternative simply provides collection of septic tank effluent from all houses and disposal in a community field. The system is ideal for relatively small design populations. Advantages of the option include:

- system is simple, and requires no specialized operator skills.
- while regular maintenance is necessary, the schedule is somewhat flexible consisting primarily of routine inspection and septic tank pump-out.
- with relocation of septic tank discharge away from lakeshore areas, a significant "gain" in phosphorus removal efficiency may be achieved.

A community disposal field is most feasible for a relatively small design population. The alternative is not generally feasible for design population greater than 200 and/or where soils have low permeability rates. In these cases, the area requirements for the disposal field effectively eliminate the concept in terms of being feasible.

(3) Sewage Treatment Plant and Disposal to Ground

When design populations for alternative systems exceed the range of 200 to 300 people, provision of a treatment plant with effluent disposal to ground becomes more cost effective. Higher effluent quality achieved by a treatment plant enables reducing the disposal system area requirements as compared to a system discharging septic tank effluent.

Within the R.D.O.S. Waste Management planning area, the alternative of a small sewage treatment plant discharging treated effluent to ground is considered when a connection to an existing municipal system is not feasible and when the design population is greater than 200 to 300 people. The treatment plant alternative permits the incorporation of phosphorus removal in the system, and thereby enables use of ground disposal sites having higher transmission ratings. Treatment plant systems are also compatible with a conventional gravity collection system, which is an advantage over small community disposal systems where septic tank effluent is collected.

The selection of a specific type of treatment plant for a given service area is beyond the scope of this Waste Management Plan. Recognizing that design populations are, in all cases, less than 1000 people, it is important that the selected system be simple and require only periodic maintenance or operator attention.

5.2.2 Areas for Alternative Sewerage Systems

On the basis of the phosphorus loading summaries presented in Tables 4.10 and 4.11, ten (10) sectors or areas in Electoral Areas A, C and D have been selected for an evaluation of alternative sewerage systems. These ten sectors are briefly described as follows:

Electoral Area A

(1) Osoyoos Northwest Sector - Alternative waste management options are to be considered for the lakeshore area from the municipal boundary north to the north end of Osoyoos Lake. The objective would be to reduce the phosphorus loadings from Very High, High, and Moderately High rated polygons on the lakeshore. In the Northwest Sector of Osoyoos Lake, alternative systems offer the potential to reduce present phosphorus loadings by about 200 kg/year, which represents 76% of the total phosphorus loadings from the sector.

(2) Osoyoos Southeast Sector - Alternative sewerage systems are to be evaluated for the lakeshore area from the Osoyoos Town boundary to the U.S.A. border. The focus in this area will be to provide alternative system(s) for the campgrounds and lakeshore development in the area.

(3) Osoyoos Southwest Sector - The principal objective in this area would be to evaluate options for lakeshore development south of Haynes Point in the 16th Avenue area. It is probable that any alternative system would be sized to accommodate all low density development in the area including 85th Street, 87th Street and 91st Street. (See figure 6.7)

Electoral Area C

(4) Old Sawmill Road Area - From Table 4.11, semi-rural development in this area south of Oliver presently has an average phosphorus removal efficiency of about 52%. Alternative waste management systems are to be evaluated to service the entire sector located on the Okanagan River plain where phosphorus transmission ratings average High. The construction of a community sewerage system in the Sawmill Road area removes limitations relating to septic tanks and may, therefore, increase the opportunities for development (subdivision) in the area. The Regional District will have to ensure that community plan and zoning documents clearly define lifestyle objectives of residents in the area and that land use policies accurately reflect these objectives. Present septic tank system limitations may be the primary mechanisms by which the rural character of the area has been preserved.

(5) Tugulnuit Lake Area - The area south of Tugulnuit Lake is identified as a major future development area. The objective of alternative waste management systems in this area would be to service present and future development south of Tugulnuit Lake as well as perimeter development to the north.

(6) Gallagher Lake Area - Individual septic tank and tile field systems in the Gallagher Lake area have a 75% phosphorus removal rating. The development potential in the immediate vicinity of Gallagher Lake is also a concern. Alternative sewerage systems would be designed to service existing and proposed future development in the immediate vicinity of Gallagher Lake. A community sewerage system will reduce the phosphorus loading from septic tank and tile field systems to Gallagher Lake. Whether an improvement in apparent water quality of Gallagher Lake will result from a reduction in phosphorus loading is at this point uncertain. Gallagher Lake has not been evaluated in the same detail as other mainstream Okanagan Basin lakes by the Ministry of Environment. An evaluation study of the water quality of Gallagher Lake and the responses to phosphorus loadings is warranted.

(7) South Vaseux Lake - The principal factor for inclusion of the South Vaseux Lake area in the list for alternative system evaluation is the low phosphorus removal efficiency (46%) of existing septic tank and tile field systems. The objective would be to evaluate options for the concentrated development on the south end of the Lake which is situated on a Very High rated phosphorus transmission polygon. The alternative sewerage system will reduce the phosphorus loading to Vaseux Lake but whether this reduction will be reflected by an improvement in water quality is unknown. Being a shallow, productive lake, lake sediments likely represent a major source of phosphorus to aquatic vegetation.

Electoral Area D

(8) East Vaseux Lake - East Vaseux Lake warrants consideration for an alternative sewerage system for similar reasons described for the South Vaseux Lake area. Phosphorus removal efficiencies of existing septic tank and disposal systems in this area average 47%. Similar comments related to water quality under (7) South Vaseux Lake also apply to this area.

(9) Skaha Estates Area - The computed overall average phosphorus removal efficiency of septic tanks and tile fields in this area is 58% (see Table 4.10), significantly less than the objective of 80%. Any alternative system considered for Skaha Estates would include the entire development area.

(10) Kaleden Lakeshore Area - Lakeshore development between Sycle and Ponderosa Points in Kaleden has been identified as an area warranting consideration for an alternative sewerage system. The entire area comprises polygons having a rating of High or Very High resulting in an overall phosphorus removal efficiency for existing systems of 36%, the lowest of all sectors evaluated.

The preceding described sectors or areas are considered to have sufficient concentrations of development to warrant consideration of alternative wastewater management systems. Table 5.1 presents a revised inventory of phosphorus loadings in the three Electoral Areas with the assumption that the previously described 10 sectors were serviced by alternative systems.

The Penticton I.R. #1 also warrants evaluation of an alternative sewerage system. The Reserve is not mentioned in this section because it is technically outside of the Waste Management Plan boundaries. As shown in Table 4.10, the Reserve area along the north end of Skaha Lake is a major source of phosphorus to Skaha Lake.

TABLE 5.1

SUMMARY OF PHOSPHORUS REDUCTIONS
BY ALTERNATIVE SYSTEMS

SECTOR	PRESENT		REDUCTION BY ALT. SYSTEM*		RESIDUAL		P. REMOVAL EFFICIENCY	
	P. LOAD	POP.	P.	POP.	P.	POP.	PRESENT	REVISED
ELECTORAL AREA A								
o Northwest Osoyoos Rural	263.0	687	200	376	63.0	311	67%	82%
o Southeast Osoyoos Rural	100.4	571	70	93	30.4	478	88%	95%
o Southwest Osoyoos Rural	144.5	710	60	85	84.5	625	86%	87%
ELECTORAL AREA C								
o South Oliver Ext.Fringe	231.2	1347	0	0	231.2	1347	83%	83%
o Old Sawmill Road	190.7	396	130	207	60.7	189	52%	72%
o Tugulnuit Lake	277.4	1088	210	252	67.4	836	79%	87%
o North Oliver Rural	193.8	743	0	0	193.8	743	76%	76%
o Gallagher Lake	90.9	224	75	220	15.9	4	75%	**
o South Vaseux Lake	51.1	89	44	47	7.1	42	46%	83%
ELECTORAL AREA D								
o East Vaseux Lake	69.9	110	50	101	19.9	9	47%	**
o OK Falls Rural	59.2	253	0	0	59.2	253	77%	77%
o Skaha Estates	158.6	348	130	312	28.6	36	58%	**
o Kaleden Lakeshore	81.1	117	70	117	11.1	0	36%	**
o Kaleden Bench Area	84.3	683	0	0	84.3	683	89%	89%
o East Penticton Fringe	14.0	121	0	0	14.0	121	87%	87%
TOTALS - ALL ELECTORAL AREAS	2010.1	7487	1039	1810	971.1	5677		

* Reduction Values are Approximate

** Essentially Total Sector Population Serviced by Alternative System

Note: All Phosphorus Loadings are expressed as kg per year.

As shown in Table 5.1, the phosphorus loading in the Electoral Areas could be reduced from 2010 kg/year to 971 kg/year if alternative systems were provided in the previously described 10 areas. In percentage terms this reduction is about 50%. The alternative systems would reduce the permanent population using septic tank and tile field systems from the present 7500 to 5700 approximately. The overall average phosphorus removal efficiency of all remaining individual septic tank and tile field systems would be about 85%, up significantly from the present planning area average of 75%.

5.3 General Waste Management Strategies

To this point, sewerage system alternatives have been described which are to be evaluated for ten (10) specific or focus areas within the Waste Management Planning area. General strategies or policy statements are presented which will apply to rural sectors not having a population density to warrant consideration of an alternative system, i.e., South Oliver Extended Fringe, and to areas where alternative systems prove to be unfeasible.

Before presenting specific policies which would form the basis for the general waste management strategies, the basic objectives are:

- where possible, achieve phosphorus loading reductions from individual systems presently on Very High, High or Moderately High polygons.
- reduce the possibility of increased phosphorus loadings in the rural areas by reducing the potential of development on Moderately High or higher rated polygons.
- provide a series of Waste Management related policies which can be incorporated into Community Planning documents and ultimately, zoning bylaws.

The general policy statements presented herein have evolved through the Technical workshop sessions of the Waste Management Plan and review meetings with the Ministry of Environment and the administrative staff and Area Directors of the R.D.O.S. Each proposal for general waste management related strategies is described following.

(1) Alternative On-Site System Design Criteria

Sewerage system construction will not eliminate all individual septic tank systems on Moderately High or higher rated polygons. For new system construction and reconstruction of existing malfunctioning or failed systems, revised on-site system design criteria are proposed which will maximize phosphorus removal efficiencies to the greatest extent possible. Specific requirements to be incorporated into these design standards might include:

- greater vertical/horizontal separation distances from water courses if possible.
- specifications for larger disposal fields to maximize effluent/ soil contact.
- requirements for increased phosphorus removal by chemical addition.

(2) Revisions to Increase Minimum Residential Parcel Size Criteria

Current R.D.O.S. zoning bylaw provisions specify a minimum parcel size of 836 m^2 (9000 $ft.^2$) for subdivisions when community water service is available. This parcel size significantly reduces the opportunity and flexibility to implement alternative design criteria to maximize phosphorus removal.

Revising the minimum parcel size requirements from 836 m^2 to 1672 m^2 (18000 $ft.^2$) is considered minimum to implement alternative on-site design criteria. Application of the revised minimum parcel criteria is most important in areas having a Moderately High or higher phosphorus transmission rating. Consideration may also be given to increasing the minimum parcel size to 1672 m^2 throughout the Regional District. This larger parcel size will significantly reduce the possibility of septic tank operating problems related to mounding effects between systems.

(3) Alternative System Evaluations at Time of Subdivision

Individual septic tank and tile field systems will likely continue to be used for wastewater disposal in the rural areas of Electoral Areas A, C and D. A policy may be considered for adoption by the Regional District which requires developers to evaluate other sewerage system options at the time of subdivision. The objective is to identify an alternative approach should septic tank operation prove to be unsatisfactory over the long term future. As part of this policy, the Regional District may require the installation of components of a sewage collection system and the dedication of rights of way for future use. As will be shown in subsequent sections of this report, construction of collection systems in developed areas is an expensive undertaking. This policy would make future community sewerage system construction more economically feasible. Collection mains do not represent a major capital cost if installed at the time of subdivision in conjunction with other utilities.

(4) Specification of Minimum Phosphorus Removal Criteria

Medium density residential proposals are identified in Community Plans for Electoral Areas A and C as possible future developments. The Community Plans specifically require that wastewater treatment and disposal systems be constructed in accordance with Ministry of Health and Environment standards. The Regional District may consider amendments to these Community Plans which also require a specific phosphorus removal efficiency for the wastewater works. The specification of a phosphorus removal efficiency will not reduce the development potential of the defined areas, but instead recognizes the significance of reducing or minimizing phosphorus loadings to Okanagan Basin water courses. Specific examples of where this policy may apply includes medium density development areas at the north end of Osoyoos Lake, north of Oliver and the Gallagher Lake area.

(5) Septic Tank Pump Out

The long term satisfactory operation (from a hydraulic point of view) of septic tank and tile field systems is enhanced with regular septic tank pump out. Policy alternatives may be considered by the Regional District to increase the awareness of the public as to the importance of septic tank pump out or the implementation of a system whereby the Regional District assumes a direct role in making sure systems are pumped out on a regular basis. Increased public awareness may be achieved by simply preparing a brochure which is mailed to all rural area residents with their tax notices.

The Regional District could take a more direct role by imposing a levy on all single family residential properties which would pay for pump out service every three years. In this case, each homeowner would qualify for a septic tank pump out service once every three years with the cost paid for by the Regional District from funds collected for that function.

This policy has implications on works on private property which would have to be carefully considered in the preparation of necessary bylaws. There is no doubt that a septic tank pump out program offered by the Regional District would be a positive step toward ensuring optimum performance of individual systems.

(6) Waste Management Objectives for Agricultural Operations

Small livestock operations in the Waste Management Planning area are generally located adjacent to the Okanagan River. Waste from these livestock represents a significant source of phosphorus and other materials to Okanagan Basin water courses. The Regional District may consider implementing modifications to agricultural zoning bylaws which recognize waste management recommendations as compiled by the Ministry of Agriculture. The objective of this policy is not to impose unrealistic requirements on the agricultural industry, but at minimum, increase the awareness of individual operators. The Ministry of Agriculture guidelines describe acceptable practices for waste storage and transportation, livestock watering and runoff control.

(7) Septic Tank System Operational Record

This Waste Management Plan will likely be reviewed and amended at some future date to reflect changes in Community Plans and/or revised environmental quality objectives. A data base summarizing malfunctions and failures of septic tank systems in the three Electoral Areas would be of assistance in the future reviews of the Waste Management Plan. In this regard, the Regional District may consider discussing a referral system with the Ministry of Health whereby reports of system malfunctions and repairs are filed with the Regional District. These statistics would be of significant assistance in defining problem areas and priorities for the evaluation of community sewerage system alternatives. Statistics related to septic tank system performance may also assist in the formulation of land use policies.

Implementation of all or some of the general strategies or policy statements may be of equivalent or greater importance than construction of alternative sewer systems. Prior to formal implementation of the policies, it is recognized that specific areas in the three Electoral Areas as areas of high concern or environmental control zones may be necessary. A reasonable definition of environmental control zones may be the inclusion of all phosphorus polygons having a Moderately High or higher transmission rating.

At this Stage One Report stage, the general range of what are considered as reasonable general strategies is defined. The Stage Two Report will evaluate the implications of the policy recommendations and the methods for implementation in more detail.

6.1 Northwest Sector - Osoyoos Rural Area

6.1.1 Description

The Northwest Sector of the Osoyoos Rural Area is the lakeshore area extending from the Osoyoos municipal boundary north to the north end of Osoyoos Lake. The sector is illustrated in Figures 6.1 to 6.3 inclusive. Overall, the sector includes approximately 5.8 km of lake area. As shown in Figures 6.1 to 6.3, concentrated "nodes" of development along this length represent the major concern with respect to phosphorus loading. These development nodes, beginning at the Osoyoos municipal boundary, are briefly summarized as follows.

Adjoin. Municipal Boundary	Lacey Point	30 homes	M & MH polygons
1 km North	104th Ave. area	12 homes	MH polygons
2.8 km North	148th Ave. area	13 homes	VH polygon
3.9 km North	Inkaneep Point	15 homes	VH polygon
4.5 km to 5.5 km	Lakeshore Houses	25 homes	MH,H,M polygons
5.8 km	Willow Beach	30 homes	VH, H polygons

6.1.2 Alternative System Planning Constraints

A major constraint associated with planning of alternative sewerage systems in the Northwest Sector is the lakeshore length (approximately 5.8 km) and the "spaces" between each of the housing clusters. As an example, there are no lakeshore houses for a distance of 1.8 km between the 104th Avenue area and the 148th Avenue area. The distance along the lakeshore is a major constraint associated with the feasibility of a single collection system which would collect wastewater from all the housing clusters.

There is no vacant land immediately west of the lakeshore area that could be used for a treatment and disposal system. The area west of the lakeshore to Highway #97 is completely developed as orchard.

Development of a disposal system for the Northwest Sector will require, at a minimum, easement acquisitions from orchards in the area.

6.1.3 Waste Management Options

Option 1 - Collector System Connected to Town System

This alternative would involve construction of a forcemain north from the Town of Osoyoos following the old CPR right of way to the north end of Osoyoos Lake. Each development cluster would have a small collection system and a pump station which would pump collected wastewater into the central collector. The old CPR right of way makes this collection system feasible. Without the north to south right of way, easement acquisition and restoration would likely prove to be major constraints. It is envisioned that the north-south lakeshore collection system in the Northwest Sector would connect to the Town of Osoyoos sewerage system. The Regional District should pursue access to the CP right of way for a future sewer main installation through discussions with CP Rail and the Provincial Government.

A variation of this option is the opportunity to construct the system in phases in a south to north direction. Initial construction phases would service Lacey Point and possibly the 104th Avenue area with subsequent phases involving extensions to the north.

Option 2 - Separate Collection-Disposal Systems for each Development Cluster

Opposite to the concept of a single collector system, this option would involve the construction of a separate treatment and disposal system for each development cluster in the Northwest Sector. Each system would be designed for 10 to 30 houses. Options to be considered for these separate cluster systems include:

- collection and ground disposal on soils of ML or L phosphorus rating
- collection and disposal using enhanced phosphorus removal system on CPR right of way
- collection to holding tanks for removal by pump out
- collection and pumping of effluent to the Town of Osoyoos sewerage system.

Each of the above four options have varying degrees of applicability to the housing clusters in the Northwest Sector. As an example, connection to the Town of Osoyoos sewerage system remains as an obvious option for Lacey Point.

6.1.4 Collection System Connected to Town of Osoyoos

6.1.4.1 System Description

A common collection system which would service all lakeshore development in the Northwest Sector and deliver all collected wastewater to the Town of Osoyoos is illustrated in figures 6.1, 6.2 and 6.3. Figure 6.1 illustrates the north end of a gravity trunk sewer extension from the Town of Osoyoos to Lacey Point. From Lacey Point north a 150 mm forcemain following the CP Railway right of way is proposed north to Willow Beach at the north end of Osoyoos Lake. The overall length of the 150 mm forcemain is 5750 m. A collection system is proposed in each of the six lakeshore housing development clusters which would terminate in a lift station designed to pump into the 150 mm forcemain.

The collection system would be constructed from south to north beginning in the Town of Osoyoos. From the terminus of an existing sanitary sewer main in the Town on the CPR right of way near 70th Avenue, a gravity sewer extension is proposed to the Lacey Point area. The overall length of the gravity trunk main extension is 1100 m to the end in the Lacey Point area designated as forcemain station

0+000. Sewer mains serving sectors of the Town of Osoyoos immediately adjacent to Lacey Point do not have adequate hydraulic capacity for the complete Northwest collection system. Existing sewer mains on 83A, 85 and 87 Streets in the Town of Osoyoos are 150 mm (6") mains which flow south (see figure 6.1) and discharge into a small lift station. There is inadequate hydraulic capacity in these collection system components to accept wastewater from either all or a portion of the Northwest Sector area of Electoral Area A.

A conventional gravity collection system is proposed in the Lacey Point area as illustrated in figure 6.1. Houses west and above the CP right of way would connect by gravity to the trunk sewer extension from the Town of Osoyoos. Sectors west and below the CPR right of way would be serviced by a conventional collection system with collected wastewater being pumped into the gravity trunk sewer. For the most part, houses on Lacey Point can be serviced by a conventional collection system. Homes at the south end are significantly lower than the road and can only be served by pumping septic tank effluent "up" to the collection line.

The second housing area serviced is in the vicinity of 104th Avenue as illustrated in figure 6.1. Service to this area requires 1000 m of 150 mm forcemain north from Lacey Point. Except for homes at the south end, all homes in the 104th Avenue vicinity would be serviced by a conventional collection system terminating in a lift station at the north end as illustrated in figure 6.1.

The concept of a small collection system terminating in a lift station pumping into the 150 mm forcemain on the CP right of way is proposed on Roberts Point (polygon #37), Inkaneep Point, and housing areas at the north end of Osoyoos Lake. Collection systems serving Roberts and

Inkaneep Points are principally conventional gravity systems. In each area several houses can only be serviced by individual pumping of septic tank effluent. Lakeshore development at the north end of Osoyoos Lake (designated 87th Street and 194th Avenue areas) can only be serviced by low pressure systems because of the elevation difference between the access road and houses. In these two areas, each house would pump septic tank effluent into the collection system. As illustrated in figure 6.3, no collection system is proposed in the Willow Beach area. There is no formal subdivision in the Willow Beach area, therefore, a single service connection would be provided for the entire area.

6.1.4.2 System Design Criteria

The collector system which would collect wastewater from lakeshore areas in the Northwest Sector of the Osoyoos Rural Area would provide sewer service to existing houses, present subdivided but vacant lots, and population growth in accordance with the Rural Area Settlement Plan. Population growth anticipated in the sector is described in detail in section 4.1.2. The design population criteria for the common collector alternative is presented in Table 6.1.

The collector system would provide sewer service to a 1986 estimated population of 376 which is anticipated to increase to 600 by year 2007. No provision has been made in the design for service to areas other than the seven housing areas listed in Table 6.1. The system could, however, be oversized if considered appropriate, to accommodate future development areas along the lakeshore which have not been identified in the Rural Area Settlement Plan.

The construction of a sewerage system into the Northwest Sector could result in development proposals in the area which may not be otherwise feasible. In general, this future development would be located on the lakeshore and east of the CP Railway right of way. Development of this strip of land would not impact the ALR boundaries in the area. Specific examples of possible development in this area include:

- development of lakeshore property at station 1+500 of the collector (see figure 6.1). Preliminary inquiries about development of this property have been received by the Regional District.

- development of vacant land formerly used in association with the packing house at collector station 2+000 (see figure 6.2).
- subdivision of small holding properties in the 87th Street and 194th Avenue areas (see figure 6.3).
- redevelopment of any existing single family lots in the area to medium density recreation related land use.

The above illustrates some development potential in the area which justifies consideration of oversizing of the collector system. None of the above noted possible development proposals are addressed by the present Community Plan.

TABLE 6.1

DESIGN POPULATION - NORTHWEST SECTOR COLLECTOR

A) Present - 1987

AREA	POLYGONS	RESIDENTIAL UNITS	POPULATION	SEASONAL
Lacey Point	35 & 36	34	99	
104th Ave.	35	13	38	
Roberts Point	37	13	38	
Inkaneep Point	38	15	44	10 sites
87th Street	48, 36, 39	14	41	
194th Avenue	49	10	29	
Willow Beach	50 & 51	30 +	87	80 sites

Total Present Population 376

Average Daily Sewage Flow

Residences	171 m^3/day
Seasonal	20
Total	**191 m^3/day (42,000 Igpd)**

B) Projected - 2007

AREA	POLYGONS	RESIDENTIAL UNITS			TOTAL	POPULATION	SEASONAL
		Present	Vacant	Future			
Lacey Pt.	35 & 36	34	8	22	64	186	
104th Ave.	35	13	0	0	13	38	
Roberts Pt.	37	13	4	-	17	49	
Inkaneep Pt.	38	15	3	0	18	52	10 sites
87th Street	48,36,39	14	3	-	17	49	
194th Ave.	49	10	8	-	18	52	
Willow Beach	50 & 51	30	0	30	60	174	80 sites

Total Design Population 600

Projected Average Daily Sewage Flow

Residences	272 m^3/day
Seasonal	20
Total	**292 m^3/day (64,000 Igpd)**

Table 6.2 presents data for phosphorus loadings to Osoyoos Lake with the construction of the Northwest Sector collector system. At present, a population of 687 uses individual septic tank and tile field systems which contribute an estimated 263 kg of phosphorus per year to Osoyoos Lake. The Northwest Sector sewage collector system would service 376 people in the area which represents 205.6 kg of phosphorus per year (78% of the total for the sector). The system would leave an estimated population of 311 on septic tank systems which have an estimated residual loading of 57.4 kg of phosphorus per year. The average removal efficiency of these remaining systems is 82%.

Data for projected populations and phosphorus loadings in year 2007 is also given in Table 6.2. By year 2007, it is anticipated that a population of 600 would be served by the system. If this population used septic tank and tile field systems, the phosphorus loading to Osoyoos Lake would approach 282 kg/year. By year 2007, the sector population increases by 257 people, but the population using individual on-site systems increases by only 33. The Northwest Sector collector system, therefore, services the majority of future development in the area as indicated by a nominal increase in phosphorus loading from 57.4 kg/year in 1987 to 60.5 kg/year in year 2007.

The projected population for year 2007 of 944 given in Table 6.2 is some 56 people higher than the projection presented previously in section 4.1. The higher population in Table 6.2 reflects house construction on highly desirable lakeshore lots which at the present time cannot comply with Ministry of Health standards for on-site septic tank and field systems. If an alternative sewerage system is not constructed in the Northwest Sector, these lakeshore lots would remain vacant because minimum septic tank construction standards cannot be complied with. The additional population of 56 would be realized in this case.

TABLE 6.2

PHOSPHORUS LOADINGS - NORTHWEST SECTOR COLLECTOR

	PRESENT		2007 PROJECTION	
	POP.	P. LOADING*	POP.	P. LOADING
SECTOR TOTALS	687	263.	944	342.7
ALT.SYSTEM REDUCTIONS				
Lacey Point	99	33.6	186	43.7
104th Avenue	38	15.0	38	15.0
Roberts Point	38	25.4	49	30.6
Inkaneep Point	44	38.5	52	38.5
87th Street	41	9.2	49	9.2
194th Avenue	29	5.4	52	5.4
Willow Beach	87	78.5	174	139.8
TOTALS	376	205.6	600	282.2
SECTOR RESIDUALS	311	57.4	344	60.5

* kg per year

6.1.4.3 Capital Cost Estimates

Estimated capital costs for the Northwest Sector collector system as illustrated in figures 6.1, 6.2, and 6.3 are summarized in Table 6.3. The construction cost estimates start at the connection to the Town of Osoyoos system at the south end and give incremental costs for phased construction to the north. As an example, system construction up to and including the collection system in the Lacey Point area has an estimated capital cost of $134,000 plus $166,000 yielding a total of

TABLE 6.3

NORTHWEST SECTOR COLLECTOR SYSTEM - CAPITAL COST ESTIMATE

AREA SERVED	COST	SUBTOTAL	REDUCTION	COST PER Kg P
Trunk Sewer Extension	$134,000		0	
Lacey Pt: Sta.0+000	166,000	$ 300,000	33.6	$ 8930
104th Ave.: Sta.1+000	150,000	450,000	48.6	9560
Roberts Pt: Sta.1+650	196,000	646,000	74.0	8730
Inkaneep Pt: Sta.3+770	155,000	801,000	112.5	7120
Willow Beach:Sta.5+750	305,000	1,106,000	205.6	5380

$300,000. Extension of the system from Lacey Point north to include the 104th Avenue lakeshore area represents an incremental cost of $150,000 for a total of $450,000. Table 6.3 indicates that this extension would complete the construction of the forcemain on the CPR right of way to station 1+000 as illustrated on figure 6.1.

The capital cost estimates are expressed in terms of cost per kg of reduced phosphorus loading. As would be expected, the cost per kg of reduced phosphorus loading is highest for the initial segments of the system. In large part these high per kg P costs reflect the apportionment of the costs of the trunk sewer extension in the Town of Osoyoos. As an example, service to the Lacey Point area has an overall estimated capital cost of $300,000 or $8930 per Kg P removed. Of the $8930, $3990 of the per kg cost is attributed to the trunk sewer extension in the Town of Osoyoos.

As shown in Table 6.3, the per Kg P removed cost reduces from about $9000 for the first three segments of the system to $5380 for the overall system. This reduction of the per Kg P cost reflects the high loadings from the Willow Beach area as compared to the other four development areas to be serviced. Of the total estimated phosphorus loading reduction of 205.6 kg/year, the Willow Beach area accounts for 78.5 kg or 38% of the total.

6.1.4.4 User Rate Calculation

Three alternative formulae for assistance from senior government agencies are described in detail in section 3.4. Applying these alternative assistance formulae to the system capital cost estimates given in Table 6.3 results in approximate parcel taxes per benefiting parcel presented in Table 6.4. The parcel tax estimates given in Table 6.4 represent the net cost for capital cost debt retirement only. The total cost to benefiting parcels would also include a monthly system user fee. In the case of the collector system connected to the Town of Osoyoos, it is reasonable to assume that the Town user fee of $90.00 per single family dwelling would be charged against each benefiting parcel.

TABLE 6.4

NORTHWEST SECTOR COLLECTOR SYSTEM - USER COST ANALYSIS

AREA SERVICED	CAPITAL COST	BENEFITING PARCELS	PER PARCEL COST*			
			Formula 1	Formula 2	Formula 3	Formula 4
to Lacey Point	$ 300,000	40	$ 567	$ 258	$ 59	$ 800
to 104th Avenue	450,000	53	650	250	67	940
to Roberts Point	646,000	70	708	233	72	1030
to Inkaneep Point	801,000	88	700	216	72	1010
to Willow Beach	1,106,000	123	690	214	71	1000

*** Parcel Tax per year**

Formula 1 - 25% Revenue Sharing (B.C. Gov't.) + 6% OK Water Board

Formula 2 - 75% MOE - OK Water Quality + 18% OK Water Board on Trunk Sewers, Formula 1 on Collection System

Formula 3 - 75% MOE - OK Water Quality + 18% OK Water Board on all components

Formula 4 - No Assistance.

6.1.5 Cluster Collection and Disposal Systems

6.1.5.1 System Description

This alternative would provide a separate small scale community sewerage system for each cluster of houses in the Northwest Sector. Instead of one common system serving the complete sector as described in section 6.1.4, each cluster of houses would now be serviced by a separate sewerage system.

Figure 6.4 illustrates a low pressure collection system at Inkaneep Point from which collected septic tank effluent would be discharged to a conventional tile field in an orchard on the bench or following phosphorus removal, to a contour trench system on the old CPR right of way. Disposal to a conventional disposal field or a more convenient contour trench system following phosphorus removal are considered to be the most realistic disposal options for the small scale systems for each development cluster.

The conventional disposal system for Inkaneep Point illustrated in figure 6.4 is sited in an orchard having a low phosphorus transmission rating. The system is sized in accordance with Pollution Control Objectives of the Ministry of Environment and a percolation rate of 10 minutes per 25 mm. There is no alternative for this system other than the collection of septic tank effluent recognizing the lift on the effluent pumping station.

The ground disposal system following chemical addition for phosphorus removal is proposed to be located on the old CPR right of way and comply with the minimum 30 m setback from the lakeshore as required by the Ministry of Health. This system would involve a small diameter septic tank effluent collection system pumping wastewater to a community septic tank. Alum would be added to the tank from an adjacent storage tank for phosphorus removal. From the septic tank, treated wastewater is discharged to ground through a closing siphon. Phosphorus removals between 80 and 90% appear achievable with the system.

Relative advantages and disadvantages of the two design approaches for the community systems are summarized following:

- phosphorus removal system does not require easement acquisition in orchard area
- operating costs of the system with phosphorus removal will be higher than conventional disposal
- overall phosphorus reductions with two systems are probably comparable
- estimated capital costs for two systems are comparable, $129,000 for conventional disposal and $110,000 for phosphorus removal - ground disposal.

Recognizing that the concept of phosphorus removal prior to ground disposal is an unproven technology, the small scale system alternative has been evaluated on the basis of conventional disposal systems. In each case, phosphorus removal combined with more conveniently sited ground disposal is an alternative at comparable costs.

Using the collection and conventional disposal system illustrated in figure 6.4 for Inkaneep Point as the model for other development clusters in the Northwest Sector, the overall service to the Northwest Sector would include the following:

<u>Willow Beach, 194th Avenue and 187th Street Areas</u>

Low pressure collection system and pump wastewater to disposal field in gravel pit located north of Lot 406 (see figure 6.3 for location of Lot 406) which is within a ML rated polygon

<u>Inkaneep Point</u>

Low pressure collection system and pump collected septic tank effluent to disposal in orchards on bench (see figure 6.4) on L rated polygon

Roberts Point

Low pressure collection system and pump to conventional disposal field in orchards above on ML rated polygon. Concept is essentially the same as described for Inkaneep Point.

104th Avenue Area

Low pressure collection system and pump to conventional disposal system in orchards. Same system concept as described for Inkaneep Point. The disposal system is located on a ML rated polygon.

Lacey Point

A preliminary analysis of capital costs indicates that there is no capital cost saving associated with serving Lacey Point with a separate community disposal field. The separate community system would comprise:

- collection system within the Lacey Point area.
- approximately 500 m of forcemain to a disposal field in an orchard on Lot 505 or Lot 506 (see figure 6.1).
- a conventional disposal field for a design flow of 45 m^3/day (10,000 gpd) comprising 2560 metres of tile on a site area of about 1.3 ha.

The estimated cost of the pump station, forcemain and disposal system components is $150,000 including an allowance of $30,000 for land acquisition. This cost compares to $134,000 (from Table 6.3) for a trunk sewer connection to the Town system. In addition to capital cost, the connection to the Town system has an advantage of a lower operating and maintenance cost. Potential contamination of S.O.L.I.D. wells (located south of Lacey Point as shown in figure 6.1) would be a concern with the community disposal system option. In this analysis, therefore, proposed sewer service to Lacey Point remains as a connection to the Town of Osoyoos system.

Overall service to the Northwest Sector area would comprise four small scale community systems and disposal fields and a collection system at Lacey Point discharging to the Town of Osoyoos sewerage system.

6.1.5.2 System Design Criteria

Design populations for the separate system alternative would be essentially the same as presented in Table 6.1 for the common collector alternative. In general, the small community systems would be sized for present houses and vacant lots with each cluster. No provisions could be made for future population growth in the Willow Beach area.

Table 6.5 presents data for phosphorus loading reductions which would be achieved with the construction of the proposed small community sewerage systems. Unlike the common collector system described in the previous section where 100% phosphorus removal is achieved with connection to the Town system, the removal is now dependent on the phosphorus transmission rating of the disposal site.

Construction of all described small community sewerage systems would result in a phosphorus loading reduction from the present 263 kg/year to an estimated 82.3 kg/year, a reduction of 180.7 kg/year. In year 2007, the residual phosphorus loading from the Northwest Sector area is estimated to be 99.1 kg/year. Both residual estimates are higher than values of 57.4 kg/year (1987) and 60.5 kg/year (2007) given in Table 6.2 for the collector system connected to the Town of Osoyoos sewerage system.

TABLE 6.5

PHOSPHORUS LOADINGS* - SMALL COMMUNITY SYSTEMS IN THE NORTHWEST SECTOR

PRESENT POPULATION (1987)

	Population	Present P Trans and Loading	Revised P Transmission	P Loading	Reductions
SECTOR TOTALS	687	263			
ALT. SYSTEM RED.					
Lacey Point	99	MH - 33.6	0%	0	33.6
104th Avenue	38	MH - 15.0	ML - 10%	3.5	11.5
Roberts Point	38	VH - 25.4	ML - 10%	2.9	22.5
Inkaneep Point	44	VH - 38.5	L - 2.5%	1.1	37.4
87th Street	41	M&MH- 9.2	ML - 10%	4.1	5.1
194th Avenue	29	MH - 5.4	ML - 10%	2.9	2.5
Willow Beach	87	H&VH- 78.5	ML - 10%	10.4	68.1
All Other Areas	311	57.4		57.4	0
TOTALS	**687**	**263.0**		82.3	**180.7**

PROJECTED POPULATION (2007)

	Population	P Loading
Lacey Point	186	0
104th Avenue	38	3.5
Roberts Point	49	4.0
Inkaneep Point	52	1.9
87th Street	49	4.9
194th Avenue	52	5.2
Willow Beach	174	19.1
All Other Areas	344	60.5
TOTALS	**944**	**99.1**

* all Phosphorus loadings expressed in kg/year

6.1.5.3 Capital Cost Estimates

Estimated capital costs for the small community sewerage systems designed to service all lakeshore development clusters in the Osoyoos Northwest Sector are summarized in Table 6.6.

TABLE 6.6
NORTHWEST SECTOR SMALL COMMUNITY SYSTEMS
CAPITAL COST ESTIMATE

AREA SERVICED	ESTIMATED SYSTEM COST	PHOSPHORUS REDUCTION	COST PER kg
Lacey Point	$ 300,000	33.6	$ 8,930
104th Avenue Area	102,000	11.5	8,870
Roberts Point	120,000	22.5	5,330
Inkaneep Point	129,000	37.4	3,450
87th St., Willow Beach, 194th Ave.	330,000	75.7	4,360
TOTALS	**$ 981,000**	**180.7**	**$ 5,430**

Table 6.6 illustrates a cost per kg of reduced phosphorus loading for the small community systems ranging between $3450 and $8870. The higher value of $8870 is the 104th Avenue area which has the fewest number of serviced lots as compared to other systems. The highest per kg cost is for the Lacey Point area reflecting the capital cost of the trunk sewer extension from the Town of Osoyoos as described in section 6.1.4.1.

6.1.5.4 User Rate Calculation

User rate calculations for the alternative of constructing four small community sewerage systems in the Northwest Sector and connecting Lacey Point to the Town of Osoyoos are presented in Table 6.7. The user rate calculations use the same assistance alternative formulae and format as described in section 6.1.4.4 for the common collector option.

User rate information given in Table 6.7 represent the equivalent parcel tax for capital cost debt retirement only. A user fee of the order of $100 per year would be charged each connected house to recover operating costs. A detailed analysis of anticipated system operation and maintenance costs would be necessary to provide a more accurate user fee estimate.

TABLE 6.7
NORTHWEST SECTOR SMALL COMMUNITY SYSTEMS
USER COST ANALYSIS

AREAS SERVICED	CAPITAL COST	BENEFITING PARCELS	PER PARCEL COST			
			Formula 1	Formula 2	Formula 3	Formula 4
Lacey Point	$300,000	40	$ 567	$ 258	$ 59	$ 800
104th Ave.	102,000	13	590	105	60	860
Roberts Pt.	120,000	17	530	80	54	767
Inkaneep Pt.	129,000	18	580	81	60	810
Willow Beach, 87th Street, 194th Avenue	330,000	35	725	210	73	1050

6.2 Southeast Sector - Osoyoos Rural Area

6.2.1 Description

The Southeast Sector of the Osoyoos Rural Area is located on the lakeshore extending south from the Town of Osoyoos municipal boundary to the U.S. border. Figures 6.5 and 6.6 illustrate the Southeast Sector and phosphorus transmission polygon boundaries. The objective of an alternative sewerage system in this sector is collection of wastewater from campgrounds located adjacent to the lakeshore. Collection of wastewater by provision of a community collection system from the housing area in the vicinity of 39th Street, 35th Street and 33rd Street does not appear to be an immediate priority because the area is completely within a Low rated polygon achieving 97.5% phosphorus removal.

Option 2 - Collection to a Central Pump Out Station

As an alternative to the previously described system providing a connection to the Town of Osoyoos system, the alternative of constructing the collection system on the East Osoyoos lakeshore terminating at a central pump out station is evaluated. In this case, the capital costs associated with the forcemain crossing Haynes Point and connecting to existing trunk sewers in West Osoyoos are delayed.

Option 3 - Community Disposal System on East Osoyoos Bench

Consideration is given to the alternative of discharging collected wastewater to a community disposal field in East Osoyoos. Extensive orchard development and natural ground slopes are constraints associated with this option. Disposal to a community disposal system in East Osoyoos would represent a residual phosphorus loading in the area corresponding to the transmission class of the disposal site. Connection to the Town of Osoyoos system results in a 100% phosphorus loading reduction.

6.2.4 Collection to a Central Pump Out Station

6.2.4.1 System Description

A collection system which would collect wastewater from the east lakeshore area of the Osoyoos Rural Area is illustrated in figures 6.5 and 6.6. The collection system would service all lakeshore development from the Town of Osoyoos boundaries south to the U.S.A. boundary. The terminus of the collection system would be a pump out station (this option) or a lift station (for connection to the Town) located adjacent to Haynes Point. From the Town of Osoyoos boundary to 36th Avenue, a conventional gravity collection system is proposed. A preliminary assessment of the road and lake elevations suggests that this section of gravity main can be constructed without significant groundwater complications. The objective of the gravity service to 36th Avenue is to provide the flexibility to service the housing concentration in the 33rd to 39th Street area without additional sewage pumping stations.

East Lakeshore Drive is essentially level from the U.S.A. boundary in the south to the Town of Osoyoos at the north. The road elevation characteristics combined with the proximity to the lake severely restrict the amount of the east lakeshore area which can be serviced by gravity. Accordingly, a low pressure septic tank effluent main is proposed south of 36th Avenue which would service a 1.8 km length of the lakeshore. Pressure sewer services would be provided to clusters of houses and campgrounds in this area. A conventional gravity collection system to service this area would require an additional two lift stations and have a capital cost 2 1/2 times the cost of the low pressure system.

Wastewater would be collected to a pump out station as shown on figure 6.6. A preliminary capacity analysis of the East Osoyoos sewage collection indicates that the system does not have adequate capacity for estimated peak flows from the Southeast Sector area but could accommodate flow rates of up to 90 L per minute (20 Igpm) on a continuous basis. The terminal station as shown on figure 6.6 would, therefore, be designed to pump at a constant rate not exceeding 90 Lpm to the Town of Osoyoos system with excess flows diverted to holding tanks for removal by pump and haul. A detailed analysis of gravity sewers and pump stations in Osoyoos may indicate continuous capacity availability greater than 90 Lpm and/or that higher pumping rates are possible during the late night period.

A second alternative to reduce pump and haul quantities may be to delete servicing one or more campgrounds in the area. Although the exact location of disposal systems for all campgrounds is unknown, several reportedly pump collected wastewater to disposal systems in the orchards to the east. Little benefit may be achieved from a phosphorus loading point of view by servicing these campgrounds.

Deletion of some of the campgrounds from the initial phase of the sewer system will not resolve public and Health Branch concerns relating to bacteriological contamination of beaches in the area. The option of deleting some campgrounds from the service area warrants consideration in the Stage Two detailed analysis if inadequate sewer main capacity in East Osoyoos is confirmed.

The connection to the existing sewage collection system in East Osoyoos will provide adequate capacity for anticipated sewage flows outside of the tourist season, i.e., September to mid June approximately. Pump and haul would be necessary only during the summer months for flow exceeding an average of 90 Lpm or 130 cubic metres per day. The concept of this alternative is that the pump and haul system would be used only on an interim basis until such time as capital funds are available to construct the forcemain crossing to Haynes Point and completion of the connection to trunk sewers in West Osoyoos.

6.2.4.2 System Design Criteria

Design population and flow criteria for the Southeast Sector collection system and pumping system to East Osoyoos is presented in Table 6.8. Recognizing that the system is not envisioned as a long term servicing option for the area, data presented in Table 6.8 is limited to 1987 population estimates.

TABLE 6.8

SERVICE POPULATIONS - SOUTHEAST PUMP-HAUL OPTION

Polygon	Residential Units	Population	Seasonal	Area Description
16 - MH	6	17		Adj. to Town Boundary
14 - VH	5	15	180 sites	Wild Rapids Campsite
15 - H	1	3		Near 36th Avenue
13 - ML	2	6	101 sites	Waltons Mountain
7 - M	2	6	231 sites	
10 - VH	6	17		
11 - H	1	3		
6 - H	3	9	140 sites	
4 - MH	6	17		Extreme South End
	32	93	652 sites	

Average Winter Sewage Flow - 42 m^3/day (9,300 gpd)
Average Summer Flow - 140 m^3/day (31,000 gpd)
Peak Summer Flow - 200 m^3/day (44,000 gpd)

Data presented in Table 6.8 illustrates that the Southeast Sector sewerage system would service a total of 32 residential units and all campsites, approximately 652 sites. Average sewage flows during the winter months are estimated to be 42 m^3/day which can be accommodated by the flow limited connection to the Town sewerage system in East Osoyoos. Actual sewage volumes which would have to be removed by pump and haul will depend on actual occupancy rates for the campground facilities. Over the summer season, mid June to August 31 annually, the average pump and haul volume will be about 1700 m^3 (375,000 gal.) Recognizing that septic tank and raw sewage is collected by the system, any trucked wastewater could be discharged directly into the Town of Osoyoos sewerage system in West Osoyoos.

Phosphorus loading data for the Southeast Osoyoos Rural Area are summarized following, with construction of the collection system and pump and haul as described:

Present Phosphorus Loading for Sector	-	100.4 kg/yr.
Reduction with Collection System	-	76.4 kg/yr.
Residual Sector P Loading	-	24.0 kg/yr.
Sector Population	-	571
Population Serviced by Alt. System	-	93
Residual with Individual Systems	-	478

The collection system as proposed would reduce the phosphorus loading from the Southeast Sector area by 76.4 kg/year or 76%. The residual septic tank and disposal systems would represent a phosphorus loading of 24 kg/year and have an overall average phosphorus removal efficiency of 95%.

6.2.4.3 Capital Cost Estimate

Capital cost estimate for the Southeast Sector collection system terminating with pump and haul is presented in Table 6.9. The overall capital cost estimate of $402,000 is equivalent to $5280 per kg of reduced phosphorus loading to Osoyoos Lake.

TABLE 6.9

SOUTHEAST SECTOR PUMP-HAUL - CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		ESTIMATED COST
1.	Ø250 Gravity Sewer	950 m	$ 62,000
2.	Manholes	10 req'd.	18,000
3.	Sewer Services		18,000
4.	Ø100 Low Pressure Collector	400 m	20,000
5.	Ø150 Low Pressure Collector	1400 m	84,000
6.	Pressure Services		16,000
7.	Pressure System Appurtenances		6,000
8.	Road Restoration		32,000
9.	Wastewater Pumping Station & Storage Tanks		48,000
10.	Forcemain to Town System	450 m	18,000
		Subtotal	**$ 322,000**
	Contingencies & Engineering (allow 25%)		**80,000**
		TOTAL	**$ 402,000**

Total Phosphorus Reduction - 76.0 kg/yr.
Average Capital Cost/kg = $5,290

6.2.4.4 User Rate Calculation

The results of a user rate analysis using the assistance formula described in section 3.4 are summarized in the tabulation following. Included in the user rate analysis is a proportioned share of the estimated costs for pump and haul. The pump and haul annual costs are based on an average per 1500 Igal. truckload cost of $35.00 which is derived from discussions with local septic tank pump out contractors. The given cost represents the average cost per benefiting parcel for debt retirement and pump and haul costs only. A user fee per connected house or equivalent of $100 per year would be additional to the given per parcel costs.

Benefiting Lots/Parcels	35
Annual Pump Out Costs	$ 9,000
Pump Out Cost per Equiv. Dwelling Unit*	$ 85/year

Approximate User Costs:

Formula 1 - $ 857 + $85 = $ 942/year

Formula 2 - $ 712 + $85 = $ 797/year

Formula 3 - $ 86 + $85 = $ 171/year

Formula 4 - $1,230 + $85 = $1,315/year

* 10 campsites equivalent to domestic connection

Parcels benefiting from the system have been limited to 35 representing lots having existing houses or commercial facilities. A more detailed user-rate analysis would consider a parcel tax related to parcel size with larger lots paying proportionately more. Recognizing that the system involves pump and haul, apportionment of a proportion of capital costs to presently vacant lots is not considered appropriate. Additional connections to the system would be discouraged to the greatest extent possible until the trunk sewerage works to West Osoyoos are constructed.

6.2.5 Collection to Connection to Town System in West Osoyoos

6.2.5.1 System Description

This alternative involves the same collection system as described in the previous section for construction on the East Osoyoos lakeshore area. Instead of collected wastewater being pumped at a controlled rate into the East Osoyoos collection system, wastewater is now pumped in a forcemain to Haynes Point and then into trunk sewers in West Osoyoos. Figure 6.6 illustrates the forcemain alignment to Haynes Point. The forcemain would be installed in the sandbar extending east from Haynes Point and could be installed using conventional excavation equipment. The crossing to Haynes Point will require the installation of, at most, 100 metres of pipeline with the excavation equipment actually working in the lake.

Figure 6.7 illustrates the forcemain alignment from the west end of Haynes Point to ultimate connection to the Town of Osoyoos sewerage system. A forcemain alignment following the lakeshore is proposed to minimize to the greatest extent possible the static lift on the East Osoyoos sewage pumping station. From East to West Osoyoos, a total of 2300 metres of 200 mm diameter forcemain is proposed.

Approvals from the Ministry of Environment and Parks will be required to install the forcemain across Haynes Point. The section across the sandbar between East Osoyoos and Haynes Point is proposed to be fuse jointed polyethylene pipe having a minimum of 1.2 to 1.5 metres of cover. Adequate cover is important to minimize the possibility of damage from boat traffic in the area.

Referring to figure 6.7, the forcemain from East Osoyoos from the east end of 32nd Avenue to the connection with the Town of Osoyoos system would be designed to accommodate future connections from sewer extensions in the area. A forcemain connection is illustrated which would accept collected wastewater from the Southwest Osoyoos area and the 32nd Avenue area. Consideration may also be given to connecting facilities, present or proposed, to the sewage forcemain. Existing sanitary facilities in the Park consist of totally contained privies which are emptied by a pumpout contractor.

6.2.5.2 System Design Criteria

Design population and flow criteria for the Southeast Sector with a forcemain connection to the Town of Osoyoos sewerage system crossing Haynes Point is essentially the same as presented in section 6.2.4. The population and area serviced is the same, recognizing the collection system along the East Osoyoos lakeshore is identical for both alternatives. The primary difference between this alternative and the previous option is the capability to provide service to presently vacant subdivided lots and future development in the area. Table 6.10 summarizes the present and projected 2007 design populations and flows for the system.

Table 6.10 illustrates that the Southeast Sector collection main will provide service to a present population of 93 and a total of 20 vacant properties. A large percentage of the vacant properties are large parcels which may be intensively developed providing tourist commercial facilities with the availability of sanitary sewer service. Projected 2007 service populations for the system are also given in Table 6.10. By 2007, it is anticipated that the collection system would be extended into the housing area north of 36th Avenue. At a minimum, the serviced population of the system will be 420 in year 2007 or about 65% of the total projected population of the Southeast Sector area.

The projected populations given in Table 6.10 are in accordance with RDOS data discussed in section 4.1. The RDOS projections represent modest growth in the area and do not evaluate the growth implications of a community sewerage system servicing the area. As shown in Table 6.10, no expansion of present campground facilities in the area has been anticipated in the growth projection. It is reasonable to assume that tourist facilities in the area will be expanded over the next 20 years, particularly if a community sewerage system is provided.

TABLE 6.10

SERVICE POPULATION - SOUTHEAST SECTOR COLLECTION SYSTEM

Present - 1987

Polygon	Residential Units/Pop.	Vacant	Parcel Total	Seasonal*	Area Description
16 - MH	6/17	0	3		Adj. to Town Boundary
14 - VH	5/15	11	14	180	Wild Rapids Campsite
15 - H	1/ 3	0	1		Near 36th Avenue
13 - ML	2/ 8	1	3	101	Waltons Mountain
7 - M	2/ 6	2	4	231	
10 - VH	6/17	6	12		
11 - H	1/ 3	0	1		
6 - H	3/ 9	0	3		
4 - MH	6/17	0	5	140	Extreme South End
12 - MH	0/ 0	1	1		
	93	20	47	652	

Average Winter Sewage Flow - 42 m³/day (9,300 gpd)

Average Summer Flow - 140 m³/day (31,000 gpd)

Projected - 2007

Polygon	Residential Units	Population	Seasonal
16 - MH	6	17	
14 - VH	1	33	180
15 - H	1	3	
13 - ML	2	6	101
7 - M	4	12	231
10 - VH	9	26	
11 - H	1	3	
6 - H	3	9	
4 - MH	6	17	140
12 - MH	1	3	
17 - L	100	290	
		420	652

Average Winter Sewage Flow - 190 m^3/day (42,000 gpd)

Average Summer Sewage Flow - 290 m^3/day (64,000 gpd)

* Seasonal values are campsites

Phosphorus loading reductions for the collection alternative pumping to West Osoyoos will be the same as presented in the previous section. The difference between the two options is the capability to service population growth to year 2007. Phosphorus reduction data for 1987 and 2007 is summarized as follows.

	1987	2007
Total Sector P Loading	100.4 kg/yr.	125 kg/yr.
Reduction with Collection System	76.4 kg/yr.	100.4 kg/yr.
Residual P Loading	24.0 kg/yr.	24.6 kg/yr.
Sector Population (permanent)	571	658
Population on Alt. System	93	420
Residual with Individual Systems	478	238

The above phosphorus transmission data illustrates a reduction in 1987 from 100.4 kg/yr. to 24 kg/yr. with the system construction. In year 2007, without construction of the collection system as proposed, the phosphorus transmission from the sector as a whole is estimated to increase to 125 kg/yr. With the collection system, the residual loading to Osoyoos Lake in year 2007 is estimated to be 24.6 kg/yr., essentially the same as the 1987 residual with the collection system. The collection system as proposed, therefore, reduces the present loading by 80% and essentially eliminates any increase in the residual loading through 2007.

6.2.5.3 Capital Cost Estimate

A capital cost estimate for the complete Southeast Sector collection system, forcemain crossing Haynes Point and connection in West Osoyoos is presented in Table 6.11. Overall, the system capital cost crossing Haynes Point to West Osoyoos has an estimated cost of $700,000. The section of forcemain and gravity main in West Osoyoos north of 32nd Avenue, see figure 6.7, would service the Southwest Sector area and an area within the Town boundaries not presently serviced by sewer. The capital cost of this section of forcemain of $102,000, items 5, 6 and 7 in Table 6.11 should, therefore, be apportioned roughly according to the flow from each benefiting area. Assuming the cost of this section of trunk sewer is apportioned as follows:

- 1/3 to Southeast Osoyoos
- 1/3 to Southwest Osoyoos
- 1/3 to Town of Osoyoos

the system capital cost given in Table 6.11 reduces from $700,000 to $615,000. On the basis of a capital cost of $615,000, the cost per kg of reduced phosphorus loading for the proposed system serving East Osoyoos is $8,050.

6.2.5.4 User Rate Calculation

A net cost to benefiting land parcels for the East Osoyoos collection system is presented following. As with previous user rate calculations, the costs per benefiting parcel represent capital cost debt retirement only and do not include a user fee which is anticipated to be of the order of $100 per year per equivalent domestic connection. The user rate calculation has been undertaken using an estimated capital cost of $615,000, which is attributable to the Southeast Sector area.

Benefiting Lots/Parcels - 47

Approximate User Costs for Debt Retirement

Formula 1 - $ 940/year
Formula 2 - $ 535/year
Formula 3 - $ 96/year
Formula 4 - $1,360/year

TABLE 6.11

OSOYOOS SOUTHEAST SECTOR COLLECTION SYSTEM

CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		ESTIMATED COST
1.	Components 1 to 8 from Table 6.9		256,000
2.	Sewage Pumping Station East Osoyoos		56,000
3.	Ø200 Fuse Joint Forcemain Osoyoos Lake	500 m	57,000
4.	Ø200 Forcemain on Haynes Point to 32nd Ave.	1250 m	88,000
5.	Ø200 Forcemain - 32nd Ave. to Gravity Sewer	550 m	39,000
6.	Ø250 Gravity Trunk Sewer c/w Manholes	360 m	33,000
7.	Restoration	allow	30,000
	Subtotal		**$559,000**
	Contingencies & Engineering (allow 25%)		**$141,000**
	TOTAL		**$700,000**

Although capital costs with the forcemain connection across Haynes Point are significantly higher than the previous alternative, net per benefiting parcel costs are lower as shown above with the elimination of costs for pump and haul and an increase in benefiting parcels to include vacant lots. Parcel size has not been a consideration in the event of benefiting properties. Lot area should be a factor in a detailed analysis which would derive a higher cost for a multi-acre property as compared to a single family lot.

6.2.6 Community Disposal System for Southeast Osoyoos Area

6.2.6.1 System Description

As an alternative to pumping wastewater to the Town of Osoyoos system, a community subsurface disposal system could be constructed in the area east of the proposed sewage lift station in figure 6.7. Whether effluent is pumped to a community diposal system or the Town, the collection system remains essentially the same as illustrated in figures 6.6 and 6.7. Collection of septic tank effluent throughout the sector is recommended with a disposal field to eliminate the need for and cost of a community septic tank.

The proposed community disposal location shown in figure 6.6 is only conceptual to illustrate a general vicinity. Potential groundwater contamination is a concern in the East Osoyoos area because large segments are not serviced by a community water system. Essentially all of the West Osoyoos lakeshore area is serviced by S.O.L.I.D. The potential impact of the community disposal field on shallow groundwater wells in the area would have to be carefully examined in a detailed analysis study.

6.2.6.2 System Design Criteria

The community disposal system in East Osoyoos would be sized for the anticipated 1987 average daily sewage flow of 140 m^3/day (31,000 gpd) as presented in Table 6.10. Recognizing that the disposal field is located in the same Low rated phosphorus transmission polygon as the housing area in the 37th Street area, there is no benefit achieved by providing capacity for this area. The disposal system would, therefore, service only houses and campgrounds in the lakeshore area.

For an average summer sewage flow of 140 m^3/day, two disposal fields, each comprising 4000 lm of tile would be required in compliance with Ministry of Environment guidelines for a design percolation rate of 10 min./25mm. These disposal fields will be large in comparison to systems described for the Northwest Sector. A total site area of at least 3.7 ha will be required for the two proposed fields and a designated standby area. The design flow of 140 m^3/day is approaching a point where a small treatment plant may be considered to reduce the area requirements of the disposal field.

From a phosphorus loading point of view, the proposed disposal field system relocates all present lakeshore wastewater discharges to a Low rated transmission area. The anticipated phosphorus loading reduction achieved is summarized as follows:

	1987
Total Sector P Loading	100.4 kg/year
Reduction with Collection System	(-) 76.4 kg/year
Residual from Disposal Field	(+) 7.2 kg/year
Net Reduction	69.2 kg/year
Sector Residual Loading	31.2 kg/year
Sector Population (permanent)	571
Population on Alt. Systems	93
Residual with Individual Systems	478

As given above, a community disposal system serving the Southeast Sector area would achieve a net phosphorus loading reduction of 69.2 kg/year.

6.2.6.3 Capital Cost Estimate

A preliminary capital cost estimate for the described community disposal field system is presented in Table 6.12. No allowance has been made in the capital cost estimate for any additional treatment works which assumes collection of septic tank effluent. The total estimated system capital cost of $715,000 is equivalent to $10,300 per kg of reduced phosphorus loading.

TABLE 6.12

COMMUNITY DISPOSAL SYSTEM FOR SOUTHEAST SECTOR

CAPITAL COST ESTIMATE

Item	Description		Estimated Cost
1.	Components 1 to 8 from Table 6.9		$ 256,000
2.	Septic Tank Effluent Pumping Station		40,000
3.	Ø100 Forcemain	450 m	23,000
4.	Disposal Field	8000 lm	158,000
5.	Solid Headers, Dist. Boxes, etc.		15,000
	Subtotal		**$ 492,000**
	Contingencies and Engineering (allow 25%)		**123,000**
	Disposal Area Land Acquisition		**100,000**
	TOTAL SYSTEM COST		**$ 715,000**

6.2.6.4 User Rate Calculation

A net cost to benefiting land parcel for debt retirement of the system capital cost is presented below. As with all other user cost calculations, no provision is made for a user or connection fee.

Benefiting Lots/Parcels - 47

Approximate User Costs for Debt Retirement

Formula 1 - $ 1,170

Formula 2 - $ 570

Formula 3 - $ 120

Formula 4 - $ 1,700/year

6.3 Southwest Sector - Osoyoos Rural Area

6.3.1 Description

The Southwest Rural Area Sector generally includes low density single family residential development located south of Haynes Point. Figure 6.7 illustrates the Southwest Sector and phosphorus transmission polygons in the area.

Discussion with the Area Director and Ministy of Health designated this area as the third priority of the three Osoyoos Rural Area Sectors in terms of existing problems. As shown in Figure 6.7, except for a small area comprising about 10 houses at the east end of 22nd Avenue, (Polygon #32) and the Idle-O-Apartment site (Polygon #27), the remainder of developed areas in this sector are located primarily in Moderately Low and Low rated phosphorus transmission polygons. The Idle-O-Apartment complex is serviced by a package treatment plant discharging to ground which has some history of unsatisfactory performance.

Based strictly on the phosphorus transmission mapping, the primary objective of alternative sewerage system planning in the Southwest Sector is to reduce the phosphorus loading from the High rated polygon at the east end of 22nd Avenue and the VH rated Idle-O-Apartment site. If a community collection system is constructed to service this area, consideration is given to servicing all development in the area to achieve an economy of scale and theoretically reduce costs per individual house served.

6.3.2 Alternative System Planning Constraints

Constraints associated with providing an alternative system to service the Southwest Sector depend on whether the system is being considered for the area as a whole or limited to servicing polygon #32 at the east end of 22nd Avenue and the Idle-O-Apartment complex. If the entire area is intended to be serviced by an alternative system, approximately 80 existing houses representing an average daily sewage flow of 88 m^3/day (19,200 gpd) would be serviced. Recognizing that the area is confined by the U.S.A. border to the south, Osoyoos Lake to the east and orchards to the west, connection to the Town of Osoyoos sewerage system would appear to be the preferred option for a plan to service the area as a whole.

Adjacent land use and topographic features become less of a constraint for a sewerage system designed to service only the houses in High rated polygon #32 and the Idle-O-Apartments. Separate system alternatives are, therefore, considered feasible for service to the 12 houses and 4 vacant lots at the east end of 22nd Avenue (polygon #32) and the Idle-O-Apartments.

6.3.3 Waste Management Options

Option 1 - Small Community System for East 22nd Ave. Area and Idle-O-Apartments (Polygons 32 and 27)

One option to be evaluated in detail involves construction of a small community disposal system for service to the East 22nd Avenue area (10 houses and 4 vacant lots) and the Idle-O-Apartments. No capacity is provided for adjacent residential areas. Another disposal option which might be considered for this area includes connection to the Town of Osoyoos. The connection to the Osoyoos system is discussed as Option 2 for the Southwest Sector.

Option 2 - Connection to the Town of Osoyoos System

Existing development in the Southwest Sector is readily serviced by a conventional gravity sewer system terminating at a lift station at the east end of 22nd Avenue. Effluent would be pumped to the Haynes Point forcemain described previously for service to the Southeast Sector. The connection to the Town of Osoyoos option evaluates servicing only the west end of 22nd Avenue (polygon #32), the Idle-O-Apartment complex and all developed areas in the Southwest Sector area.

6.3.4 Small Community System for East 22nd Avenue Area and Idle-O-Apartments

6.3.4.1 System Description

A small scale community sewerage system designed to service only the east end of 22nd Avenue and the Idle-O-Apartments is illustrated on figure 6.7 and is designated as Alternative #1. Septic tank effluent would be collected in a gravity flow collection system. The collection system would not extend beyond the boundary of polygon #32 as shown on figure 6.7. Collection of septic tank effluent is proposed as compared to raw sewage to eliminate the requirement for a community septic tank facility.

The Idle-O-Apartments would be connected to the proposed lift station by a 50 mm diameter forcemain installed along the lakeshore. The apartment complex is presently serviced by an extended aeration treatment which it is assumed could be modified to produce the equivalent of septic tank effluent. An existing dosing pump station would be modified to pump wastewater to the east end of 22nd Avenue instead of the on-site disposal system.

All collected wastewater at the east end of 22nd Avenue would be pumped to a disposal field on the bench area to the west. Figure 6.7 illustrates the disposal field being sited on Lot 631. This field location is conceptual and has been selected because it is a pasture area as compared to adjacent land which are orchards. As described for small community systems in the Northwest Osoyoos area, the disposal field is sized in accordance with Ministry of Environment Guidelines as is based on a percolation rate of 10 min. per 25 mm.

6.3.4.2 System Design Criteria

The proposed community disposal field would be sized for a total of 14 single family lots at the east end of 22nd Avenue and 28 strata title apartments at the Idle-O-Apartment complex. For a total of 42 potential housing units serviced by the system, the design sewage flow is 44 m^3/day (9700 gpd) based on 2.9 people per house and a per capita flow of 0.36 m^3/day. Using a design percolation rate of 10 minutes per 25 mm, the disposal field would comprise a total of 1250 m of tile in each of two disposal fields. A site area of about 1.2 ha would be necessary for the proposed fields and a designated standby area.

From a phosphorus loading point of view, the small scale system as proposed relocates wastewater disposal from High and Very High transmission rated polygons (#32 and #27) to an area having a Low transmission rating. Anticipated phosphorus removal, therefore, increases from the present average of about 25% to 97.5%. For the east end of 22nd Avenue and the Idle-O-Apartments, the phosphorus loading would decrease from 62.2 kg/year to 1.5 kg/year, a reduction of 60.7 kg/year.

6.3.4.3 Capital Cost Estimate

A capital cost estimate for the described small scale community sewerage system designed to service the east end of 22nd Avenue is presented in Table 6.13. The overall project capital cost estimate is $178,000 which equates to $2930 per kg of reduced phosphorus loading to Osoyoos Lake. This equivalent per kg capital cost is based on a loading reduction of 60.7 kg per year.

6.3.4.4 User Cost Calculation

A user cost analysis for the capital cost debt retirement for the small community sewerage system is presented following:

Benefiting Single Family Lots 42

Approximate User Costs for Debt Retirement

Formula 1 - $328

Formula 2 - $ 86

Formula 3 - $ 33

Formula 4 - $480

As with all other user rate calculations, the above represents the cost per lot which would be charged, probably as a parcel tax, to recover debt servicing costs. A monthly user fee would be additional to the above for system operation and maintenance costs.

TABLE 6.13

SMALL COMMUNITY SEWERAGE SYSTEM FOR 22nd AVENUE AREA & IDLE-O

CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		ESTIMATED COST
1.	Ø200 Gravity Sewer	160 m	$ 9,600
2.	Cleanout Assemblies	3	1,500
3.	Services	140 m	5,600
4.	Restoration		4,000
5.	Septic Tank Effluent Pump Station		18,000
6.	Ø50 Forcemain	750 m	15,000
7.	Disposal Field	2500 m	50,000
8.	Solid Headers, Distribution Boxes, etc.		10,000
	Subtotal		**$113,700**
	Contingencies & Engineering (allow 25%)		**$ 28,300**
	Site Acquisition		**$ 36,000**
	TOTAL		**$178,000**

6.3.4 Connection to the Town of Osoyoos Sewerage System

6.3.4.1 System Description

The option of connecting to the Town of Osoyoos sewerage system has been evaluated on the basis of serving the east end of 22nd Avenue (polygon #32) and the Idle-O-Apartments (polygon #27) or servicing all urban density single family development in the area. The trunk sewerage components for each service area alternative are essentially the same and are illustrated in figure 6.7.

The east end of 22nd Avenue (polygon #32) and the Idle-O-Apartments are the major phosphorus sources or contributors in the Southeast Sector. These two areas represent an estimated phosphorus loading of 62.2 kg/year which is equivalent to 44% of the sector total. Figure 6.7 illustrates a sewage lift station located at the east end of 22nd Avenue which would pump collected wastewater to the north through a 100 mm diameter forcemain. To minimize the design lift of the sewage pumping station, the forcemain is illustrated following an alignment along the lakeshore and then west of the marsh area adjacent to Haynes Point. The forcemain connects to the proposed forcemain crossing Haynes Point from East Osoyoos at the east end of 32nd Avenue. It is assumed that the existing sewage pumping station at the Idle-O-Apartments could connect directly into the proposed forcemain from the 22nd Avenue area.

A total length of 1100 m of 100 mm forcemain is proposed from the east end of 22nd Avenue to the connection point to the 200 mm forcemain from East Osoyoos. The forcemain as proposed is sized for future service extensions in the 22nd Avenue area. Relatively modest cost savings could be realized by sizing the forcemain only for the Idle-O-Apartments and the 14 single family lots at the east end of 22nd Avenue. The forcemain size reduction would effectively eliminate the future feasibility for extension of the system service area in the Southwest Sector area.

Figure 6.7 also illustrates the collection system to service all urban density single family development in the Southwest Sector. The expansion of the service area is straightforward as all collection mains could be drained to the proposed sewage lift station at the east end of 22nd Avenue. The only area not capable of being serviced by gravity is 85th Street where a 075 low pressure collection main is proposed and illustrated in figure 6.7.

The connection to the Town of Osoyoos sewerage system enables the collection system to be designed for raw sewage collection. Except where a low pressure collection main is proposed, all existing septic tanks in the area can be removed from service. The previous option involving a small system to service the East 22nd Avenue area is feasible only with the collection of septic tank effluent, therefore, requiring all existing systems to remain in operation.

6.3.4.2 System Design Criteria

Design population and flow criteria for the Southwest Sector collection system are summarized in Table 6.14. A subtotal is provided for service only to the Idle-O-Apartments and the East 22nd Avenue area. In this case, the system would service a total population of 85 people which would represent an average daily sewage flow of 38 m^3/day (8500 gpd). A modest increase in sewage flow would be anticipated to year 2007 arising from house construction on the 4 vacant lots at the east end of 22nd Avenue.

Table 6.13 illustrates that a population of 278 would benefit if the collection system area were expanded to include all urban density development in the Southwest Sector. Population growth in the area which would be serviced by the system is anticipated to be modest as indicated by a projected service population of 330 in year 2007. The increase in population is represented by house construction on presently vacant properties. It is important to recognize that the Southwest Sector sewerage system does not have the potential of a significantly larger service population based on current RDOS planning documents.

TABLE 6.14

SERVICE POPULATION - SOUTHWEST SECTOR COLLECTION SYSTEM

Present - 1987

POLYGON	UNITS/POP.	VACANT	TOTAL
27 VH; Idle-O-Apts.	28/56		28
32 - H; 22nd Avenue	10/29	4	14
Subtotal	34/85	4	42
29 - ML	13/40	1	14
24 L	8/23	4	12
23 ML	7/20	1	8
20 M	32/93	7	39
22 ML	5/15	1	6
TOTALS	103/278	18	121

Average Daily Sewage Flow - 127 m^3/day (28,000 gpd)

Projected - 2007

Projected Service Population - 330

Average Daily Sewage Flow - 151 m^3/day (33,000 gpd)

Phosphorus loading reductions for a collection system serving only the Idle-O-Apartments and the East 22nd Avenue area are summarized as follows:

	1987	2007
Total Sector P Loading	144.5 kg/yr.	155.2 kg/yr.
Reduction with Collection System	62.2 kg/yr.	67.8 kg/yr.
Residual P Loading	82.3 kg/yr.	87.4 kg/yr.
Sector Population (Permanent)	710	835
Population on Alt. Systems	85	95
Residual with Individual Systems	625	740

The collection system servicing the Idle-O-Apartments and Polygon #32 reduces the phosphorus loading from the sector as a whole to 82.3 kg/year. This residual loading is not expected to increase significantly through year 2007. Based on a sector population of 625 continuing to use individual septic tank and tile field systems, a residual loading of 83.2 kg/year equates to an average phosphorus removal efficiency consistent with Okanagan Water Quality Project objectives.

Phosphorus loading reductions achieved with complete service of the Southwest Sector (a population of 278 from Table 6.14) is tabulated below.

	1987	2007
Total Sector P Loading	144.5 kg/yr.	155.2 kg/yr.
Reduction with Collection System	97.0 kg/yr.	102.9 kg/yr.
Residual P Loading	47.5 kg/yr.	52.3 kg/yr.
Sector Population (permanent)	710	835
Population on Alt. System	278	330
Residual with Individual Systems	432	505

Servicing all developed areas in the Southwest Sector results in a residual phosphorus loading of 47.5 kg/year. The increase in residual loading to year 2007 is anticipated to be marginal; increasing to 52.3 kg/year. The average phosphorus removal efficiency of remaining individual septic tank and tile field systems is estimated to be 88% in 1987 and 90% in year 2007.

The tabulation preceding indicates a population of 432 continuing to use individual septic tank and field systems in the Southwest Sector. A significant portion of this population is located in the 87th and 89th Street areas with roughly half of the area within the municipal boundaries and half outside the boundaries. As illustrated in figure 6.7, it is reasonable to assume that these areas will also be connected to the Town of Osoyoos sewerage system in the near term future. Within the area there are about 50 single family units representing a population of 145. Sewer service to this area would reduce the sector population using septic tanks from 432 to about 280.

6.3.4.3 Capital Cost Estimates

A capital cost estimate for the connection to the Town of Osoyoos sewerage system from the Southwest Sector is presented in Table 6.15. The estimated capital cost to service the east end of 22nd Avenue and Idle-O-Apartments is $187,000. This cost estimate includes a one third apportionment of the costs for the trunk sewer from the Town of Osoyoos to 32nd Avenue. This section of sewer main and capital costs are described in detail in section 6.2.4. A capital cost of $187,000 achieves a phosphorus loading reduction of 62.2 kg/year which is equivalent to $3000 per kg/year.

Expanding the collection system service area to include all urban density in the Southwest Sector increases the project capital cost to $509,000. A phosphorus loading reduction of 97.0 kg/year would be achieved which is equivalent to $5,250 of capital cost per kg of phosphorus.

6.3.4.4 User Cost Calculation

A user cost analysis for the capital cost debt retirement for the connection to the Town of Osoyoos is presented following. The Idle-O-Apartment development is one parcel, however, its benefit is significantly greater than that of one single family lot. In the user fee calculations, the apartment complex is considered as the equivalent of 28 benefiting single family parcels.

TABLE 6.15

CONNECTION TO TOWN SYSTEM FROM SOUTHWEST SECTOR

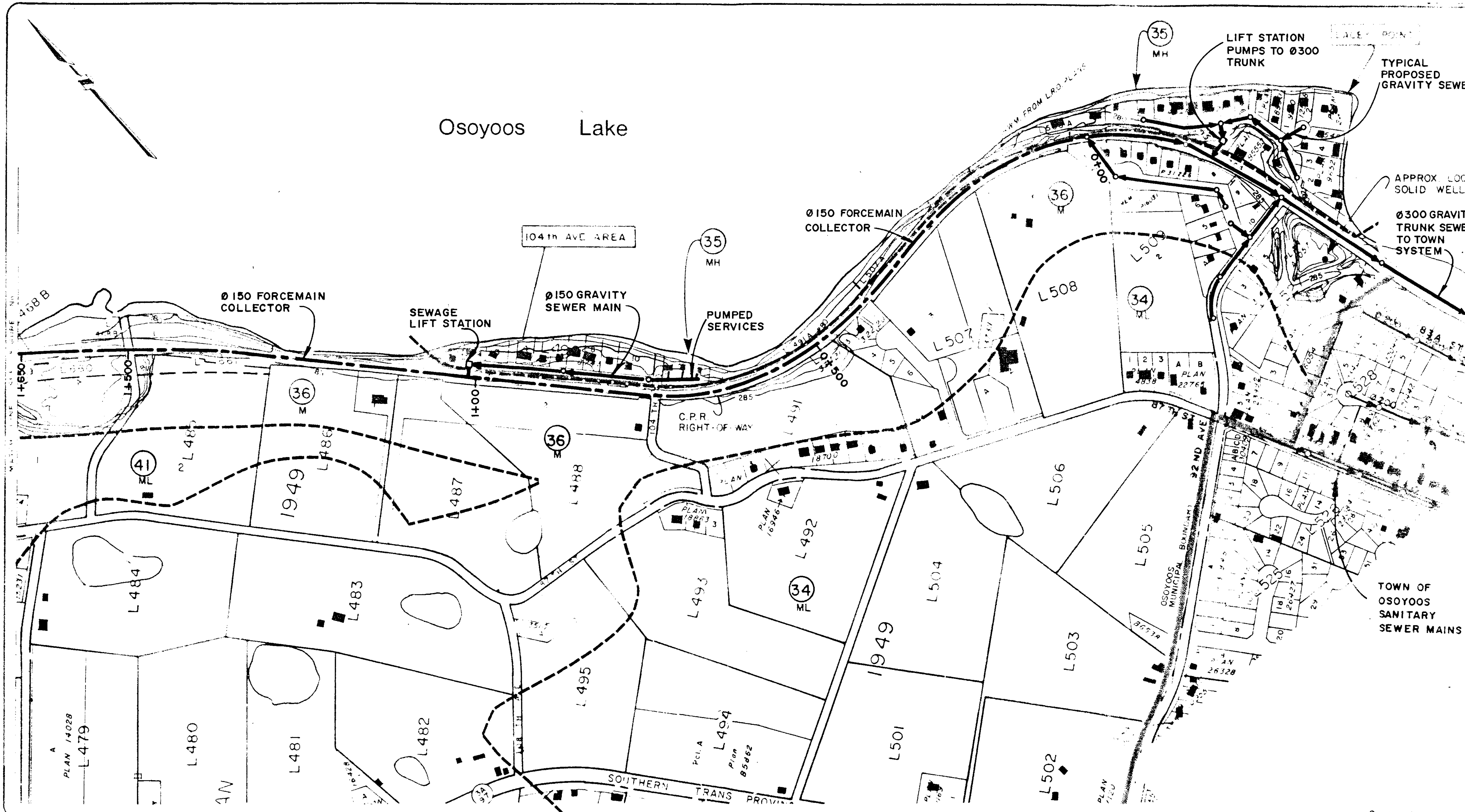
CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		ESTIMATED COST
A.	**Service only East 22nd Avenue & Idle-O-Apts.**		
1.	Ø200 Gravity Sewer	160 m	$ 9,600
2.	Manholes and Cleanouts		2,500
3.	Ø100 Sewer Services	140 m	5,600
4.	Restoration		4,000
5.	Sewage Pumping Station		35,000
6.	Ø100 Forcemain to Haynes Pt.	1100 m	55,000
7.	Connection for Idle-O-Apts.		4,000
8.	Proportioned Cost Share Trunk Sewers in Town*		34,000
	Subtotal		**$149,700**
	Contingencies & Engineering (allow 25%)		**37,300**
	TOTAL - East 22nd Ave. & Idle-O-Apts.		**$187,000**
B.	**Expand Service for Entire Southwest Sector**		
1.	Ø200 Gravity Sewer	1800 m	$108,000
2.	Ø75 Low Pressure Collector	350 m	14,000
3.	Manholes and Cleanouts		36,000
4.	Sanitary Sewer Services		45,000
5.	Road Restoration		40,000
6.	Sewage Pumping Station Oversizing from item 5		15,000
	Subtotal		**$258,000**
	Contingencies & Engineering (allow 25%)		**64,000**
	Incremental Total Cost		**$322,000**
	TOTALS of A and B		**$509,000**

*** 1/3 of Items 5,6,7 in Table 6.11**

Benefiting Lots/Parcels	42	121
Approximate User Costs for Debt Retirement		
Formula 1	$350	$310
Formula 2	$ 70	$190
Formula 3	$ 35	$ 32
Formula 4	$510	$450

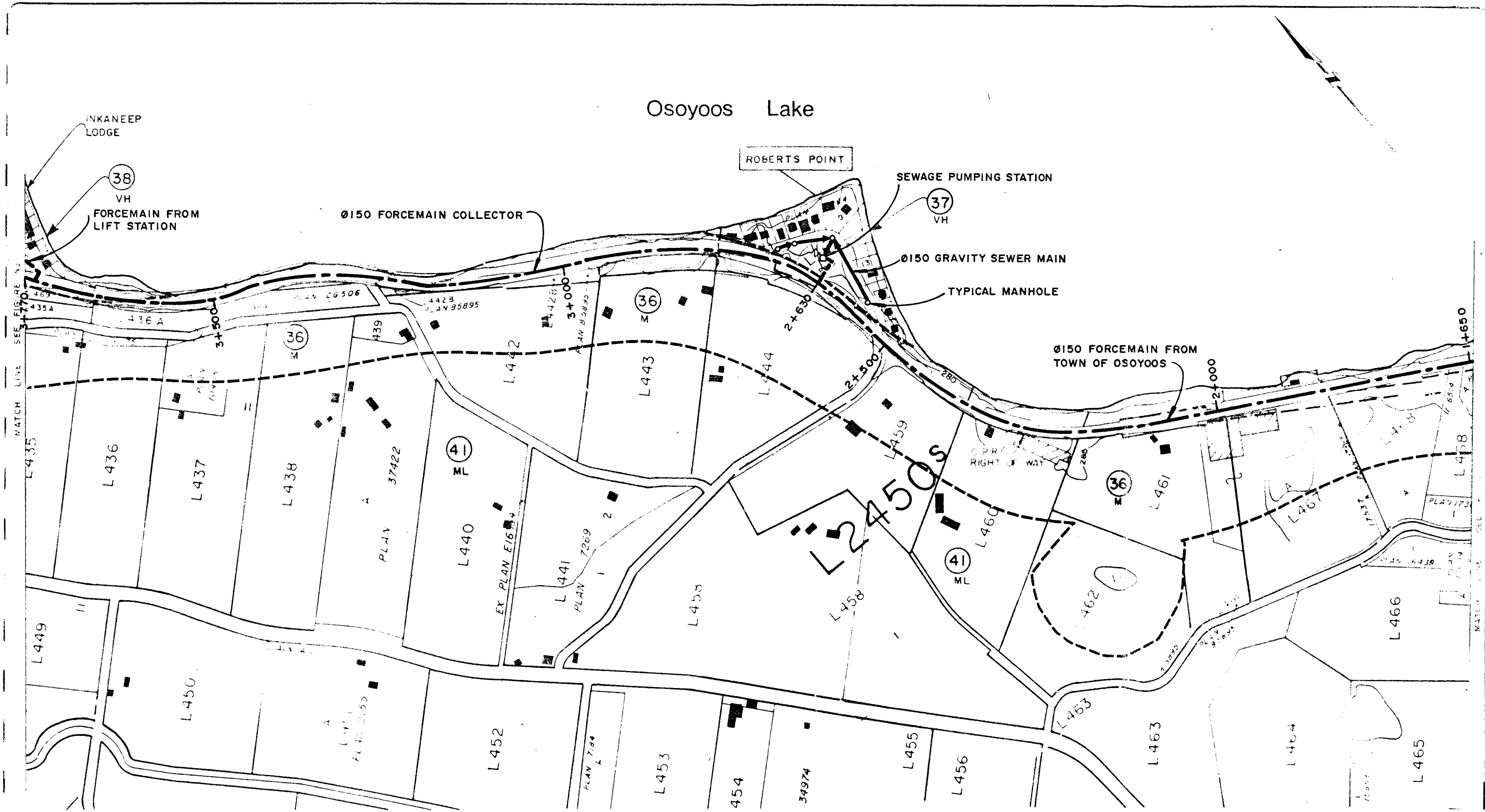
The parcel tax calculation for debt retirement illustrates that increasing the service area of the system to include all of the Southwest Sector results in a general decrease in per parcel costs.



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A, C & D

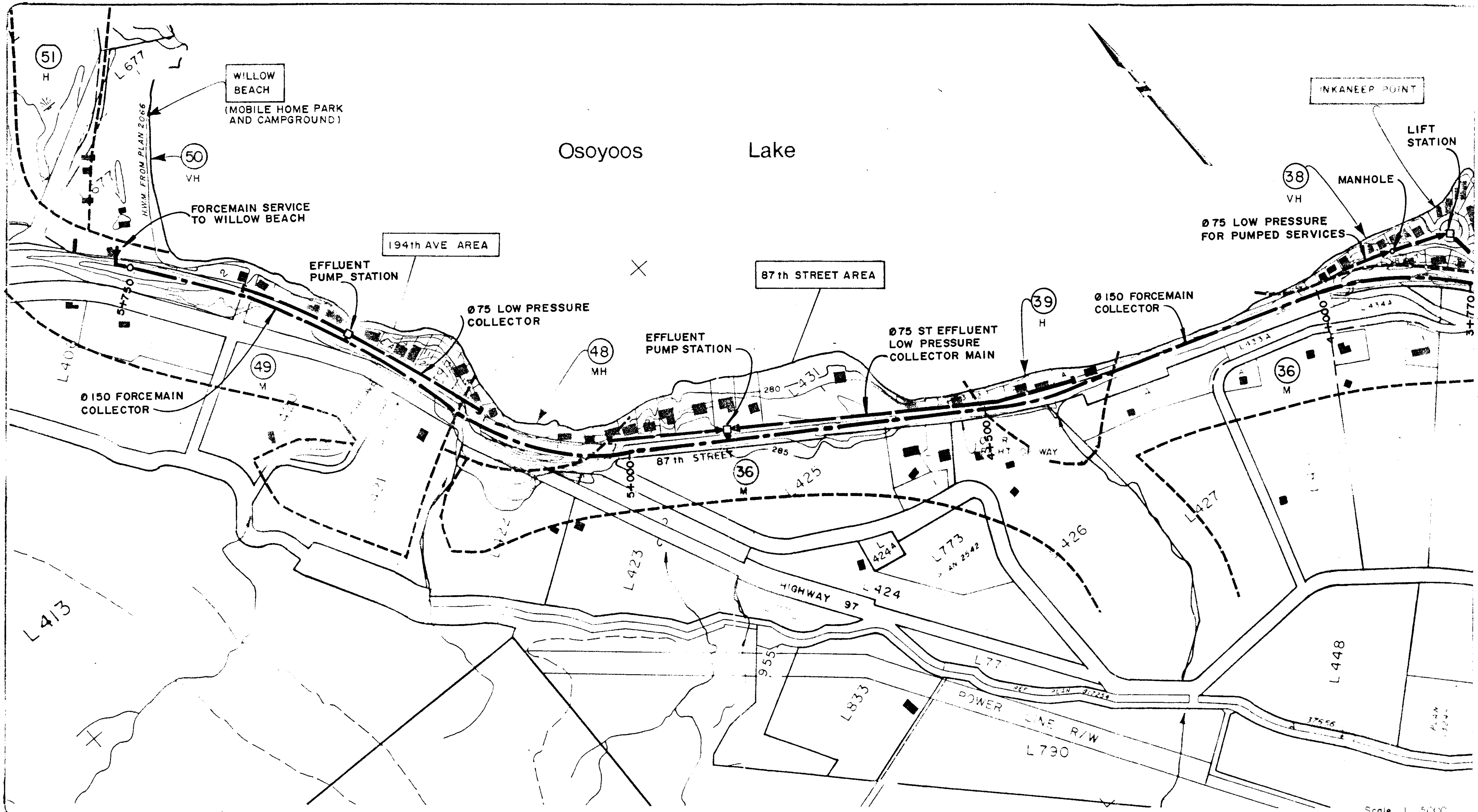
Figure 6.1
North West Sector
Osoyoos Rural Area
Electoral Area A



Regional District of
Okanagan - Similkameen

Waste Management Plan
Electoral Areas A.C & D

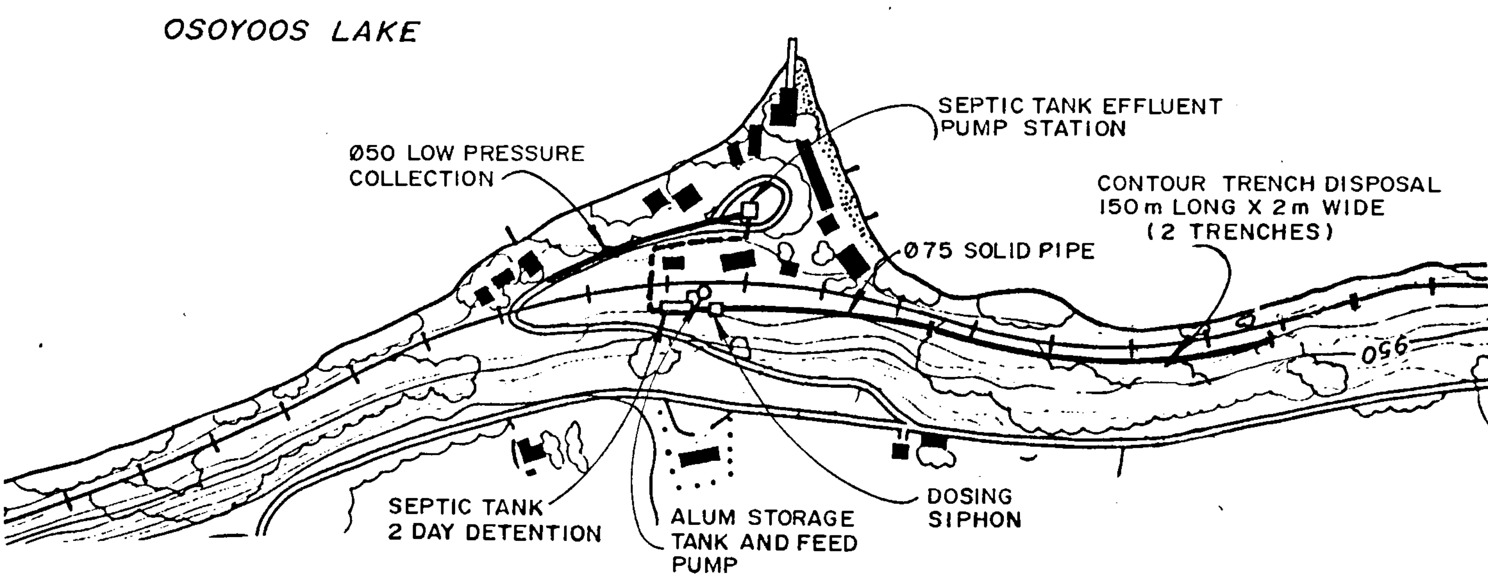
Figure 6.2
Osoyoos Rural Area
Electoral Area A
North West Sector



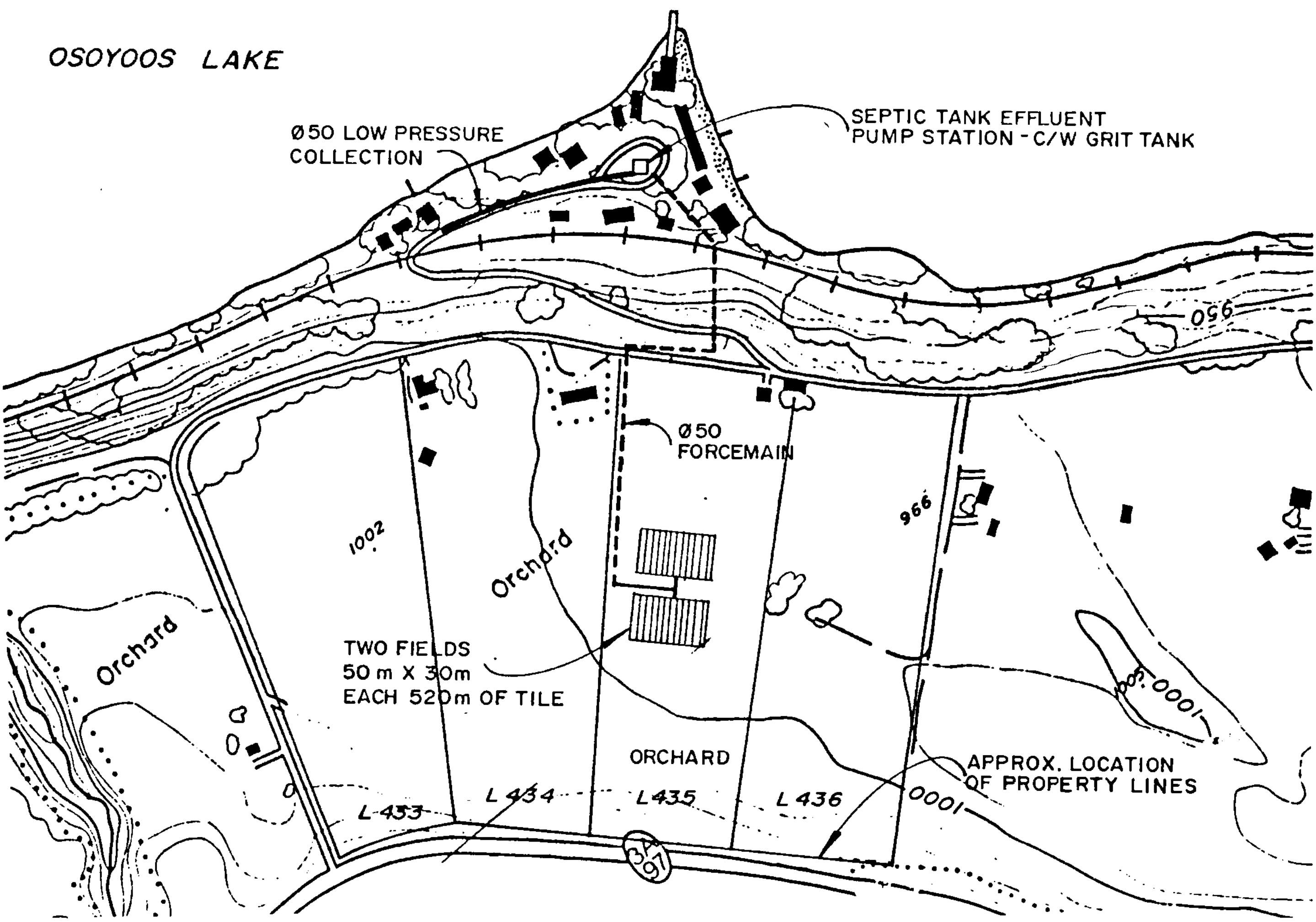
Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 6.3
Osoyoos Rural Area
Electoral Area A
North West Sector



PHOSPHORUS REMOVAL AND GROUND DISPOSAL ON C.P. RIGHT OF WAY

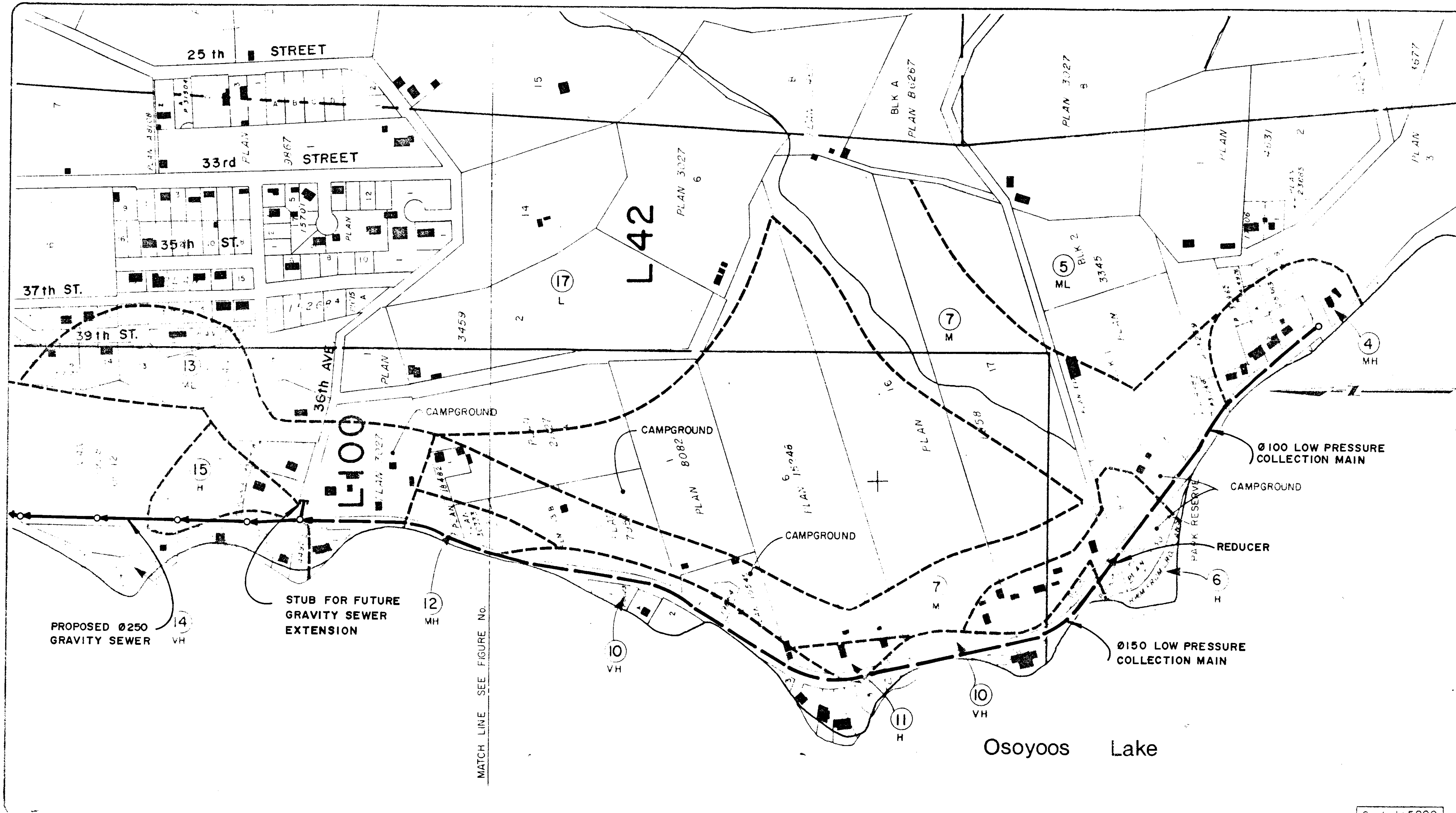


CONVENTIONAL SUBSURFACE DISPOSAL OF SEPTIC TANK EFFLUENT

INKANEEP POINT COMMUNITY SYSTEM ALTERNATIVES

Scale 1:500

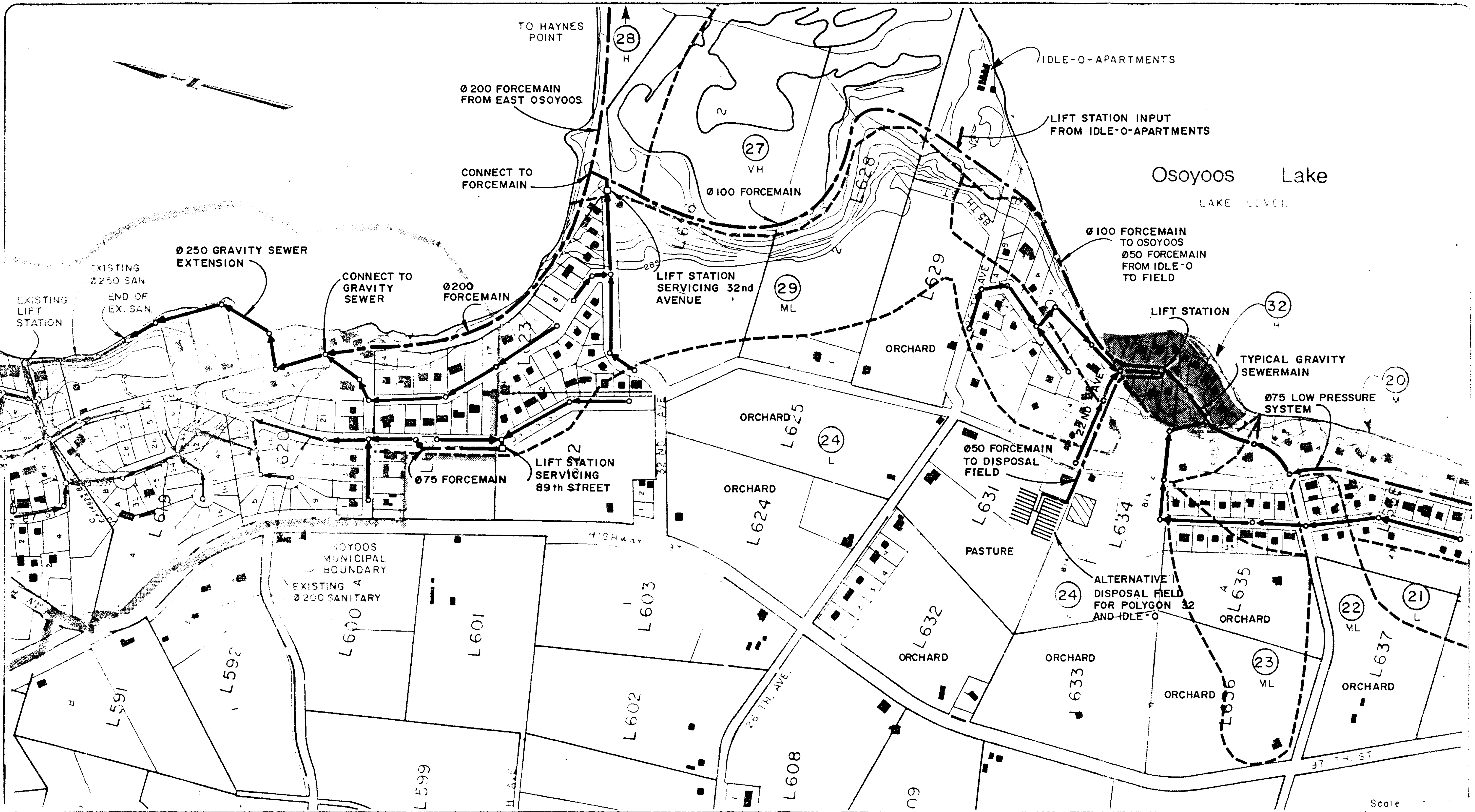
FIG. 6-4



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

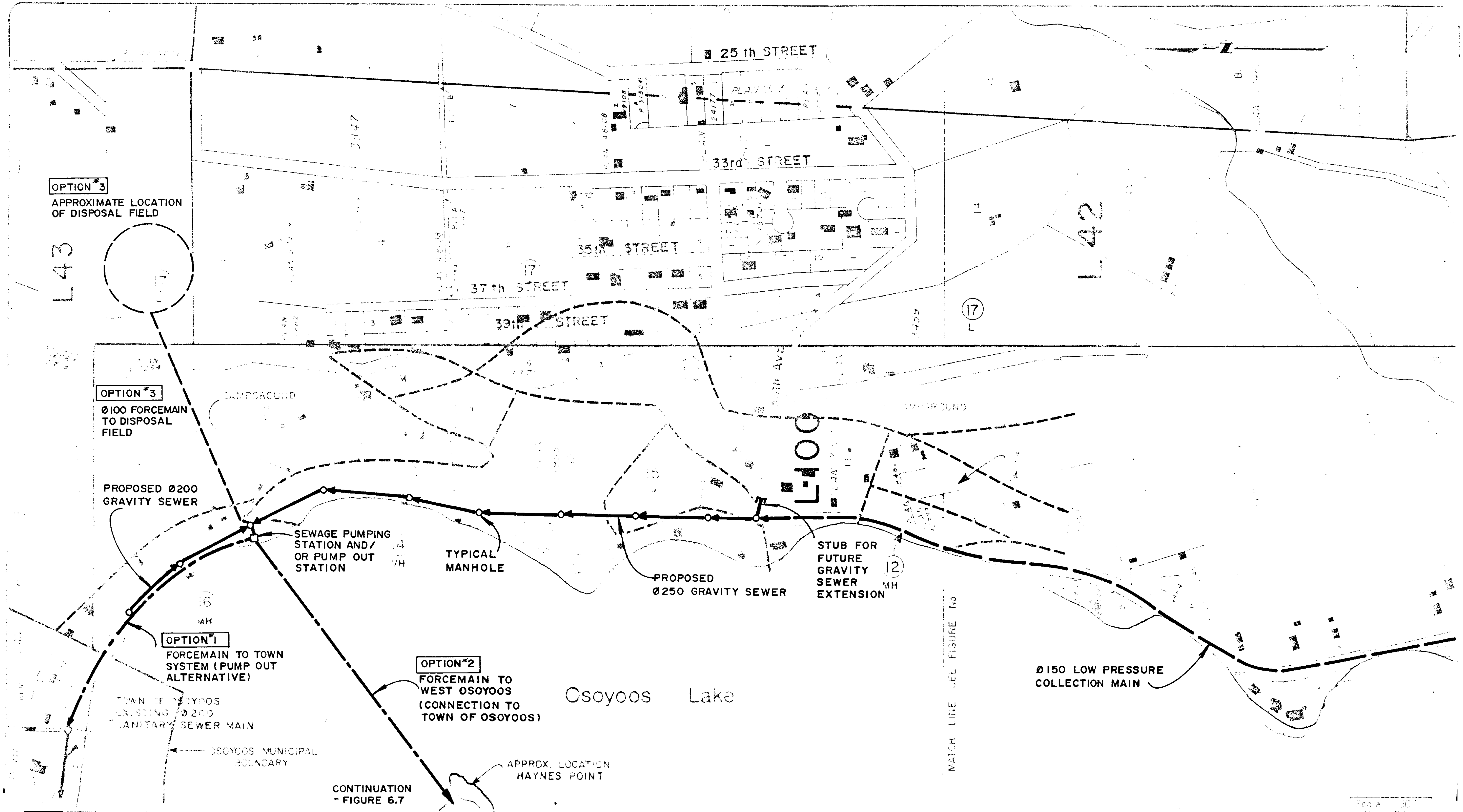
Figure 6.5
South East Sector
Osoyoos Rural Area
Electoral Area A



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A C & D

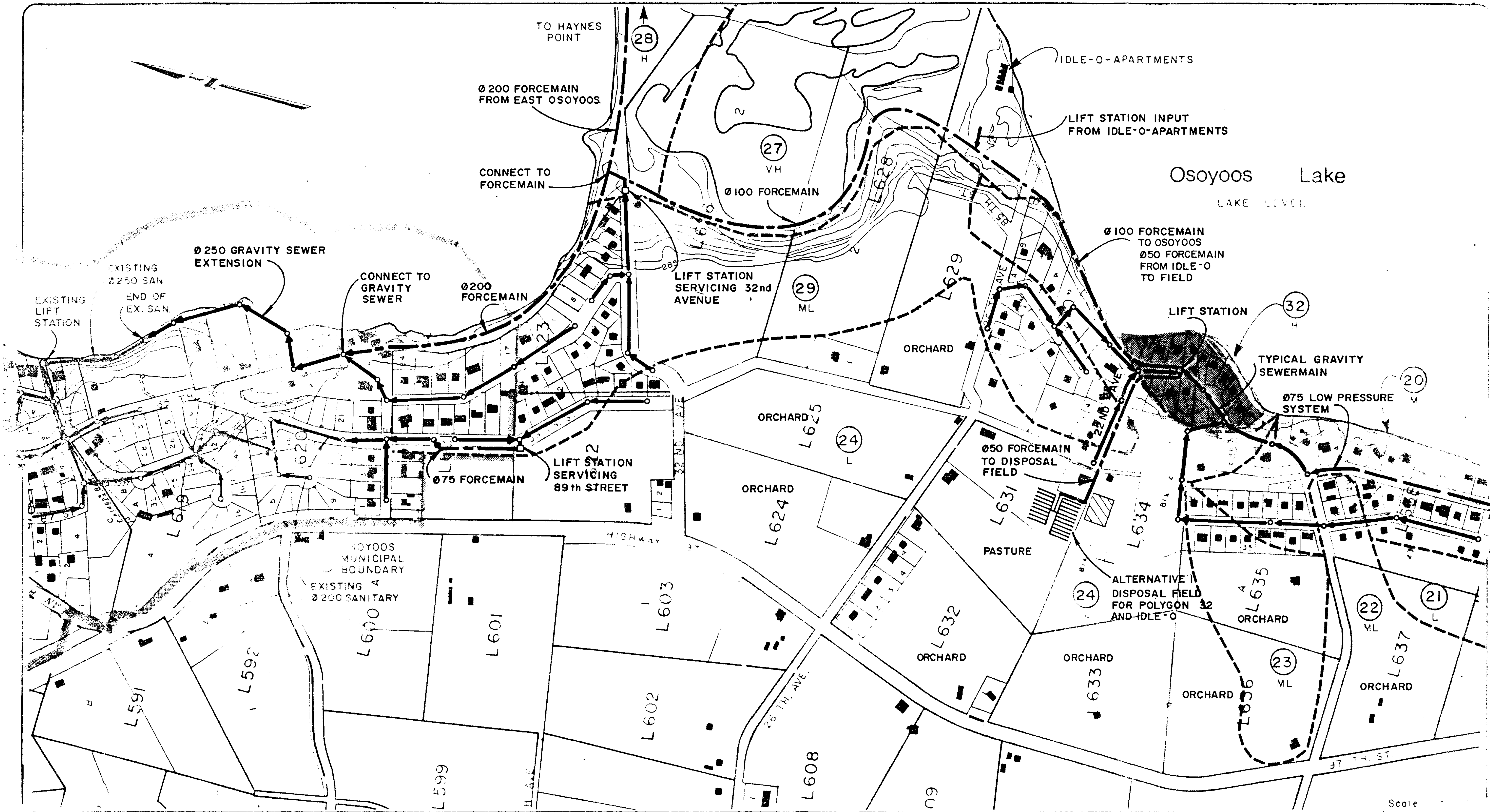
Figure 6.7
South West Sector
Osoyoos Rural Area
Electoral Area



Regional District of Okanagan - Similkameen

Waste Management Plan Electoral Areas A, C & D

Figure 6.6
South East Sector
Osoyoos Rural Area
Electoral Area A



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A C & D

Figure 6.7
South West Sector
Osoyoos Rural Area
Electoral Area

7.1 Sawmill Road Area (South Oliver Rural Area)

7.1.1 Description

The Sawmill Road sector is a rural residential area south of the Village of Oliver paralleling the Okanagan River and is illustrated in Figures 7.1 and 7.2. From the boundary of the Village of Oliver the distance to the southern end of the Sawmill Road sector is about 3.0 km. Development in the Sawmill Road area is predominantly small holding rural and low density residential. The largest concentration of housing development is located at the southern end of the sector. According to RDOS community plan mapping, the entire Sawmill Road sector is within the floodplain of the Okanagan River.

The objective of an alternative sewerage system in this sector is to provide service to essentially all existing housing units within the area. Figures 7.1 and 7.2 illustrate that essentially all of the Sawmill Road sector has either High or Very High phosphorus transmission ratings.

7.1.2 Alternative System Planning Constraints

The rural residential density in the Sawmill Road area is a constraint which will impact the cost per unit served of the collection system. This rural residential density combined with high groundwater table conditions and essentially flat topography effectively preclude a conventional gravity collection system.

Within the Sawmill Road sector there is no suitable site for a community subsurface disposal system for collected wastewater. All areas are subject to high groundwater conditions and have phosphorus transmission ratings of High or Very High. Disposal options to the west are complicated by the extensive orchard land use. A community disposal in the orchard area to the west would, however, utilize an area having a Moderately Low phosphorus transmission rating (average 90% phosphorus removal).

7.1.3 Waste Management Options

Option 1 - Collection System with Connection to the Village of Oliver

A low pressure septic tank effluent collection system is proposed for the Sawmill Road area as illustrated in Figures 7.1 and 7.2. A low pressure collection main is proposed along Sawmill Road from the north to south ends of the sector. Individual septic tank effluent pumps would pump directly into the main or sublaterals of the primary collection main. Each individual pump would be sized for the static lift to the point of connection in Oliver, thereby eliminating the need for a community lift station. Adequate collection main capacity is available at the southern boundary of the Village to accept sewage from the 75 houses in the Sawmill Road area.

A conventional gravity sewer system was evaluated in conceptual detail for service to the Sawmill Road area. Neglecting the potential impact of high groundwater table conditions on capital cost, the conventional gravity collection system capital cost is estimated to be $460,000 which is $180,000 higher than the estimated cost of the low pressure system. A large component of the additional cost is represented by two sanitary sewage lift stations. The gravity system would service the concentration of houses at the north and south ends of the Sawmill Road area or approximately 45 of the present 75 lots or land parcels in the area. Rural density housing in the middle area of the sector would still be serviced by a low pressure collector system. For capital cost reasons, the gravity sewer alternative is not evaluated further.

Option 2 - Collection System with Community Disposal in Orchard Area to the West

The collection system within the Sawmill Road area would be essentially the same as described above for the connection to the Village of Oliver. Wastewater would be collected to a central lift station at the south end of the Sawmill Road area and then pumped 300 to 500 meters to the west to a disposal system in the orchard area. A potential advantage of this option is the opportunity to phase the collection system implementation by constructing initial phases in the relatively concentrated development area at the southern end of the sector.

7.1.4 Collection System with Connection to the Village of Oliver Option 1

7.1.4.1 System Description

Servicing the fringe area of Oliver along Sawmill Road with a low pressure septic tank effluent collection system connected to the Village is illustrated in Figures 7.1 and 7.2. Existing septic tanks would continue to function as primary settling tanks. A low pressure effluent pump would be installed downstream of each septic tank to pump effluent to the connection to the Village of Oliver system. In total, about 2000 m of 75 mm Ø and 1100 m of 50 mm Ø low pressure pipe are required to collect the effluent. There is adequate hydraulic capacity in the Village's sewer to receive flows from the Sawmill Road area.

A basic assumption of this concept for servicing the Sawmill Road area is that the static lift and friction losses on individual sewage pumps to the connection to the Oliver system will be less than about 200 metres. This total head is nearing the maximum head limit of individual unit effluent pumps. If a more detailed analysis of ground elevation and pipe friction losses indicates that operating heads for individual pumps will be generally higher than 20 m, collection of effluent to a community pump station at the south end of the Sawmill Road area will be required. A 100 m forcemain approximately 2100 m in length to the connection to the Village of Oliver system would also be required. These two additional facilities would increase the estimated low pressure collection system cost by about $116,000.

A potential advantage of the lift station at the south end of the Sawmill Road area is the opportunity to provide a gravity septic tank effluent collection system to houses in the immediate area. Approximately 25 houses on polygon 57 (see figure 7.2) at the south end of the Sawmill Road area could be relatively easily serviced by a gravity septic tank effluent collection system if a community lift station were necessary.

7.1.4.2 System Design Criteria

The low pressure sewage collection system, as illustrated in Figures 7.1 and 7.2, will service all areas between the abandoned CP Railway right of way and the Okanagan River. In general, the service area includes all High and Very High rated polygons in the Sawmill Road sector. Service populations for the proposed system are summarized in Table 7.1.

TABLE 7.1
SERVICE POPULATIONS IN SAWMILL ROAD AREA

Polygon	1987 Population	2007 Population
55-VH	20	20
56-H	3	3
57-H	99	142
58-MH	6	6
59-VH	3	3
60-VH	6	6
61-M	3	3
63-H	29	29
66-VH	38	52
TOTALS	207	264
Average Daily Sewage Flow	95 m^3/day (20,700 gpd)	120 m^3/day (26,400 gpd)

Areas of the Sawmill Road sector not serviced by the proposed collection system are located east of the Okanagan River and west of the old CP Rail right of way. Development on the east side of the Okanagan River includes 8 rural residential houses on Very High or High phosphorus transmission polygons. The low density of development combined with the capital costs of constructing a pipeline system across the Okanagan River do not justify consideration of a community sewerage system. The homes on the east side of the Okanagan River warrant consideration for alternative on-site disposal systems for phosphorus removal. Areas west of the CP Rail right of way have Moderately Low and Low phosphorus transmission ratings and, therefore, are not a priority for service by a community system.

Phosphorus loading reductions for the Sawmill Road collection system pumping to the Village of Oliver are presented in the tabulation following:

	1987	2007
Total Sector P Loading	190.7 kg/yr.	229.8 kg/yr.
Reduction with Collection System	143.7 kg/yr.	182.8 kg/yr.
Residual P Loading	47 kg/yr.	47 kg/yr.
Sector Population (permanent)	396	453
Population on Alt. Systems	207	264
Residual with Individual Systems	189	189

The above data illustrates a reduction of the estimated 1987 phosphorus loading from 190.7 kg/yr. to 47.kg/year. The residual remains the same at 47 kg/year to year 2007 indicating that all population growth in the Sawmill Road area would be serviced by the collection system. The provision of a sewage collection system in the Sawmill Road area may increase the development potential of the area by removing the present septic tank constraints. Whether or not subdivision of larger land parcels in the Sawmill Road is possible may be a factor in a final decision to implement the system.

The phosphorus loading residual of 47 kg/year from a population of 189 is equivalent to an average phosphorus removal of 75% from remaining septic tank and tile field systems. While this average removal is still slightly below the minimum existing development objective of 80%, it is a significant improvement from the present average removal of 52% given in Table 4.3.

7.1.4.3 Capital Cost Estimate

A capital cost estimate for the low pressure sewerage system to service the Sawmill Road area with a connection to the Village of Oliver system is presented in Table 7.2. The capital cost estimate includes all collection system components and provides for a service connection to the property line of each benefiting parcel in the area. Each homeowner will be responsible for the costs of the service connection from the property line to the house and the costs of the effluent pumping station. On property service construction costs could be substantial in many cases recognizing the multi-acre size of many of the parcels and the setback from the house to the collection main in the road right of way.

The overall project estimated capital cost is $284,000 which is equivalent to $1,980 per kg/year of reduced phosphorus loading. This calculation is based on a total loading reduction for the sector as a whole of 143.7 kg/year.

No allowance has been made in the capital cost estimate given in Table 7.2 for expenditures at the Village of Oliver sewage treatment plant. Capacity evaluation studies related to the sewage treatment plant (16) suggest that the existing treatment plant does not have significant reserve capacity. The connection of the Sawmill Road area to the sewage treatment plant represents an additional flow of 95 m^3/day which is about 10% of the present average daily flow to the plant. Assuming that the Village does not undertake sewer extensions in other areas which would increase the hydraulic loading on the plant, the existing treatment plant should be capable of accepting flows from the Sawmill Road area.

TABLE 7.2

SAWMILL ROAD AREA COLLECTION SYSTEM

WITH CONNECTION TO THE VILLAGE OF OLIVER

CAPITAL COST ESTIMATE

Item	Description	Estimated Cost
1.	Low Pressure Collection Mains - Ø50 - 1100m	$ 37,000
	Ø75 - 2000m	90,000
2.	Pressure Services - Ø50 - 1000m	35,000
3.	Forcemain - Ø100 - 300m	15,000
4.	Road Restoration	48,000
5.	Connection to Village System	2,000
	Sub-Total	**$ 227,000**
	Contingencies and Engineering (allow 25%)	**57,000**
	Total	**$ 284,000**

7.1.4.4 User Cost Calculation

Three alternative formulae for senior government assistance for the system construction are described in section 3.4. Applying these three assistance formulae to the estimated project capital cost of $284,000 results in the following user costs for debt retirement.

Benefiting Lots/Parcels - 75

Approximate User Costs for Debt Retirement

Formula 1 - $ 280.00

Formula 2 - $ 240.00

Formula 3 - $ 30.00

Formula 4 - $ 390.00

A monthly user fee amounting to about $100 per year would be additional to the above to cover operating and maintenance costs of both the collection system and the Village of Oliver treatment plant. Individual homeowners would also pay a connection fee on a one time basis.

7.1.5 Collection System with Effluent Disposal to Community Field

7.1.5.1 System Description

The wastewater collection system in the Sawmill Road area would, with this option, be essentially the same as illustrated in Figures 7.1 and 7.2 and as described in section 7.1.4.1. Septic tank effluent would be collected to a lift station located at the south end of the Sawmill Road area. Figure 7.2 illustrates the general direction of the forcemain to the disposal field.

For this preliminary analysis of disposal options, no specific site is designated for the disposal field. It is assumed that the disposal field will be sited in an orchard up to 400 m west of the lift station shown on Figure 7.2. There are no undeveloped areas suitable for a community disposal field west of the proposed Sawmill Road wastewater pumping station.

The disposal field would be located in an area having a Moderately Low phosphorus transmission rating. Topographic mapping for the South Oliver Fringe area suggests that the disposal field would be a minimum of 40 m vertically above the Sawmill Road area.

The subsurface disposal field would be sized in accordance with Ministry of Environment guidelines. For an average daily sewage flow of 95 m^3/day from Table 7.1, the disposal field at a minimum would comprise 2700 metres of conventional tile in each of the two disposal fields. This sizing calculation is based on an assumed percolation rate of 10 minutes per 25 mm. The proposed disposal field would require a minimum site area of 2.5 ha (6 acres) which includes a standby reserve area for a replacement field.

Recognizing that a septic tank effluent collection system is proposed in the Sawmill Road area, no community septic tank is proposed preceding the disposal field. Collected effluent would simply be pumped to a grit removal/dosing chamber prior to the disposal field.

7.1.5.2 System Design Criteria

The collection area remains the same as described in the previous section for the connection to the Village of Oliver option. Service areas, populations and estimated wastewater volumes will, therefore, be the same as presented in Table 7.1. The major difference between the two options is in phosphorus residual loading. With the connection to the Village of Oliver system, it is assumed that 100% phosphorus removal is achieved through the Village's spray irrigation system. The community disposal field, on the other hand, will achieve an average phosphorus removal of 90% leaving a 10% residual loading. Reductions calculated on this basis for the community disposal field are summarized as follows:

	1987	2007
Total Sector P Loading	190.7 kg/yr.	229.8 kg/yr.
Reduction with Collection System	(-)143.7 kg/yr.	(-)182.8 kg/yr.
Residual from Disposal Field	(+) 20.7 kg/yr.	(+) 26.4 kg/yr.
Net Reduction	123 kg/yr.	156.4 kg/yr.
Sector Residual Loading	67.7 kg/yr.	73.4 kg/yr.
Sector Population (permanent)	396	453
Population on Alt. Systems	207	264
Residual with Individual Systems	189	189

Residual sector loadings given above are about 20 kg/yr. higher than previously presented for the connection to the Village of Oliver system.

7.1.5.3 Capital Cost Estimate

A capital cost estimate for the low pressure sewerage system in the Sawmill Road area with effluent being pumped to disposal in a community subsurface field is presented in Table 7.3.

TABLE 7.3

SAWMILL ROAD AREA COLLECTION SYSTEM
WITH PUMPING TO A COMMUNITY DISPOSAL FIELD
CAPITAL COST ESTIMATE

Item	Description		Estimated Cost
1.	Low Pressure Collection Mains -	Ø50 - 1100m	$ 37,000
		Ø75 - 2000m	90,000
2.	Pressure Services -	Ø50 - 1000m	35,000
3.	Effluent Pumping Station		45,000
4.	Road Restoration		38,000
5.	Forcemain to Disposal Field	approx. 400m	22,000
6.	Dosing Siphon and Grit Tank		12,000
7.	Disposal Field	5400m	106,000
8.	Solid Headers, Dist. Boxes, etc.		18,000
	Sub-Total		**$ 403,000**
	Contingencies and Engineering (allow 25%)		**100,000**
	Disposal Area Site Acquisition		**75,000**
	Total		**$ 578,000**

Overall estimated capital costs are some $294,000 greater than the previously described option involving a connection to the Village of Oliver system. The overall system capital cost of $578,000 is equivalent to $4700 per kg/year based on a sector area reduction of 123 kg/year.

7.1.5.4 User Fee Calculation

A user cost analysis for capital cost debt retirement for the disposal to a community subsurface disposal system is presented following. The user fees presented do not include a monthly user cost for operation and maintenance or a connection fee.

Benefiting Lots/Parcels - 75

Approximate User Costs for Debt Retirement

Formula 1 - $ 600.00

Formula 2 - $ 360.00

Formula 3 - $ 60.00

Formula 4 - $ 870.00

7.2 Tugulnuit Lake Area

7.2.1 Description

The Tugulnuit Lake Area generally includes the lakeshore area around the perimeter of the Lake and the concentrated development area between the southern end of the Lake and the Village of Oliver boundary. The Tugulnuit Lake Sector and phosphorus transmission polygons in the immediate vicinity of the Lake are illustrated in Figure 7.3.

From Figure 7.3, the priority areas for an alternative sewerage system to reduce the phosphorus loading are generally located in the immediate lakeshore area. Polygons having ratings of High or Very High are located on the north and south ends and the west side of the Lake. These areas have a combined population of 200 (approximately 69 units). Alternative sewerage systems will be evaluated which will service the entire Tugulnuit Lake Sector and only the lakeshore areas having High or Very High phosphorus transmission ratings.

7.2.2 Alternative System Planning Constraints

The Tugulnuit Lake Sector is bounded essentially on all sides by topographic and boundary constraints which significantly restrict the options available for effluent disposal other than a connection to the Village of Oliver sewerage system. These constraints are:

- east side - Osoyoos Indian Reserve #1
- west side - Okanagan River and Floodplain
- north end - Okanagan River Floodplain
- south end - Prime Development Areas and the Village of Oliver

The potential service population in year 2007 in the Tugulnuit Sector from Table 4.3 is 1600 from which an average daily sewage flow of 580 m^3/day (128,000 gpd) could be expected. This is a significant quantity of wastewater and would require, at the absolute minimum, a site area approaching 2 ha (5 acres) for separate treatment and disposal systems.

The lakeshore area of Tugulnuit Lake represents a difficult area to economically service by a collection system. In all probability, low pressure sewerage systems will offer the most reasonable alternative for a collection system along the northern and eastern lakeshores.

The Osoyoos Indian Reserve boundary represents a jurisdictional constraint in terms of potentially servicing all lakeshore development in the Tugulnuit Lake area. Development adjacent to the southeast corner of the Lake on Osoyoos IR #1 includes a campground, motel, and a mobile home park. Participation of the Osoyoos Indian Band in an overall plan to provide an alternative sewerage system in the Tugulnuit Lake area should be a topic for discussion between the Regional District and the Band.

Groundwater quality may be a factor in the consideration of expanding areas serviced by individual septic tank and tile field systems at the south end of Tugulnuit Lake. Figure 7.3 illustrates the approximate location of three (3) production wells operated by S.O.L.I.D. for service primarily to domestic connections in the Tugulnuit Lake area. There is a possibility that the Village of Oliver may construct water wells in the vicinity as supply sources for the municipality. Data provided by the Ministry of Health suggests no adverse impact to date on water quality in the S.O.L.I.D. wells from septic tank systems in the area.

7.2.3 Waste Management Options

Option 1 - Collection System with Connection to the Village of Oliver

The entire Tugulnuit Lake Sector could ultimately be serviced by a collection system which would connect to the Village of Oliver sewerage system. The Village has provided oversized forcemains and gravity sewers to the east side of the Okanagan River to ultimately accept sewage flow from the Tugulnuit Lake area.

Option 2 - Provide Service to Moderately High and Higher Transmission Polygons

This option would evaluate the feasibility of not constructing a sewerage system in the complete Tugulnuit Lake sector but instead alternative systems are provided only in areas having a phosphorus transmission classification of Moderately High, High or Very High. From Figure 7.3, areas which would, in this case, be serviced include:

(1) North End of Tugulnuit Lake - Polygon 85 - Very High Rating
Development includes campground and rural residential housing

(2) West Side of Lake - Polygon 85 - Very High Rating
Development includes about 25 lakeshore single family residential lots

(3) South End of Lake - Polygon 85 and 86 - Very High and High Ratings respectively
Development includes two campgrounds and some single family housing

For comparative purposes, the option which would provide an alternative system for lakeshore areas includes a separate community subsurface disposal field instead of the connection to the Village of Oliver system.

7.2.4 Collection System with Connection to Village of Oliver

7.2.4.1 System Description

A report dated April 1987 prepared by Urban Systems Ltd. (USL) and titled "Expansion Area Study: The Village of Oliver" (15) evaluates in predesign detail a sanitary sewage collection system which would service the Tugulnuit Lake area. The report was commissioned by the Village of Oliver to provide water and sanitary sewer service cost information to be used as a component of the Village's boundary expansion study to include the Tugulnuit Lake area. This report divides the Tugulnuit Lake area into three sub-areas, numbered 1 to 3 inclusive, as shown in Figure 7.3. For purposes of this Waste

Management Plan, the basic area definitions by USL have been used except that sub-area 3 has been divided into two, designated 3A and 3B and a fourth added. Figure 7.3 illustrates sub-area 3A as areas having High and Very High phosphorus transmission ratings at the south end and along the west side of Tugulnuit Lake. The area defined as sub-area 4 includes the north end and east side of Tugulnuit Lake. This area was not addressed in the April 1987 servicing study by USL. The eastern boundary of sub-area 4 coincides with the west boundary of the Osoyoos Indian Reserve #1.

Sub-area 1 is located in the vicinity of Belleview Drive and generally includes low density and small holding development. The area is serviced by a conventional gravity sewer system which drains to the west and connects into existing trunk sewers in the McPherson Drive area. A 1985 Urban Systems report entitled, "Sewer and Water Study; The Village of Oliver" (16) identifies a reserve capacity for a population equivalent of 600 in the McPherson Drive trunk sewer collection system. More than adequate collection system hydraulic capacity is available for the area designated as sub-area 1.

Sub-area 2 comprises the areas immediately adjacent to the Village of Oliver boundaries on Tuc-el-Nuit and Park Drives as illustrated in Figure 7.3. This area slopes naturally to the south and would be serviced by conventional gravity sewers extended from existing Village of Oliver mains on Park Drive.

In general, sub-area 3 slopes to the north toward Tugulnuit Lake and as a result cannot be serviced by gravity extensions of existing sewer mains. The major element of the sewerage system in sub-area 3 is a sewage lift station located in the Park at the southwest corner of the Lake. As illustrated in Figure 7.3, sanitary sewer mains drain by gravity from throughout sub-area 3 to this lift station. The Tugulnuit Lake sewage lift station would pump collected sewage through a 150 mm forcemain to the Okanagan River Bridge on Park Drive. The forcemain length is approximately 1500 m. Adequate trunk sewer capacity is available in the existing sewerage system from the east side of the Okanagan River Bridge to the treatment plant.

All proposed sanitary sewers in sub-area 3 are gravity mains with the exception of the line on Tuc-el-Nuit Drive serving lakeshore houses (polygon 85 in Figure 7.3). All homes fronting the Lake would have to pump septic tank effluent up to the gravity main on Tuc-el-Nuit Drive. The northernmost 10 lots in this area would be serviced by a low pressure collector main and would also require the use of individual pump systems.

To provide sewer service to sub-area 4, a combination conventional gravity and low pressure system is proposed as illustrated in Figure 7.3. Residential development on the east side of the Lake is serviced by a conventional gravity collection system terminating at a lift station at the north end of the Lake. Figure 7.3 illustrates the gravity components in easements. A 100 mm low pressure collector/ forcemain extends around the north end of the Lake from this lift station connecting to the collection system in sub-area 3 on the west side of Tugulnuit Lake. Lots in the northwest corner of Tugulnuit Lake would, on an individual basis, pump septic tank effluent into the low pressure main.

7.2.4.2 System Design Criteria

The population which would be serviced by the proposed collection system serving the Tugulnuit Lake area is summarized in Table 7.4.

TABLE 7.4
SERVICE POPULATION - TUGULNUIT LAKE COLLECTION SYSTEM

	Population			
	1987		2007	
Sub-Area	**Permanent**	**Seasonal**	**Permanent**	**Seasonal**
1	75		175	
2	162		262	
3A	200	300	220	300
3B	148		451	
4	52	90	86	90
	637	390	1194	390
Total Sect.Pop.	1088		1654	
Residual Using Ind. Systems	451		460	
Est. Av. Daily Flow	290 m^3/day (63,800 gpd)		550 m^3/day (121,000 gpd)	
Peak Summer Flow	380 m^3/day (83,600 gpd)		640 m^3/day (141,000 gpd)	

As shown in Table 7.4, the collection system would service an estimated population of 637 in 1987 and 1194 in year 2007. Essentially, 100% of the anticipated population growth in the sector between 1987 and 2007 would be serviced by the collection system. The majority of the residual population which would remain serviced by individual septic tank and disposal field systems are located on the Osoyoos Indian Reserve on polygons 83 and 82 as illustrated in Figure 7.3.

Table 7.5 presents data for phosphorus loading reductions with the construction of the Tugulnuit sewerage system. Estimates have been made according to sub-areas illustrated in Figure 7.3 to demonstrate the proportion of phosphorus loadings which would be removed per serviced area.

At present, a permanent population of 1088 and a seasonal population of 580 on individual septic tank and tile field systems contribute an estimated 277.4 kg of phosphorus per year to the Okanagan Basin. As mentioned, the Tugulnuit collection system would service an estimated permanent and seasonal population of 637 and 390 respectively, which represents 218 kg/year of phosphorus (78% of the total for the sector). The system would leave a permanent population of 451 with individual on-site facilities contributing an estimated 42.7 kg of phosphorus per year. The average removal efficiency of these remaining systems is 90%. Seasonal facilities on the Osoyoos Indian Reserve represent a phosphorus loading of 16.6 kg/year which, when added to the 42.7 kg/year from the permanent population, yields a sector total residual of 59.3 kg/year.

TABLE 7.5

PHOSPHORUS LOADINGS - TUGULNUIT LAKE COLLECTION SYSTEM

	1987		2007	
	Population	P. Loading	Population	P. Loading
Area Total	1088	277.4	1654	352.1
Sub-Area 1	75	1.9	175	4.4
Sub-Area 2	162	4.1	262	6.6
Sub-Area 3A	200	168.5	220	186.
Sub-Area 3B	148	14.6	451	41.6
Sub-Area 4	52	29.0	86	52.
Total	**637**	**218.1**	**1194**	**290.6**
Residual	**451**	**59.3**	**460**	**61.5**

Table 7.5 illustrates that the majority of the phosphorus loading originates in sub-area 3A and 4 as illustrated in Figure 7.3. These two areas comprise the Very High and High rated phosphorus transmission rating areas around Tugulnuit Lake. These two sub-areas represent a potential phosphorus loading reduction of 197.5 kg/year or 90% of the total possible reduction of 218 kg/year given in Table 7.5. Sub-areas 3A and 4, therefore, are the priorities in terms of providing a community sewerage system in the Tugulnuit Lake area. A sewerage system can be constructed in sub-area 3A with construction of systems in sub-areas 1, 2 or 3B. Recognizing that the system serving the north end of the Lake (sub-area 4) connects to the system in sub-area 3A, the system in sub-area 4 must be constructed concurrent with, or following, the system in sub-area 3A.

7.2.4.3 Capital Cost Estimate

A capital cost estimate for the community collection system illustrated in Figure 7.3 for the Tugulnuit Lake area is presented in Table 7.6. The cost estimate is separated into the various sub-areas being described herein. Collection system cost estimates for sub-areas 1 and 2 are $146,000 and $124,000 respectively. Both these systems involve extensions of existing gravity mains in the Village and are independent of each other.

The collection system to service sub-area 3A is $348,000 which includes the Tugulnuit Lake lift station and 1400 m of 150 mm forcemain connecting to the Town of Oliver system. The lift station and forcemain is necessary for service to sub-areas 3B and 4. By comparison to sub-area 3A, the capital costs for areas 3B and 4 are lower but do not include provisions for the sewage lift station or forcemain.

Capital costs per kg of reduced phosphorus loading for each of the sub-areas is presented in the tabulation following.

	Est. Capital Cost	**Reduced P Loading**	**Cost/kg/year**
Sub-Area 1	$ 146,000	1.9	$ 76,800
Sub-Area 2	124,000	4.1	30,200
Sub-Area 3A	348,000	168.5	2,060
Sub-Areas 3A & 4	505,000	197.5	2,550
Sub-Areas 3A&4&3B	817,000	212.1	3,850
Overall -	**$1,087,000**	**218.1**	**$ 4,980**

If the primary objective of collection system construction in the Tugulnuit Lake area is phosphorus loading reductions, the preceding tabulation illustrates the priority should be given to sub-area 3A followed by sub-area 4 and then sub-area 3B.

The capital cost estimate presented in Table 7.6 for the Tugulnuit Lake area sewerage system connected to the Village of Oliver system includes only collection system components. Adequate trunk sewer capacity is available from the present Village of Oliver boundary to the sewage treatment plant for anticipated flows from the Tugulnuit Lake area. No provisions are made in Table 7.6 for capital costs for upgrading of the Village of Oliver treatment plant to accommodate sewage flow from the Tugulnuit Lake area. The scope of improvements which may be required at the treatment plant depends on the amount of the Tugulnuit Lake area serviced and the scheduling of the collection system construction. Service to the Sawmill Road area as discussed in section 7.1 is also a factor in assessing the impact on the Village of Oliver treatment plant.

TABLE 7.6
TUGULNUIT AREA COLLECTION SYSTEM WITH CONNECTION TO OLIVER
CAPITAL COST ESTIMATE

Item	Description		Est. Cost
Sub-Area 1			
1.	Ø200 Gravity Sewer	1130 m	$ 68,000
2.	Manholes and Cleanouts	12	21,000
3.	Ø100 Sewer Services	200 m	10,000
4.	Restoration		18,000
	Subtotal		**$ 117,000**
	Contingencies and Engineering (allow 25%)		**29,000**
	Total Sub-Area 1		**$ 146,000**
Sub-Area 2			
1.	Ø200 Gravity Sewer	800 m	$ 56,000
2.	Manholes and Cleanouts	9	16,000
3.	Ø100 Sewer Services	300 m	15,000
4.	Restoration		12,000
	Subtotal		**$ 99,000**
	Contingencies and Engineering (allow 25%)		**25,000**
	Total Sub-Area 2		**$ 124,000**
Sub-Area 3A			
1.	Ø200 Gravity Sewer	1050 m	$ 63,000
2.	Manholes and Cleanouts	12	21,000
3.	Gravity and Pressure Services		27,000
4.	Ø100 Low Pressure Collection Main	400 m	20,000
5.	Collection System Restoration		20,000
6.	Sanitary Sewer Lift Station		50,000
7.	Ø150 Forcemain to Village Connection	1400 m	77,000
	Subtotal		**$ 278,000**
	Contingencies and Engineering (allow 25%)		**70,000**
	Total Sub-Area 3A		**$ 348,000**
Sub-Area 3B			
1.	Ø200 Gravity Sewer	2000 m	$ 120,000
2.	Manholes and Cleanouts	22	40,000
3.	Gravity Services	1000 m	50,000
4.	Restoration		40,000
	Subtotal		**$ 250,000**
	Contingencies and Engineering (allow 25%)		**62,000**
	Total Sub-Area 3B		**$ 312,000**
Sub-Area 4			
1.	Ø200 Gravity Sewer	650 m	$ 39,000
2.	Manholes and Cleanouts	9	11,000
3.	Gravity and Pressure Services		5,000
4.	Lift Station		35,000
5.	Ø100 Forcemain	700 m	28,000
6.	Restoration		8,000
	Subtotal		**$ 126,000**
	Contingencies and Engineering (allow 25%)		**31,000**
	Total Sub-Area 4		**$ 157,000**
	TOTAL SUB-AREAS 1 to 4 INCLUSIVE		**$1,087,000**

The connection of the Tugulnuit Lake area to the Village sewerage system will also necessitate an expansion of the Village of Oliver spray irrigation areas. The present irrigation area on the Fairview Mountain Golf Course is essentially fully utilized by present Village population.

The extension of service into the Tugulnuit Lake area will require upgrading of the Oliver treatment plant and an expansion of the spray irrigation areas. Although the capital costs for these improvements depend to a significant degree on how much of the Tugulnuit area is serviced, some recognition of these costs must be made. On the basis of a 1986 Sewer and Water Study by USL for the Village (16), a capital cost provision of $350,000 is made for treatment plant and irrigation area expansion to accommodate the Tugulnuit area.

Combining the previously discussed costs for collection with a $350,000 capital contribution toward capacity improvements in the Oliver treatment and disposal systems results in the following unit costs per kg of phosphorus removed:

Collection System - (overall)	$ 1,087,000	or	$ 4,980/kg
Treatment and Disposal	350,000	or	1,600/kg
Totals	**$ 1,437,000**		**$ 6,580 kg**

7.2.4.4 User Fee Calculation

A user cost analysis for capital cost debt retirement for the proposed Tugulnuit Lake area sewage collection system has been undertaken using the alternate assistance formulae described in section 3.4. The user fee analysis is presented in a format of phased collection system implementation assuming initial construction in sub-area 3A (south end of Lake), sub-area 4 (north end of Lake) and then sub-areas 3B, 1 and 2. Sub-areas 1 and 2 do not represent significant sources of phosphorus. The capital cost provision of $350,000 for upgrading of the Village treatment and disposal systems has been apportioned by flow between the four sub-areas in the Tugulnuit Lake area.

		Sub-Area 3A	Sub-Area 3A & 4	All Sub-Areas
Collection System Cost		$ 348,000	$ 505,000	$1,087,000
Treatment and Disposal		110,000	140,000	350,000
Total Capital Cost		**$ 458,000**	**$ 645,000**	**$1,437,000**
Benefiting Parcels		72	96	266
User Costs	Formula 1	$ 485	$ 517	$ 405
	Formula 2	$ 212	$ 291	$ 266
	Formula 3	$ 49	$ 52	$ 41
	Formula 4	$ 700	$ 750	$ 587

The above user costs represent debt retirement costs only and do not include a monthly user fee system for operation and maintenance or connection fees.

7.2.5 Service Tugulnuit Lakeshore Areas Only

7.2.5.1 System Description

The previous section described a community sewerage system which would service the entire Tugulnuit Lake area with collected effluent being discharged to the Village of Oliver sewer system. An alternative approach is to provide a community sewerage system which would only service shoreland areas of Tugulnuit Lake. Figure 7.4 illustrates a community sewerage system serving Moderate, High and Very High phosphorus transmission rated polygons around the perimeter of Tugulnuit Lake. The remainder of the Tugulnuit Lake area would not be serviced by the system and would, therefore, continue to use individual septic tank and field systems.

The system as illustrated in Figure 7.4 is a septic tank effluent collection system. Small bore gravity collectors are proposed at each end of the Lake with wastewater collected to wastewater pumping stations. Collected wastewater would be pumped to a community subsurface disposal system schematically sited near the north end of Tuc-el-Nuit Drive. Septic tank effluent from homes on the west side of Tugulnuit Lake would be pumped on an individual basis into the forcemain from the pump station at the south end of the Lake.

The site for the community disposal field is, at this point, only intended to illustrate the concept of the system. The site shown on Figure 7.4 is currently undeveloped and in an area having a Low phosphorus transmission rating. The proposed disposal field would be sized for the maximum daily sewage flow anticipated from the service area which, based on 1987 population information, is estimated to be 173 m^3/day (38,000 gpd). Approximately 30% of the design flow is attributable to tourist-related seasonal facilities.

Using Ministry of Environment design guidelines and assuming the percolation rate will average 10 minutes per 25 mm, the disposal field system will comprise two separate fields each providing 4800 lineal metres of tile. A minimum site area of 3.0 ha (7.3 acres) is required for the disposal fields with a further 1.5 ha available for a replacement field. Topography and uniformity of soil materials will be constraints that would have to be addressed during the detailed design of the proposed disposal field.

7.2.5.2 System Design Criteria

The service area of the proposed system is illustrated in Figure 7.4 and generally includes sub-areas 3A and 4 described with the previous alternative. Design population and flow criteria for the system are summarized following.

	1987	2007
Population Permanent	200	244
Population Seasonal	350	390
Summer Sewage Flow	150 m^3/day	173 m^3/day
	(33,000 gpd)	(38,000 gpd)

It is proposed that the subsurface disposal field would be sized for the anticipated 2007 flow of 173 m^3/day (38,000 gpd).

Figure 7.4 shows the proposed disposal field being located on a Moderately Low phosphorus transmission polygon. Accordingly, the phosphorus removal efficiency of the proposed ground disposal system will approach 90%. Anticipated phosphorus loading reductions for the system are summarized below:

	1987	2007
Total Sector P Loading	277.4 kg/yr.	352.1 kg/yr.
Reduction with Collection System	(-)184.4 kg/yr.	(-)222.9 kg/yr.
Residual from Disposal Field	(+) 23.9 kg/yr.	(+) 28.3 kg/yr.
Net Reduction	160.5 kg/yr.	194.6 kg/yr.
Sector Residual Loading	116.9 kg/yr.	157.5 kg/yr.
Sector Population (permanent)	1088	1654
Population on Alt. Systems	200	244
Residual with Individual Systems	888	1410

As shown above, the collection system would service less than 20% of the population in the Tugulnuit Lake area and result in a phosphorus loading reduction of 160.5 kg/year. This reduction represents 58% of the total phosphorus loading of the Tugulnuit Lake area. A 1987 population of 888 would remain serviced by individual septic tank and tile field systems and contribute a total of 93 kg of phosphorus per year to Okanagan Valley water courses. The average phosphorus removal efficiency of these remaining individual systems is 90%.

7.2.5.3 Capital Cost Estimate

A capital cost estimate for the collection and community disposal system which would service only the lakeshore area of Tugulnuit Lake is presented in Table 7.7. The overall project estimated cost of $750,000 equates to $4,680 per kg of reduced phosphorus loading.

TABLE 7.7

SERVICE TO TUGULNUIT LAKESHORE AREA ONLY

CAPITAL COST ESTIMATE

Item	Description		Est. Cost
A. Collection System			
1.	Ø150&Ø100 Small Dia. Gravity Collector	1250 m	$ 63,000
2.	Manholes and Cleanouts	15	19,000
3.	Ø100 Forcemain - Collector	1000 m	40,000
4.	Ø 75 Forcemain - Collector	750 m	27,000
5.	Pressure and Gravity Services		28,000
6.	Septic Tank Effluent Pump Stations	2	60,000
7.	Restoration		21,000
	Subtotal		**$ 258,000**
B. Community Disposal Field			
1.	Site Clearing and Preparation		$ 4,000
2.	Grit Tank - Dosing Siphon		20,000
3.	Disposal Tile	9600 lm	189,000
4.	Solid Headers, Distrib. Boxes, etc.		20,000
5.	Perimeter Fencing and Monitoring Covers		15,000
	Subtotal		**$ 248,000**
	Totals - A and B		**506,000**
	Contingencies and Engineering (allow 25%)		**124,000**
	Disposal System Site Acquisition		**120,000**
	Total		**$ 750,000**

7.2.5.4 User Cost Calculation

Applying the alternative senior government assistance formulae to the capital cost estimate given in Table 7.7 results in the following per benefiting parcel costs for debt retirement only:

Benefiting Lots/Parcels - 88

Approximate Costs for Debt Retirement

Formula 1 - $ 665

Formula 2 - $ 320

Formula 3 - $ 67

Formula 4 - $ 960

Connection fees and a user fee for system operation and maintenance are not included in the above costs.

7.3 Gallagher Lake Area

7.3.1 Description

The Gallagher Lake area generally includes existing commercial and residential development at the north end of the Lake. The Gallagher Lake sector is illustrated in Figure 7.5. As shown in Figure 7.5, the boundary of the Osoyoos Indian Reserve passes through the Lake essentially dividing it in half. No consideration has been given to potential development on the Osoyoos Indian Reserve adjacent to Gallagher Lake.

The objective of an alternative sewerage system at Gallagher Lake is to provide service to present and future development in areas having a Moderate or higher phosphorus transmission classification. Figure 7.5 illustrates that essentially all of the present and future development area at the north end of Gallagher Lake meets this criteria. As part of any decision process on a community sewerage system for the Gallagher Lake area, the relationship between phosphorus from septic tank systems and the water quality of Gallagher Lake warrants further study. Water quality studies undertaken by the Ministry of Environment have focused on "mainstream" Okanagan Basin lakes. There is, therefore, uncertainty about the relationship of water quality and phosphorus in Gallagher Lake. Recognizing that there is no outlet from Gallagher Lake, phosphorus loadings to Gallagher Lake are not directly transferable to the Okanagan River.

7.3.2 Alternative System Planning Constraints

Defining potentially feasible wastewater treatment and disposal alternatives for the Gallagher Lake is not straightforward. The nearest municipal sewerage system is the Village of Oliver approximately 7 km to the south. Assuming previously described sewer extensions will ultimately be constructed into the Tugulnuit Lake area, the minimum distance to a possible connection to the Oliver system is 5 km. Including a sewage pumping station, a connection to the Village of Oliver system represents a capital cost of at least $490,000. Capacity improvements at the Village of Oliver treatment plant to accommodate flows from the Gallagher Lake area would be additional. This capital cost is significantly higher than separate treatment and disposal alternatives in the immediate Gallagher Lake area.

Defining a suitable effluent disposal area within a reasonable distance of Gallagher Lake will be the emphasis of the alternative sewerage evaluation. The area to the north of Gallagher Lake on the Vaseux Creek fan appears to be the only reasonable general vicinity for a community disposal system. Steep rock mountains are constraints to the east and west. To the south, the Osoyoos Indian Reserve boundary is a constraint. Soil materials on the Vaseux Creek alluvial fan have phosphorus transmission classifications of Moderate or higher, therefore, suggesting that phosphorus removal prior to effluent disposal to ground is required if a high rate system similar to a disposal field, or infiltration basins is proposed.

The significant growth potential of the Gallagher Lake area is a factor that must be carefully considered in the selection of a community treatment plant. If constructed in 1987, the plant would serve a population of about 220. By 2007, the population in the Gallagher Lake sector is anticipated to more than double to 412, therefore, ease of expansion of the treatment system will be an important factor.

7.3.3 Waste Management Options

Option 1 - Collection to Treatment and Disposal on Vaseux Creek Fan

No significant problems are anticipated in the preliminary design of a collection system in the Gallagher Lake sector. The area has a gradual north to south slope suggesting that a conventional gravity collection system to a lift station at the lakeshore is feasible.

Conceptually, it is proposed to pump collected sewage to a treatment and disposal site north of Gallagher Lake. Site options will be evaluated in more detail, however, a site on Moderate classified soils north of Vaseux Creek appears most suitable. This general location is well separated from proposed development in the Gallagher Lake area.

Disposal options which are considered as feasible on the Vaseux Creek Fan area include a community subsurface disposal field, secondary treatment and disposal to ground by infiltration basins. The design sewage flows for the area of 187 m^3/day in 1987 and 324 m^3/day in year 2007 are somewhat larger than would normally be considered as feasible for a community disposal field for septic tank effluent. For a design flow of 187 m^3/day and an assumed percolation rate of 5 minutes/25 mm, a community disposal field comprising 8000 lm of tile would be required in each of two fields. Construction costs for the disposal fields alone would approach $300,000 with a provision for land acquisition. Phosphorus removal prior to ground disposal would be required, the cost of which is not included in the $300,000 order of magnitude estimate. The system, as proposed, would not have any reserve capacity for population growth in the area.

Secondary treatment and disposal by spray irrigation is a potentially feasible option, however, capital costs are anticipated to be several times higher than an infiltration basin system with phosphorus removal. A component of a spray irrigation system would be a lined winter effluent storage reservoir having a capacity of at least 30,000 m^3. This storage capacity represents an earthen basin (reservoir) about 1.0 ha in area with an operating depth of a minimum of 4 m. Construction costs for the reservoir would be expected to be in the range of $150,000 to $250,000 which compares to $80,000 for an infiltration basin system. Clearly, spray irrigation is discounted as a feasible option for capital cost considerations. It should be noted that the spray irrigation alternative will also include a pumping station, effluent supply mains and irrigation equipment, the costs of which have not been included in this overview comparison.

Collection to treatment and disposal on the Vaseux Creek Fan, therefore, focuses on disposal by infiltration basins with phosphorus removal.

Option 2 - Collection to Treatment and Disposal on Osoyoos IR #1

Assuming an arrangement could be worked out for a treatment and disposal system on Osoyoos IR #1, this alternative has two major advantages compared to disposal sites to the north. These are:

(1) Distance is considerably reduced. Osoyoos Indian Reserve site is about 700 metres from the north end of Gallagher Lake compared to about 1800 metres for a disposal site on the Vaseux Creek fan.

(2) Soil materials on Osoyoos IR #1 have a Moderately Low phosphorus transmission classification suggesting that phosphorus removal prior to disposal would not be required.

7.3.4 Collection to Treatment and Disposal on Vaseux Creek Fan

7.3.4.1 System Description

Figure 7.5 illustrates, in conceptual detail, a conventional collection system and a treatment and disposal system located north of Vaseux Creek. Collection mains would provide service to present development bordering Gallagher Lake and located on the west side of Highway 97. Future development on both sides of Highway 97 can be serviced by simple extensions of the collection mains illustrated in Figure 7.5. Although the development potential of lands north of Vaseux Creek appears to be minimized, any development in this area could simply pump directly to the proposed treatment plant. Figure 7.5 shows the lift station located on the west side of Highway 97 at the Indian Reserve boundary. This lift station could be relocated to the west to more conveniently service proposed development west of Highway 97.

Collected wastewater in the Gallagher Lake area would be pumped a distance of 1800 m to a treatment and disposal system located north of Vaseux Creek. At this stage, the configuration of the treatment works is conceptual and the location approximate. The site shown in Figure 7.5 has the advantage of being well separated from present or future development in the Gallagher Lake area. The site is in an area having a Moderate phosphorus transmission rating. Chemical precipitation of the phosphorus with alum addition is proposed prior to disposal to ground in rapid infiltration basins.

Specific recommendations on the type of treatment plant to be constructed are beyond the level of detail of this conceptual analysis. Factors which will have to be considered in the selection of a specific system are discussed in more detail in the design criteria section following. The plant would be designed to produce a secondary quality of effluent represented by effluent BOD and suspended solids of 45 and 60 mg/L respectively.

7.3.4.2 System Design Criteria

Development in the Gallagher Lake area is in large part mobile homes and campsites. To a lesser degree, the system will service single family dwellings and commercial properties. Population and flow estimates are summarized below. Flow estimates are based on per capita flow, 0.45 m^3/day (100 Igpd). Seasonal flow estimates from campsites are based on the Ministry of Health guidelines of .454 m^3/unit (100 Igpd/unit).

Population			Flows	
Year	Perm.	Seasonal	Winter	Summer
1987	220	612	96m^3/d (22,000 Igpd)	187m^3/d (41,200 Igpd)
2007	408	912	187m^3/d (41,000 Igpd)	324m^3/d (71,200 Igpd)

Components of the proposed Gallagher Lake sewerage system will be sized in accordance with the above flow estimates. Recognizing the variation of average daily flow ranging between a 1987 winter flow of

96 m^3/day to a peak summer flow of 324 m^3/day in year 2007, it is probable that an intermediate design flow value of about 200 m^3/day would be selected for the initial phase of construction. Adequate site area should be secured for expansion of the facilities to provide capacity for estimated 2007 sewage flows. A total site area of about 2 ha (5 acres) should be adequate for the treatment and disposal components.

Factors which should be considered in the final selection of a specific treatment system include:

- produce a good quality secondary effluent
- be able to handle wide flow fluctuations
- minimize operator attention and skill requirements
- minimize sludge wasting function
- be compatible with surrounding land use
- be readily expandable up to 100%.

Treatment systems meeting these criteria include rotating biological contactors, aerated lagoons, and oxidation ditches.

The calculation of phosphorus loading reductions to be achieved with the construction of the Gallagher Lake sewerage system are based on an average removal rate of 80% by alum addition and a further 77.5% removal after disposal to ground. The 77.5% removal rate by the soil is consistent with the Moderate transmission rating of the site. Overall, therefore, the phosphorus removal efficiency of the system will average 95.5%. Phosphorus loading reductions achieved with the system are summarized following.

	1987	2007
Total Sector P Loading	90.9 kg/yr.	144.3 kg/yr.
Reduction with Collection System	(-) 90.0 kg/yr.	(-)143.4 kg/yr.
Residual from Disposal System	(+) 12.6 kg/yr.	(+) 22.4 kg/yr.
Net Reduction	77.4 kg/yr.	121.0 kg/yr.
Residual from Sector	13.5 kg/yr.	23.3 kg/yr.
Sector Population (permanent)	224	412
Population on Alt. Systems	220	408
Residual with Individual Systems	4	4

The tabulation above illustrates that essentially 100% of present and future population in the Gallagher Lake area would be serviced by the system. The population of 4 remaining on individual systems is located on polygon 34 on the Osoyoos Indian Reserve #1. Phosphorus loadings from the Gallagher Lake area would be reduced from the present 90.9 kg/year to 13.5 kg/year, a reduction of 85%. It should be noted that seasonal populations are a major source of phosphorus in the Gallagher Lake area and seasonal loadings are included in the preceding loading summary.

7.3.4.3 Capital Cost Estimate

A capital cost estimate for the Gallagher Lake sewage collection, treatment and disposal system illustrated in Figure 7.5 is presented in Table 7.8. The overall project cost is estimated to be $588,000 which equates to $7,600 per kg of reduced phosphorus loading based on a 1987 reduction of 77.4 kg/year. Operating and maintenance costs including chemicals for phosphorus removal will be a significant factor warranting evaluation in a more detailed assessment.

TABLE 7.8
GALLAGHER LAKE COLLECTION
WITH TREATMENT AND DISPOSAL ON VASEUX CREEK FAN
CAPITAL COST ESTIMATE

Item	Description		Est. Cost
1.	Ø200 Gravity Collection Mains	800 m	$ 48,000
2.	Services 100mm Ø	150 m	6,000
3.	Manholes and Cleanouts	7	13,000
4.	Highway Crossing allow		8,000
5.	Lift Station		45,000
6.	Forcemain 150mm Ø	1800 m	90,000
7.	Road Restoration		6,000
8.	Site Access Road, Clearing, etc.		12,000
9.	Sewage Treatment Plant - (200 m^3/day)		150,000
10.	Alum Addition Components		20,000
11.	Infiltration Basins (2)		40,000
	Subtotal		$ 438,000
	Contingencies and Engineering (allow 25%)		**110,000**
	Treatment and Disposal Site Acquisition		**40,000**
	Total Estimated Project Cost		**$ 588,000**

7.3.4.4 User Cost Calculation

User cost calculations for debt retirement of the project capital cost have been relatively straightforward in previous sections because the systems service principally single family residential development. This is not the case in the Gallagher lake area where the system services a relatively small number of multi-acre land parcels where land use is mobile home parks and seasonal use campground facilities. To provide some indication of user costs for comparison to other areas of the Regional District, an equivalent parcel calculation has been undertaken assuming:

- each mobile home space is a parcel.
- every 10 campground spaces is equivalent to a single family parcel.

On the basis of these assumptions, it is estimated that the Gallagher Lake sewerage system will have the equivalent of about 160 benefiting parcels. Approximate annual per parcel costs for debt retirement using the alternative assistance formulae described in section 3.4 are presented following:

Equivalent Benefiting Parcels - 160

Approximate Annual Costs for Debt Retirement

Formula 1	-	$ 294.00
Formula 2	-	$ 70.00
Formula 3	-	$ 30.00
Formula 4	-	$ 430.00

It should be noted that the user costs do not include a monthly user fee for system operation and maintenance or a connection fee.

7.3.5 Collection with Treatment Disposal on Osoyoos I.R. #1

7.3.5.1 System Description

The concept of disposing collected wastewater effluent from the Gallagher Lake area on Osoyoos I.R. #1 was identified as having the advantage of utilizing a site having a Moderately Low phosphorus transmission rating. In this case, chemical addition prior to ground disposal of effluent may not be necessary.

If collected effluent were pumped to the Osoyoos Indian Reserve #1 for disposal, the collection system in the vicinity of Gallagher Lake would remain the same as illustrated in Figure 7.5. The lift station would now pump to the south to a treatment and disposal site on the Reserve. The forcemain length will be reduced to 1000 m with pumping to the Reserve rather than north to the Vaseux Creek fan. The net forcemain length reduction is about 400 m.

A treatment plant and infiltration basin system is proposed for the I.R. #1. Sewage flows in excess of 200 m^3/day are greater than what is normally economically disposed of in a conventional community septic tank effluent field. The same design factors as described in the previous section would apply to the treatment plant. The infiltration basin system will likely be somewhat larger recognizing the general finer grained soil types on the Indian Reserve.

Utilization of a treatment and disposal site for the Gallagher Lake area on Osoyoos Indian Reserve #1 warrants detailed consideration only if phosphorus removal efficiencies are greater and/or project capital costs are significantly reduced. Although no formal representation to the Indian Band has been made related to a treatment and disposal site on the Reserve, gaining Band approval for the concept together with an acceptable long term land tenure arrangement is likely to be a significant constraint. Land tenure arrangements and costs may be subject to renegotiation at regular intervals which is another negative factor associated with a disposal site on the Reserve.

The system as described in the previous section for a disposal site on the Vaseux Creek fan will achieve 95.5% phosphorus removal with chemical addition. Based on the phosphorus transmission mapping, a disposal site on the Reserve will achieve 90% phosphorus removal without alum addition. There is, therefore, no benefit with the Indian Reserve site in terms of phosphorus removal except that alum addition may not be necessary. Based on an alum dosage rate of 80 mg/L, annual costs for chemicals will be in the $2,000 to $3,000 per year range. While the alum cost is significant, it is not what could be described as excessive.

Potential capital cost savings for the Indian Reserve site include the alum addition system and about 400 m of forcemain. Based on cost data presented in Table 7.8, the potential cost savings will be in the $40,000 to $50,000 range. A portion of this potential saving may be utilized for enlarging the infiltration basins. Land acquisition arrangements may further reduce these savings. Overall, the potential capital cost reduction with a treatment and disposal site on Osoyoos I.R. #1 will not be significant, less than 10% of the overall project cost of $548,000 given in Table 7.8.

In conclusion, no further consideration of a treatment and disposal site for the Gallagher Lake area on the Osoyoos Indian Reserve #1 is warranted. The site does not offer greater phosphorus removal efficiencies or significant capital cost reductions.

7.4 South Vaseux Lake Area

7.4.1 Description

The South Vaseux Lake area is located at the extreme south end of Vaseux Lake and is illustrated in Figure 7.6. The objective of an alternative system at the south end of Vaseux Lake will be to service the existing lakeshore development on polygon 41 (Very High rating) as shown in Figure 7.6. The settlement plan for the South Vaseux Lake area anticipates no major expansion of the present development area.

The residential development at the south end of Vaseux Lake represents an estimated phosphorus loading to Vaseux Lake of about 50 kg/year. An alternative sewerage system will effectively eliminate this phosphorus loading. Whether or not a phosphorus loading reduction of 50 kg/yr. will result in any improvement in the Vaseux Lake water quality is uncertain. The shallow characteristics of the Lake combined with extensive aquatic weed growth suggests that bottom sediments in Vaseux Lake are a significant phosphorus source. The relationship between Vaseux Lake water quality and phosphorus sources on the Lake warrants further study before a decision on a community sewerage system.

4.2 Alternative System Planning Constraints

The conceptual design of an alternative sewerage system for the south end of Vaseux Lake should be relatively straightforward. In general, a collection main is proposed along the south of the Lake which would enable piping of the collected wastewater to a suitable disposal site to the south. High groundwater conditions and flat topography will likely result in a low pressure collection system being proposed. Topographic constraints dictate that a disposal site be established to the south.

7.4.3 Waste Management Options

Option 1 - Collection and Community Disposal Field

This option would involve a low pressure septic tank effluent collection system discharging collected wastewater to a community disposal field to the south. Soils in this area have a Moderately Low phosphorus transmission classification. This option would essentially relocate septic tank effluent from the Very High rated area (polygon 41) adjacent to the lakeshore to Moderately Low rated soils (polygon 42). The phosphorus removal efficiency increases from 12.5% in polygon 41 to 90% in polygon 42.

Option 2 - Collection and Pumping to Gallagher Lake System

If a treatment and disposal site is selected for Gallagher Lake north of Vaseux Creek, then pumping of South Vaseux Lake wastewater to this site warrants consideration. From the Regional District's point of view, a single combined South Vaseux and Gallagher Lake system will have lower administrative operation and maintenance costs as compared to two separate systems.

7.4.4 Collection and Community Disposal Field

7.4.4.1 System Description

A low pressure collection main at the south end of Vaseux Lake with collected effluent pumped to a community disposal field is illustrated in Figure 7.6. The collection system would be designed to collect septic tank effluent from each house at the south end of the Lake. Each homeowner would be required to supply and operate a fractional horsepower effluent pump at the outlet end of their septic tanks. A total of 850 m of 075 low pressure collection main is proposed to service houses at the south end of the Lake.

Wastewater would be collected to a central septic tank effluent pumping station as shown in Figure 7.6. The station would pump collected effluent through 300 metres of Ø50 forcemain to a community disposal system on polygon 42. The location of the disposal field must be considered as conceptual. There is flexibility to locate the disposal field anywhere in polygon 42. The disposal field would be designed in accordance with Ministry of Environment guidelines. For this conceptual assessment, two fields each comprising 820 metres of conventional tile are proposed. This field sizing is based on a percolation rate of 10 minutes per 25 mm. Overall, the disposal field will require a site area of about 0.75 ha (1.8 acres) including provisions for a standby area.

7.4.4.2 System Design Criteria

The community disposal field would be sized for existing development and vacant single family lots at the south end of Vaseux Lake. On this basis, the design population and flow for the system are:

1987 Population - 16 units/47 population
Seasonal - 12 units/36 seasonal pop.
Winter Average Flow - 20.7 m^3/day (4,700 gpd)
Summer Flow - 25.2 m^3/day (5,540 gpd)

2007 Population - 19 units/56 population
Seasonal - 12 units/36 seasonal pop.
Winter Average Flow - 25.1 m^3/day (5,600 gpd)
Summer Flow - 29.3 m^3/day (6,440 gpd)

The disposal system would be sized for a total of 19 residential housing units plus seasonal facilities. As indicated above, this design population is consistent with year 2007 population projections.

Phosphorus loading reductions to be achieved with the construction of the proposed community collection and disposal systems at the south end of Vaseux Lake are summarized following.

	1987	2007
Total Sector P Loading	51.1 kg/yr.	59.1 kg/yr.
Reduction with Collection System	(-) 44.3 kg/yr.	(-) 52.2 kg/yr.
Residual from Disposal System	(+) 5.1 kg/yr.	(+) 6.1 kg/yr.
Net Reduction	39.2 kg/yr.	46.1 kg/yr.
Residual from Sector	11.9 kg/yr.	13.0 kg/yr.
Sector Population (permanent)	89	113
Population on Alt. Systems	47	56
Residual with Individual Systems	42	57

The community system at the south end of Vaseux Lake would achieve a sector phosphorus loading reduction of 39.2 kg/year in 1987.

7.4.4.3 Capital Cost Estimate

A capital cost estimate for the proposed community sewerage system serving the lakeshore area at the south end of Vaseux Lake is presented in Table 7.9. The overall project cost of $159,000 equates to $4,060 per reduced kg per year of phosphorus loading.

TABLE 7.9
SOUTH VASEUX LAKE COLLECTION AND COMMUNITY DISPOSAL FIELD
CAPITAL COST ESTIMATE

Item	Description		Est. Cost
1.	Low Pressure Collection Main - Ø75 mm	850 m	$ 34,000
2.	Service to property line - Ø50 mm	100 m	3,000
3.	Cleanouts	4	2,000
4.	Road Restoration		5,000
5.	Septic Tank Effluent Pump Station		20,000
6.	Forcemain to Disposal Field	300 m	6,000
7.	Disposal Field	1640 m	32,000
8.	Solid Headers, Distrib. Box, etc.		8,000
	Subtotal		**$ 110,000**
	Contingencies and Engineering (allow 25%)		**27,000**
	Disposal Site Land Acquisition		**22,000**
	Total Estimated Project Cost		**$ 159,000**

7.4.4.4 User Cost Calculation

A user cost analysis for the capital cost debt retirement for the community system is summarized below:

Benefiting Parcels - 22

Approximate User Costs for Debt Retirement

Formula 1	-	$ 585
Formula 2	-	$ 373
Formula 3	-	$ 60
Formula 4	-	$ 850

As with all other user cost calculations, the above represents the per parcel cost for debt retirement and does not include a monthly user fee or connection fees.

7.4.5 Collection and Connection to Gallagher Lake System

7.4.5.1 System Description

Figure 7.6 illustrates the concept of connecting the South Vaseux Lake area into the Gallagher Lake system described in section 7.3.4. The collection system serving the lakeshore homes remains the same as described in the previous section. A low pressure septic tank effluent collection system is proposed, although the flexibility is available to consider a raw sewage collection system. With a treatment plant proposed as a component of the Gallagher Lake system, the system is capable of accepting raw wastewater from the South Vaseux Lake area.

Effluent would be pumped a distance of about 2100 m in a 75 mm forcemain to the Gallagher Lake area treatment plant. Figure 7.6 illustrates the forcemain following the old CP Railway right of way. This alignment reduces restoration costs for the forcemain installation.

7.4.5.2 System Design Criteria

The service area of the community sewerage system does not change from the description presented in the previous section. Population and flow criteria for the system will, therefore, be the same as presented in section 7.4.4.2.

Phosphorus loading reductions increase slightly with the connection to the Gallagher Lake system. Chemical addition combined with ground disposal would result in a 95.5% removal efficiency at Gallagher Lake which compares to 90% for the community disposal field option. Phosphorus loading reductions anticipated with a connection to the Gallagher Lake system are:

	1987	2007
Total Sector P Loading	51.1 kg/yr.	59.1 kg/yr.
Reduction with Collection System	(-) 44.3 kg/yr.	(-) 52.2 kg/yr.
Residual from Disposal System	(+) 2.3 kg/yr.	(+) 2.7 kg/yr.
Net Reduction	42.0 kg/yr.	49.5 kg/yr.
Residual from Sector	9.1 kg/yr.	9.6 kg/yr.
Sector Population (permanent)	89	113
Population on Alt. Systems	47	56
Residual with Individual Systems	42	57

Serviced population information given above is the same as presented previously.

7.4.5.3 Capital Cost Estimate

The estimated system capital cost for a connection to the Gallagher Lake system is given in Table 7.10. Collection system estimated costs have been removed from Table 7.9. An allowance, calculated on a flow proportioned basis, is provided for oversizing of the Gallagher Lake treatment and disposal system. The overall project capital cost of $215,000 is equivalent to $5,100 per kg of reduced phosphorus loading.

TABLE 7.10
SERVICE TO SOUTH VASEUX
WITH CONNECTION TO GALLAGHER LAKE SYSTEM
CAPITAL COST ESTIMATE

Item	Description		Est. Cost
1.	Collection System (Items 1 to 4) Table 7.9		$ 44,000
2.	Septic Tank Effluent Pump Station		25,000
3.	Forcemain to Gallagher Lake	2100 m	73,000
4.	Capital Contribution to Treatment-Disposal		30,000
	Subtotal		**$ 172,000**
	Contingencies and Engineering (allow 25%)		**43,000**
	Total		**$ 215,000**

7.4.5.4 User Fee Calculation

User fees that would result from the retirement of the system capital cost are:

Benefiting Parcels - 22

Approximate User Costs for Debt Retirement

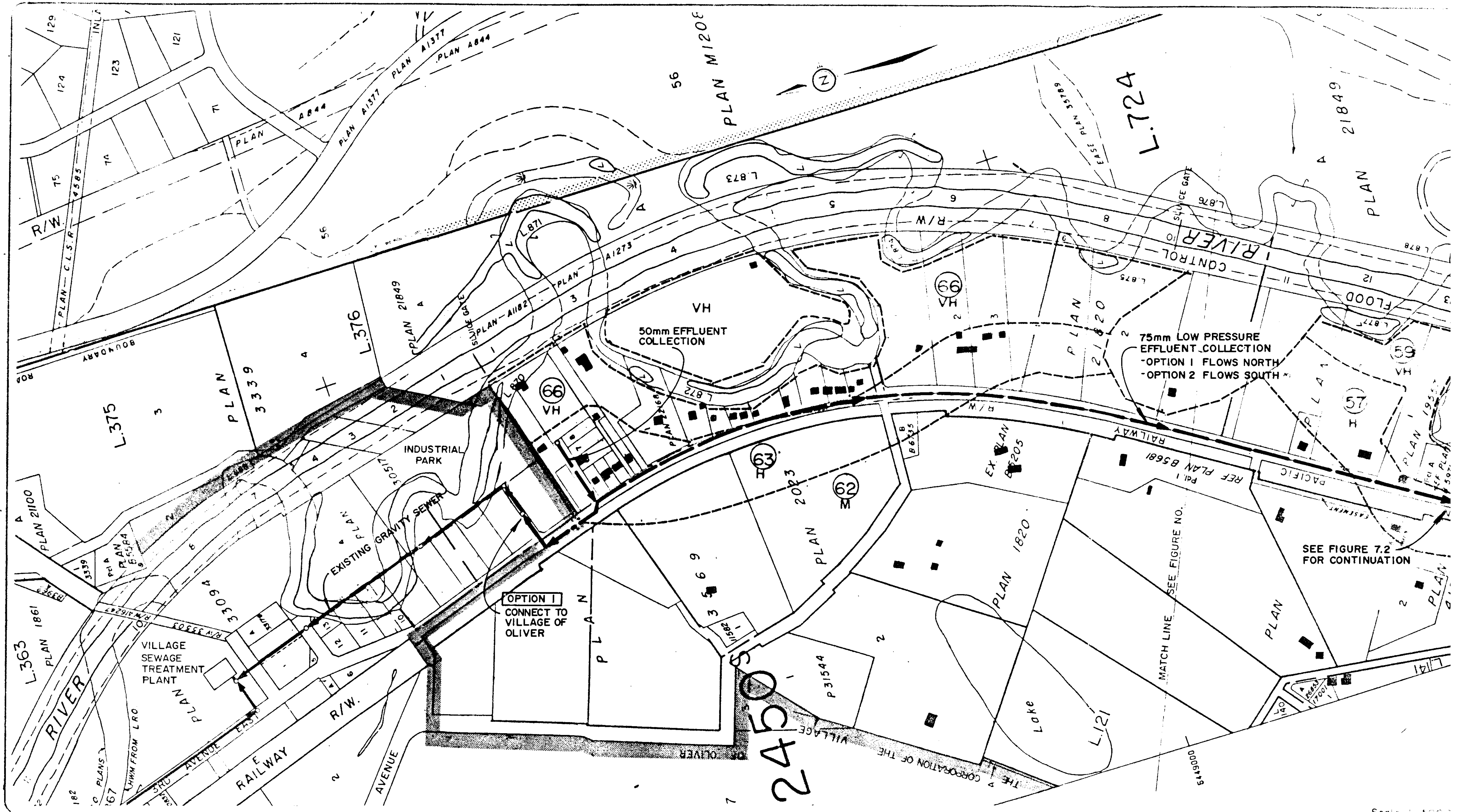
Formula 1 - $ 790

Formula 2 - $ 262

Formula 3 - $ 70

Formula 4 - $1150

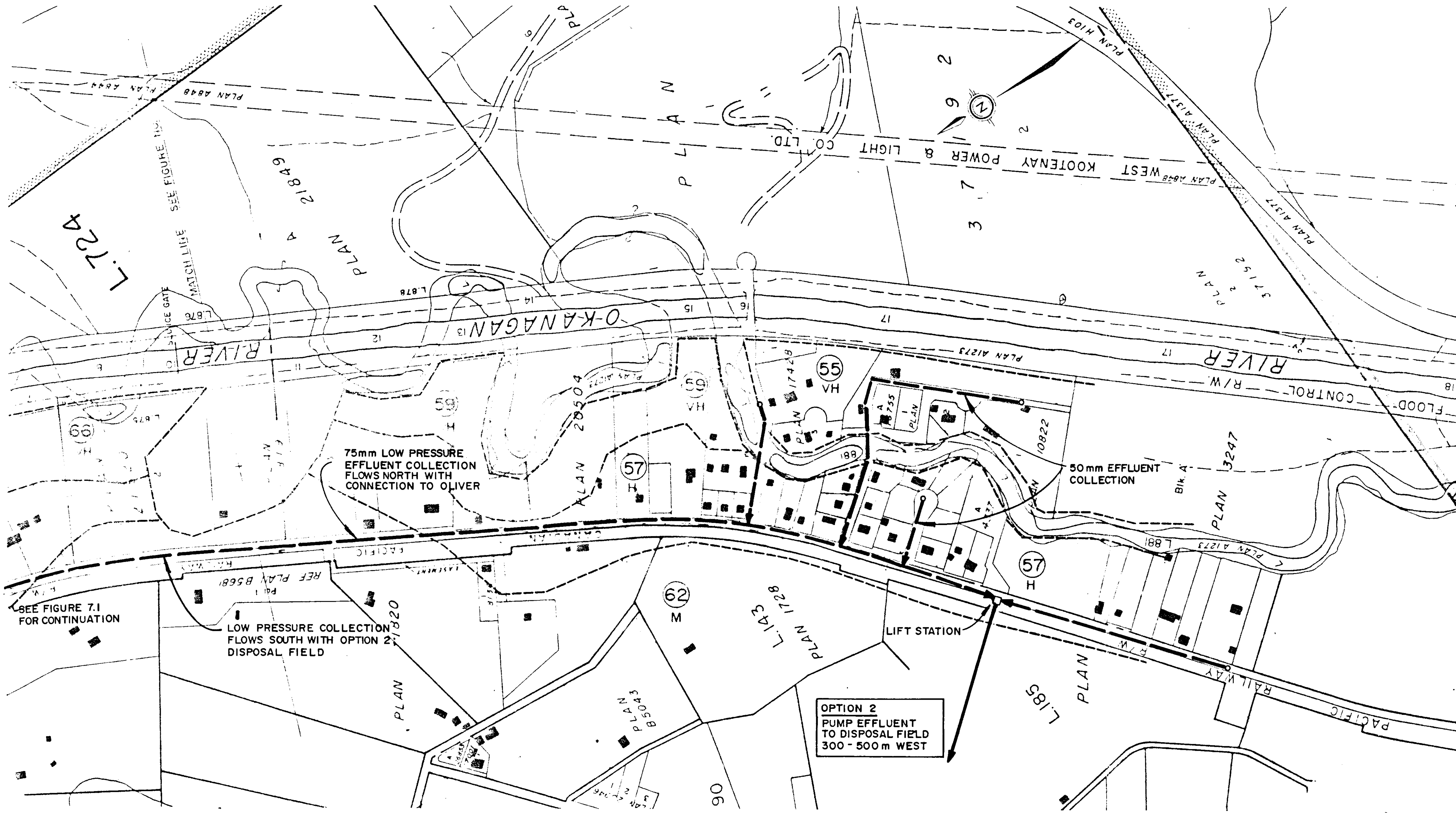
The above user cost calculations do not include a monthly user fee or a connection fee.



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

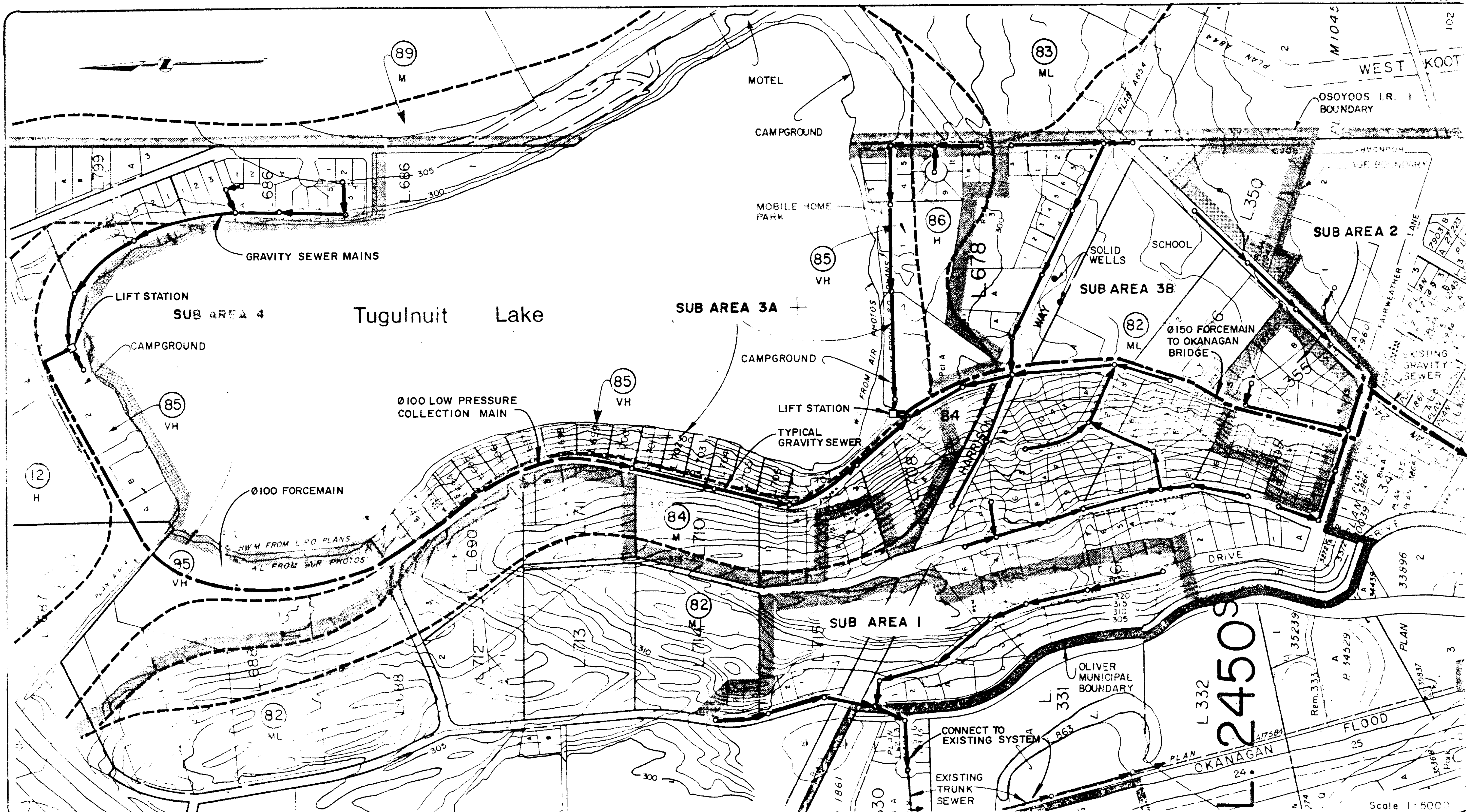
Figure 7.1
Sawmill Road Area
Oliver Rural Area
Electoral Area C



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 7.2
Sawmill Road Area
Oliver Rural Area
Electoral Area C

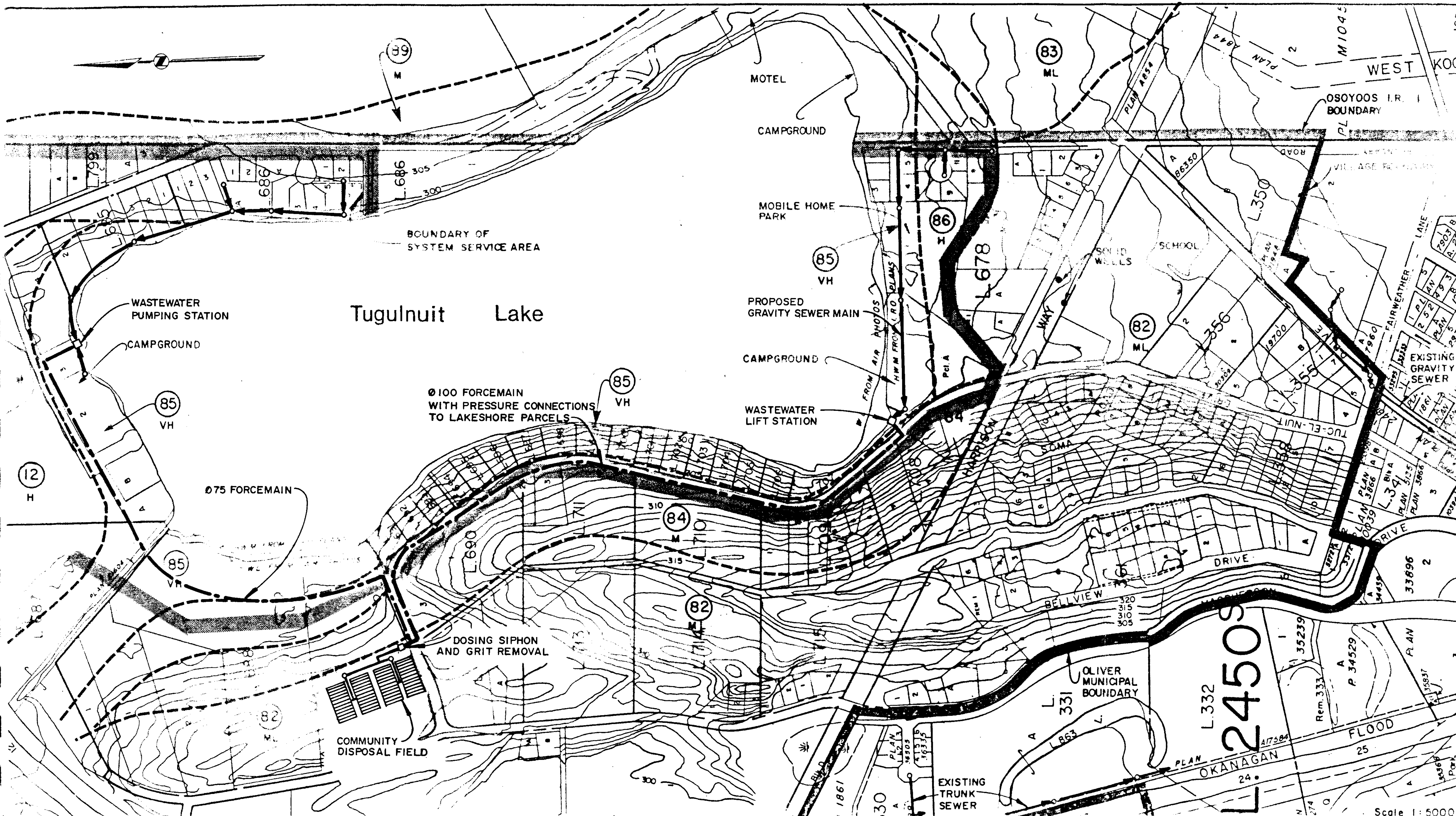


Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A C & D

Collection System with connection to Village of Oliver system

Figure 7.3
Tugulnuit Lake Area
· Oliver Rural Area
Electoral Area C

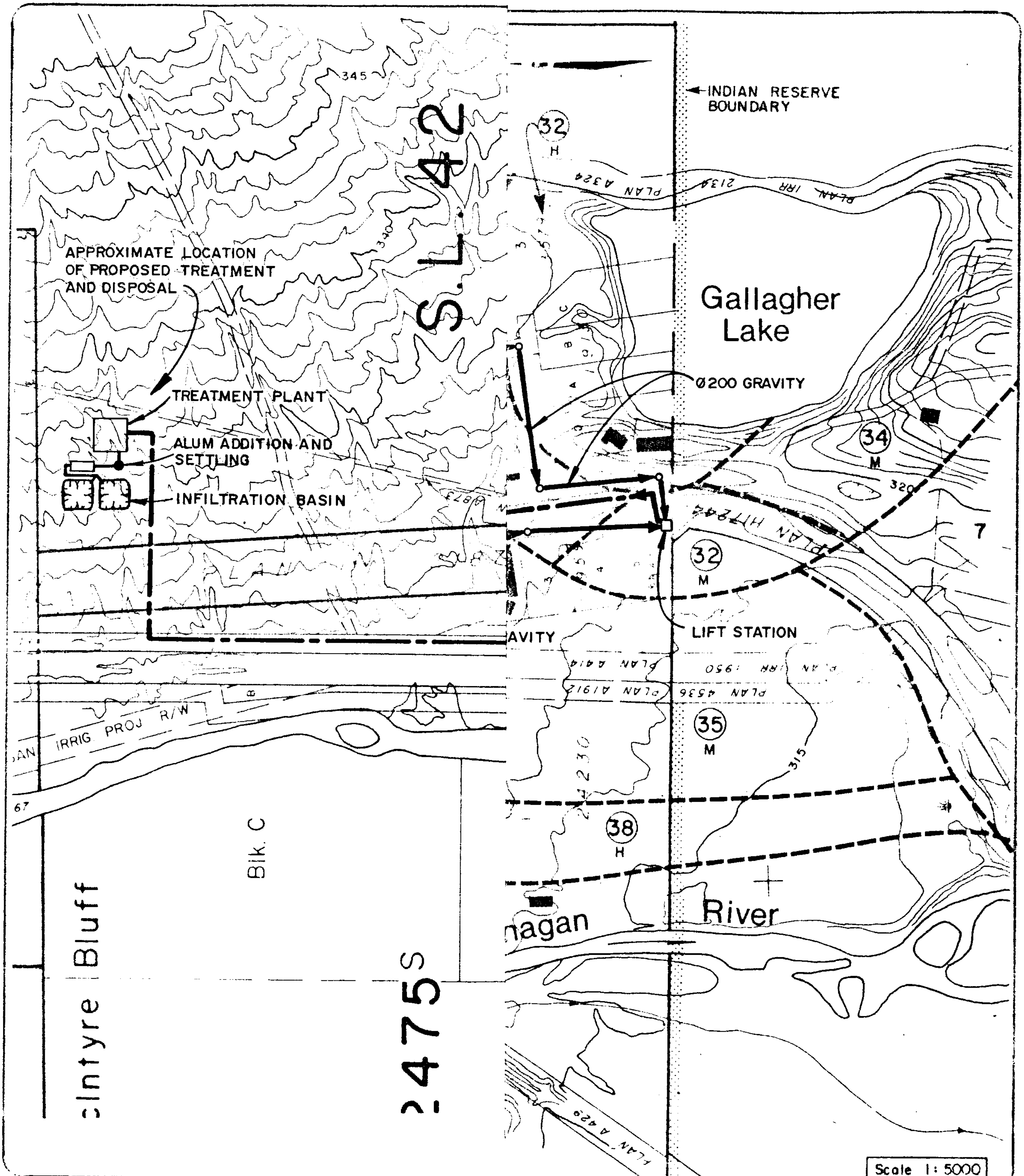


Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A, C & D

Community System to service Lakeshore Areas

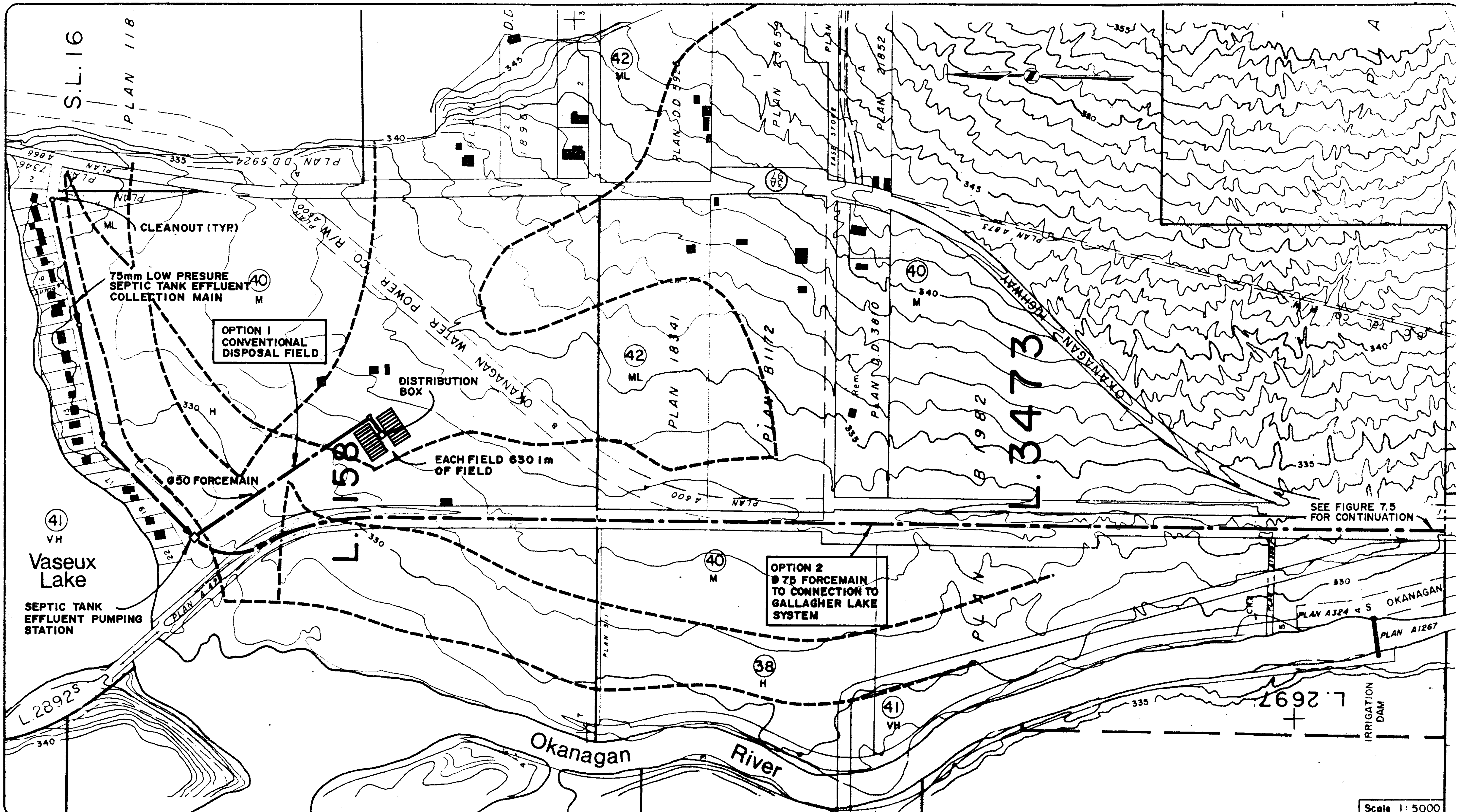
Figure 7.4
Tugulnuit Lake Area
Oliver Rural Area
Electoral Area C



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A, C & D

Figure 7.5
Gallagher Lake Area
Electoral Area C



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A, C & D

Figure 7.6
South Vaseux Lake
Electoral Area C

8.1 East Vaseux Lake Area

8.1.1 Description

The East Vaseux Lake Area comprises a relatively small single family residential area on the east lakeshore of Vaseux Lake as shown in Figure 8.1. In total there are about 36 existing homes and 4 vacant lots which would be serviced by an alternative sewerage system. The primary objective of the sewerage system would be to provide service to houses on the lakeshore in an area having a High phosphorus transmission classification (see polygon 44 Figure 8.1). As was described for the South Vaseux Lake area, there is uncertainty that the reduced phosphorus loading by servicing houses in the East Vaseux Lake area will be reflected in improved water quality in the Lake.

8.1.2 Alternative System Planning Constraints

A small community sewage collection and disposal system involving ground disposal in the immediate area of the East Vaseux Lake development area appears to be the most appropriate servicing strategy. Topographic constraints to the north, west and south effectively eliminate disposal site options in these directions. Construction of a sewage transmission main to the south for a possible connection to the South Vaseux Lake area is essentially impossible due to a large rock bluff on Highway 97 as illustrated in Figure 8.1.

The capital costs of connecting East Vaseux Lake to the South Vaseux Lake system by installing a forcemain in Vaseux Lake to avoid complications with the rock bluff was evaluated in conceptual detail. The forcemain length between the two areas would be about 2500 m. Capital costs for the connecting pipeline alone would be of the order of $200,000. A community disposal system can be constructed in the immediate East Vaseux Lake area for less than one half of this cost. Connecting East to South Vaseux Lake is, therefore, not evaluated in detail.

A small community water system services the East Vaseux Lake Area with water supply being derived from a well on the east side of Highway #97 (approximate location shown in Figure 8.1). Maintenance of an adequate separation distance from this well is a consideration in the disposal system siting.

8.1.3 Small Community Sewerage System

8.1.3.1 System Description

A community sewerage system which would service the East Vaseux Lake sector is illustrated in figure 8.1. A septic tank effluent collection system is proposed within the developed area with all wastewater collected to a central septic tank effluent collection system. Wastewater would be pumped to a community contour trench subsurface disposal system located on the east side of Highway #97 and north of the community water well.

A septic tank effluent collection system is proposed to minimize to the greatest extent possible the capital cost of the collection system. The south half of the community would be serviced by a low pressure collector main located in the Highway #97 right of way. All houses in this southern area would be required to pump their septic tank effluent on an individual basis into the collection main. A gravity flow septic tank effluent collector main is shown in figure 8.1 serving the northern half of the community. All homes on the lakeshore would be required to pump effluent into the main on an individual basis. The nine lots between Highway #97 and the access road could connect to the proposed collector main by gravity.

A preliminary analysis of the capital costs of a raw sewage or conventional collection system was undertaken for the area. In this case, a gravity sewer main would be constructed along the lakeshore with all wastewater collected to a lift station on the lakeshore west of the septic tank effluent pumping station shown in figure 8.1. The lakeshore collection main would require a minimum of 30 easements over properties in the area. Dewatering during construction represents a major uncertainty which could significantly increase the project capital costs. The estimated construction costs for the conventional collection system are of the order of $200,000 as compared to $90,000 for the septic tank effluent system as proposed. Costs for a community septic tank are included in the $200,000 estimate which is unnecessary with the septic tank effluent collection system. The 100% difference in capital costs for the systems is a major factor in the selection of the septic tank effluent collection system as proposed.

A contour trench disposal system is proposed for septic tank effluent disposal located on the east side of Highway #97. The trench system as proposed would be approximately 300 meters long and comprise two separate disposal trenches each having a trench bottom width of 4 m. As compared to a conventional subsurface disposal system, the advantages of the contour trench system as shown are:

- effluent is distributed over a 300 m length parallel to Vaseux Lake. The phosphorus removal capabilities of soils over a 300 m length can be taken advantage of which compares to 30 to 60 m for a conventional system.
- horizontal and vertical separation from Vaseux Lake is maximized with the contour trench system. The trench is located at a constant elevation which compares to a conventional system having a width measurement which would have a near side and far side relative to the lake.
- the ground slope at the contour trench site is somewhat variable, averaging 15%. Construction of a conventional disposal field on a site having a 15% cross slope represents a significant design constraint to ensure even effluent distribution in the disposal field. Preceding the proposed contour trench disposal system is a dosing siphon to achieve even effluent distribution in the field and a grit tank to remove grit, sand, small rocks, etc. which invariably enter the collection system.

The contour trench system as shown on figure 8.1 is located in an area having a medium phosphorus transmission rating. Based on topographic mapping for the site, the trench would be located an average of 150 m from Vaseux Lake and about 20 m vertically above the lake elevation.

8.1.3.2 System Design Criteria

The community sewerage system proposed for the East Vaseux Lake area is sized for service to a total of 40 single family lots (3 of which are presently vacant) and the private campground comprising 30 sites. Based on an average household population of 2.9 people and an average per capita sewage flow of 0.45 m^3/day (100 Igals.), the average daily sewage flow for the system is estimated to be 64 m^3/day (14,000 gpd).

Provision has not been made in the conceptual design of the system for the Vaseux Lake Provincial Park located immediately north of the service area illustrated in figure 8.1. The Provincial Park currently uses pit privies with holding tanks. There is flexibility in the collection system and adequate area to extend the disposal system to service the Provincial Park. Service to the Park would involve conversion of the existing washroom facilities to conventional fixtures using pressurized water.

At the public meeting in Okanagan Falls in November 1987, several members of the public mentioned a proposed Wildlife Interpretation Centre in the East Vaseux Lake area. While no provision has been made for this facility in the sewerage system, there is an opportunity to expand the systems.

The proposed disposal field is shown located on a Moderate polygon having an average phosphorus transmission rate of 22.5%. It is assumed that this phosphorus transmission is based on effluent discharge to ground through a conventional subsurface disposal field. Recognizing that the proposed contour trench system "spreads" the effluent out over a distance at least 3 to 4 times greater than a conventional system, the actual rate of phosphorus transmission should be reduced. For purposes of estimating the phosphorus loading reductions achieved with the proposed alternative system, an average phosphorus transmission rate of 20% has been used. This assumed transmission rate is essentially the same as the Moderate rating for conventional systems. A more detailed analysis of the potential increased phosphorus removal rate achieved with the contour trench system is required.

Phosphorus loading estimates and service populations for the proposed community sewerage system serving the East Vaseux Lake area are summarized following.

	1987	2007
Total Sector P Loading	69.9 kg/yr.	79.2 kg/yr.
Residual from Ind. Systems	8.5	8.5
Residual from Com. System	22.0	25.0
Total Residual	**30.5 kg/yr.**	**33.5 kg/yr.**
Phosphorus Loading Reduction	39.4 kg/yr.	45.7 kg/yr.
Sector Population (Permanent)	110	125
Population on Alt. System	101	116
Residual with Indiv. Systems	9	9

The tabulation above provides an estimated phosphorus loading reduction of 39.4 kg/year. Of the total estimated population in the area of 110, the community system would serve a total population of 101. An estimated 9 people would remain serviced by individual systems, all of which are located south of the East Vaseux Lake area.

8.1.3.3 Capital Cost Estimates

A capital cost estimate for the small community sewerage system described for service to the East Vaseux Lake community is presented in Table 8.1. Overall capital costs are estimated to be $211,000. Based on a phosphorus loading reduction of 39.4 kg/year, the project capital costs equate to $5,300 per kg/year. An allowance for disposal system site acquisition has not been made in Table 8.1 because the disposal site area appears to be Crown land.

8.1.3.4 User Cost Analysis

Per benefiting parcel costs for capital cost debt retirement for the East Vaseux Lake community sewerage system is presented following.

Benefiting Parcels - 40

Approximate User Costs for Debt Retirement

Formula 1 - $395/year

Formula 2 - $171/year

Formula 3 - $ 40/year

Formula 4 - $570/year

The per parcel costs do not include an allowance for a monthly user fee for recovery of system operation and maintenance costs.

TABLE 8.1

EAST VASEUX LAKE COMMUNITY SEWERAGE SYSTEM

CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		EST. COST
A. COLLECTION SYSTEM			
1.	Ø150 Gravity Sewer	400 m	$ 24,000
2.	Ø 75 Low Pressure Collector	380 m	19,000
3.	Cleanouts and Appurtenances		2,000
4.	Services		16,000
5.	Road Restoration		10,000
		Subtotal	**$ 71,000**
B. EFFLUENT PUMPING AND DISPOSAL			
1.	Septic Tank Effluent Pump Station		$ 20,000
2.	Ø 75 Forcemain	120 m	6,000
3.	Bored Crossing of Hwy. #97		8,000
4.	Contour Trench Disposal System		64,000
		Subtotal	**$ 98,000**
		Total System Construction	**$169,000**
		Contingencies & Engineering (allow #25%)	**$ 42,000**
		TOTAL	**$211,000**

8.2 Skaha Estates

8.2.1 Description

The Skaha Estates area is located about 3.5 km north of Okanagan Falls on the east side of Skaha Lake (see figure 8.2). Figure 8.3 illustrates the Skaha Estates development and phosphorus transmission polygons in the area. The northern part of Skaha Estates is essentially fully developed and the majority of lots have houses built upon them. House construction and additional subdivision appears to be occurring in the southern part of the area in the vicinity of Sunny Bay Road.

Figure 8.3 illustrates that the Skaha Estates area is constructed on mapping polygons having Moderate to Very High phosphorus transmission classifications. Recognizing that the entire Skaha Estates area has a phosphorus transmission rating of Moderate or higher, the objective of an alternative sewerage system will be to service the entire area. Servicing of the Moderate rated area in the vicinity of Carmel Crescent will assist in achieving some degree of economy of scale for the proposed systems.

8.2.2 Alternative System Planning Constraints

Of all areas identified for consideration for alternative systems, the Skaha Estates area has the most severe constraints, affecting the feasibility of both the collection system and the treatment and disposal components.

Topography within the Skaha Estates area represents a major constraint to the collection system. To service the entire development area, several lift stations will be required at low elevation points in the development. Bedrock outcrops are evident throughout the Skaha Estates area which will make sewer main construction expensive in comparison to other sectors in the Waste Management Planning Area. Conflicts with other utilities including water, natural gas, hydro, etc. is another factor affecting the capital costs for alternative systems.

Assuming a collection system can be constructed in the Skaha Estates area, there is no conveniently located potentially suitable treatment and disposal site. Extensive rock bluffs separate Skaha Estates from the community of Okanagan Falls. A steep rocky hillside is located immediately east of the development area. Extensive rock outcrops occur along the road north to Penticton.

8.2.3 Waste Management Options

The preceding section described in a general fashion the constraints associated with a community collection system in the Skaha Estates area. It is envisioned that the collection system would be common to all treatment and disposal options listed below.

Option 1 - Pump to Treatment and Disposal Site in McLean Creek Valley

The McLean Creek Valley appears to be the only alternative for a treatment and disposal system within the immediate vicinity of the Skaha Estates area. Topography and existing agricultural uses in the McLean Creek Valley will be complicating factors. The phosphorus transmission mapping indicates several areas in the McLean Creek Valley having Moderately Low to Low phosphorus transmission classifications which may be suitable for effluent disposal to ground. Concern was expressed by several residents of Skaha Estates that a treatment and disposal system in the McLean Creek Valley may negatively impact groundwater wells in the area. Aquifers in the valley are used extensively for domestic and irrigation water supplies.

Option 2 - Pump to Okanagan Falls Community Sewerage System

The northern point of service of the Okanagan Falls sewerage system is approximately 1300 m south of the Sunny Bay Road area. This point is separated from the Skaha Estates area by a large rock bluff rising from the edge of Skaha Lake. A connection from Skaha Estates to the Okanagan Falls system will require a submerged pipeline in Skaha Lake.

8.2.4 Treatment and Disposal in McLean Creek Valley

8.2.4.1 System Description

Figure 8.2 illustrates the alternative treatment and disposal systems in conceptual detail. Pumping of treated effluent to disposal in the McLean Creek Valley is designated as Option #1. Figure 8.3 illustrates in conceptual detail the collection system which would service the Skaha Estates area. The collection system shown in figure 8.3 would be essentially the same for both waste management options. Collection and treatment/disposal components are described in separate sections following.

(i) Collection System

The collection system illustrated in figure 8.3 for the Skaha Estates area is a conventional raw sewage gravity collection system. As shown in figure 8.3, the collection system includes three wastewater pumping stations at low elevation points in the area. For treatment and disposal in the McLean Creek Valley (option 1) the lift stations would pump collected sewage from the south to the north with lift station #1 pumping to the treatment plant. For the connection to the Okanagan Falls treatment plant, flows in all forcemains would be reversed as illustrated in figure 8.3. In this case, sewage is pumped from the north to the south along the Skaha lakeshore.

Wastewater from the south portion of the Skaha Estates area is collected to a lift station located at the west end of Sunny Bay Road. The collection system in this area is a combination of conventional gravity and low pressure systems. Lakeshore houses located on extremely steep terrain on polygon #31 would be serviced by a low pressure system in easements on the lakeshore. The discharge forcemain from lift station 3 is shown in Skaha Lake between Sunny Bay Road and lift station #2. Ideally, this forcemain would be installed with cover in the lakeshore area, however, the rock bluffs suggest that design as a submerged pipeline may be necessary. An "on land" forcemain alignment would require that the lift station be designed for a static lift of at least 30 metres.

The second lift station is shown located near the south end of Devon Drive. This station would pump wastewater collected from approximately one half of the Skaha Estates development and possibly a submerged pipeline from Kaleden. A gravity sewer main is illustrated to the south of lift station #2 which crosses private property in the area. Installing the collection system in the road right of way instead of across private property would result in a fourth lift station generally located at the south boundary of L. 461 (see figure 8.3).

A third lift station (designated #1) is proposed on Devon Drive near the point of crossing of McLean Creek. This site is a natural low point and would collect wastewater from roughly one half of the Skaha Estates development. Depending on the treatment and disposal option, lift station #1 would either pump to treatment in the McLean Creek area or pump to lift station #2 if the Skaha Estates area is connected to Okanagan Falls.

Figure 8.3 does not illustrate collection mains serving polygon 42 north of the Skaha Lake area. This area is not intensively developed and has extreme topographic constraints. A low pressure septic tank effluent collection system could be extended into this area from the terminal manhole at the north end of Devon Drive.

Future growth in the Skaha Estates area appears to be largely proposed in the south in the vicinity of Sunny Bay Road. Although no collection mains are shown in this area on figure 8.3, it is intended that lift station #1 would be sized to accommodate future growth in the area and that collection mains would extend to the northeast from the lift station on Sunny Bay Road.

Preliminary consideration has been given to servicing the Skaha Estates area with a combination pressure and gravity septic tank effluent collection system. Low pressure collection systems are generally applicable to areas where positive pressure is maintained on all proposed individual pumps. Positive pressure on the pumps reduces operational problems associated with air relief valves and "air locks" in the system. The relatively steep grade down to Skaha Lake in the Skaha Estates area effectively eliminates a low pressure system from being feasible. Low pressure systems could be used to replace gravity collection mains servicing lakeshore houses only.

An alternative septic tank effluent collection system in Skaha Estates would involve a gravity collection system essentially as illustrated in figure 8.3. The number of wastewater pumping stations would remain the same. Potential capital cost savings associated with a gravity flow septic tank effluent collection system includes:

- reduction in collection main size from 200 mm to 150 mm. The cost savings realized will be for the difference in pipe material cost only. The estimated savings for the complete collection system is $19,000.
- deletion of all but 6 manholes and replacement with cleanout assemblies. The estimated cost savings is $46,000 as compared to a conventional collection system.
- solids handling design criteria for the proposed lift stations can be reduced. The cost savings will be modest, approximately $15,000 for all stations.

Overall, the septic tank effluent collection system represents a potential capital cost reduction of $80,000 or $500 per lot serviced. As will be presented in section 8.2.4.3, this capital cost savings is about 8% of the cost of a conventional system.

While a gravity flow septic tank effluent collection system is feasible for Skaha Estates, the alternative system analysis is based on a conventional system recognizing:

- cost savings are modest.
- conventional system eliminates all septic tanks.
- residents in the area will likely prefer a conventional system because all costs associated with septic tank maintenance are eliminated.

The relatively modest cost savings associated with the septic tank effluent collection system results from the proportion of construction costs attributed to interference from other utilities, and adverse conditions including rock and road restoration.

(ii) Treatment and Disposal

In its lower reaches, the McLean Creek Valley is confined and narrow, therefore, any effluent disposal system in the Valley will likely have to be sited in the more topographically favourable higher elevation areas. Figure 8.2 illustrates conceptually an effluent disposal system in the McLean Creek Valley approximately 4 km southwest of the Skaha Estates area. This site selected is only for illustrative purposes at this point and indicates the general area where suitable effluent disposal sites appear to be available. The elevations in the McLean Creek Valley in this vicinity range between 430 and 460 m which compares to Skaha Lake at elevation 340 m.

The elevation difference between Skaha Estates and the disposal system ranges from 90 to 120 meters. This elevation difference is significantly beyond the lift capabilities of raw sewage pumps, therefore, requiring that the treatment plant be located in the immediate vicinity of the collection system service area. Figure 8.2

illustrates the sewage treatment plant being sited on presently agricultural land on the east side of the main East Lakeshore Drive. The treatment plant would be about 12 m above sewage lift station #1.

Proximity to the Skaha Estates area and limited land area effectively eliminate treatment plant options which have significant site area requirements such as lagoons, or oxidation ditch systems. The treatment plant would have to be a mechanical-type system with preference to systems not requiring intensive operation and maintenance. Suitable systems may include rotating biological contactors or bio filter (trickling filter) systems. Treated effluent from the plant would be pumped to the disposal system illustrated in figure 8.2.

The phosphorus transmission ratings of soils in the general vicinity of the proposed disposal site range between Moderate and High, therefore, phosphorus removal by chemical addition in the treatment plant will be necessary. Chemicals which may be suitable for phosphorus removal include alum and ferrous chloride (in the form of spent pickling liquor). While these chemicals will effectively remove phosphorus, waste sludge volumes will be significantly (usually 30 to 50%) higher in comparison to systems without phosphorus removal. The treatment and disposal of waste sludge from the treatment plant will be a major consideration in a more detailed evaluation of this option.

An effluent pumping station using high efficiency vertical turbine pumps is proposed following the treatment plant. The pump station would include 100% standby pump capacity in the event of mechanical problems and a standby power supply system for use in the event of an electrical service interruption.

For conceptual design and evaluation purposes, the forcemain from the treatment plant and effluent pumping station is shown following the McLean Creek Road. The forcemain is about 4.1 km in total length. Figure 8.2 illustrates the terminus point of the forcemain to be "further south" than the connection point to the Okanagan Falls sewerage system.

A comprehensive analysis of ground disposal options which might be feasible in the McLean Creek Valley has not been undertaken. Options which may be considered include rapid infiltration basins and effluent irrigation or combinations of the two. For this preliminary assessment of options, disposal by rapid infiltration basins has been assumed. The infiltration basin system will have a significantly lower capital cost than an effluent irrigation system. Therefore, if the infiltration basin system proves to be economically unfeasible, it can be assumed that the same conclusion applies to the other ground disposal options.

8.2.4.2 System Design Criteria

The present and projected design populations for the proposed community sewerage system servicing Skaha Estates is given in the tabulation following. In general, the system would service all present developed and vacant lots in the Skaha Estates area with provisions to accommodate population growth in the Sunny Bay Road area.

Present (1987)

Total	- 118 single family units
Vacant Parcels	- 40 approx.
Population Serviced	- 312
Average Daily Sewage Flow	- 155 m^3/day (34,000 gpd)

Projected (2007)

Total Population	- 530
Average Daily Sewage Flow	- 250 m^3/day (55,000 gpd)

Figure 8.3 illustrates that the proposed community collection system will service essentially all developed areas of Skaha Estates and eliminates wastewater discharges to Very High, High and Moderately High rated phosphorus transmission polygons in the area. The calculation of phosphorus reductions achieved with the sewerage system

is based on an average phosphorus removal in the treatment plant of 80% and the soil materials at the ground disposal site removing 77.5% of the 20% residual. This is based on discharge into a Moderate rated polygon in the McLean Creek area. Overall phosphorus residuals are, therefore, anticipated to be 4.5% of the total influent loading to the treatment plant.

Phosphorus loading reductions that will be achieved with the construction of a community sewerage system in the Skaha Estates area are summarized following:

	1987	2007
Total P Loading *	158.6	222.5
Residual P Loading from Unserviced Areas	13.1	3.7
Residual P Loading from Disposal System	14.0	23.9
Total Residual	27.1	27.6
Total Reduction Achieved	131.5	194.9
Permanent Sector Population	348	541
Population Serviced	312	530
Residual with Individual Systems	36	11

*** All P Loadings expressed as kg/year**

The tabulation illustrates that the present phosphorus loading to Skaha Lake will be reduced from 158.6 kg/year to 27.1 kg/year with the construction of the community system. By year 2007, the service area is assumed to be expanded to include houses on polygon #42 north of Skaha Estates (see figure 8.3). This extension of the service area results in a decrease of phosphorus loading from houses remaining on individual systems from 13.1 kg/year to 3.7 kg/year.

8.2.4.3 Capital Cost Estimate

Separate capital cost estimates for the Skaha Estates sewage collection system and treatment and disposal components into the McLean Creek Valley are presented in Table 8.2 and Table 8.3.

In comparison to collection system capital cost estimates for other rural areas, unit construction costs for the Skaha Estates area are anticipated to be significantly higher. Factors contributing to the higher construction costs are:

- location flexibility within existing road rights of way is in many areas limited to the paved surface because relatively flat shoulder and boulevard areas are not available
- location flexibility is complicated by existing utility systems including natural gas, water, hydro, etc. systems
- bedrock could be encountered in many areas which will result in higher construction costs as compared to lakeshore areas in the Oliver and Osoyoos areas

A detailed analysis of capital costs for the sewage collection system for the Skaha Estates area should include a test pit program to provide information on subsurface conditions.

TABLE 8.2
SKAHA ESTATES - COLLECTION SYSTEM
CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		EST. COST
1.	Ø200 Gravity Sewer	3300 m	$ 280,000
2.	Manholes and Cleanouts		75,000
3.	Sewer Services		71,000
4.	Pressure Collector		12,000
5.	Forcemain in Common Trench	1000 m	25,000
6.	Forcemain in Lakeshore Zone	500 m	75,000
7.	Sewage Lift Station (Minor)	2 req'd.	80,000
8.	Sewage Lift Station (Major)		65,000
9.	Restoration	4000 m	100,000
	Subtotal		**$ 783,000**
	Contingencies and Engineering (allow 25%)		**192,000**
	TOTAL		**$ 975,000**

TABLE 8.3

SKAHA ESTATES - DISPOSAL McLEAN CR. VALLEY

CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		EST. COST
1.	Forcemain; Collection to STP	330 m	$ 20,000
2.	Primary Treatment Components		90,000
3.	Sewage Treatment Plant		240,000
4.	Access Road & Site Work		20,000
5.	Effluent Pumping Station		90,000
6.	Effluent Forcemain	4100 m	270,000
7.	Forcemain Valves, Fittings, etc. allow		28,000
8.	Infiltration Basins		91,000
	Subtotal		**$ 849,000**
	Contingencies and Engineering (allow 25%)		**211,000**
	TOTAL		**$1,060,000**

The collection system total estimated capital cost of $975,000 is equivalent to $6,170 per single family lot serviced. The equivalent cost per lot for lift stations alone approaches $1,200 per lot.

From Table 8.3, the estimated capital cost of treatment, effluent pumping and disposal systems in the McLean Creek Valley is $1,060,000. Land acquisition costs for the treatment and disposal sites are not included in the capital cost estimate and will represent a significant addition to the system costs.

The total cost for the Skaha Estates collection system combined with effluent disposal in the McLean Creek Valley is $2,035,000. The system would service a total of 158 developed and vacant lots resulting in a per lot capital cost of $12,900. The proposed systems will result in an estimated reduction in the phosphorus loading to Skaha Lake of 131.5 kg/year. The system capital cost is equivalent to $15,500 per kg of phosphorus removed.

8.2.4.4 User Rate Calculation

A net cost to benefiting lots for the Skaha Estates collection system with effluent disposal in the McLean Creek Valley is presented following. The user rates are for capital cost debt retirement only.

Benefiting Single Family Lots - 148

Approximate User Costs for Debt Retirement

Formula 1 - $1000/year
Formula 2 - $ 520/year
Formula 3 - $ 102/year
Formula 4 - $1450/year

A monthly user fee would be additional to the above per parcel charges to recover system operation and maintenance costs. In comparison to municipal systems in the electoral areas, the user cost for the Skaha Estates system as described is anticipated to be relatively high reflecting:

- operation costs for three lift stations
- alum or other chemical addition in the plant
- effluent pumping costs.

In all probability, operation and maintenance components would result in a monthly user fee in the $15 to $20 range ($180 to $240 per year).

8.2.5 Connection to Okanagan Falls Sewerage System

8.2.5.1 System Description

In conceptual detail, the alternative involving connection to the Okanagan Falls sanitary sewage collection system is illustrated in Figure 8.2. Sewage is collected in a north to south direction through Skaha Estates and pumped from the lift station at the west end of Sunny Bay Road to the Okanagan Falls sewerage system.

The collection system would, in this case, be essentially the same as described previously in section 8.2.4 and illustrated in figure 8.3. Wastewater collected to the lift station numbered 1 on Devon Drive at the McLean Creek crossing would pump to the south into the lift station numbered 2 at the south end of Devon Drive. This lift station would be designed to pump directly to the Okanagan Falls system with the forcemain following a lakeshore alignment to the greatest extent possible. Figure 8.3 illustrates the lift station (number 3) at the west end of Sunny Bay Road pumping directly into the forcemain to Okanagan Falls. A possible forcemain crossing from Kaleden is also illustrated in figure 8.3.

A major constraint associated with the option of connecting Skaha Estates to the Okanagan Falls community system is the installation of the forcemain from lift station #3 to the northern end of the Okanagan Falls collection system. The distance between the two points as shown in figure 8.2 is about 1300 m but is complicated by a large cliff into Skaha Lake. Ideally, the forcemain would be buried in the lakeshore zone, however, the cliff suggests that a majority of the forcemain will have to be installed on the lake bottom. Bathymetric information for Skaha Lake obtained from the Ministry of Environment indicates that water depths in the area range between 5 and 20 m. The integrity of the pipeline in terms of resistance to breaks will be a major factor in the ultimate feasibility of the alternative. Capital cost estimates for the submerged pipeline from Skaha Estates to Okanagan Falls are based on coated and lined welded steel pipe materials.

Figure 8.2 illustrates schematically the point of connection to the existing Okanagan Falls community sewerage system. A comprehensive analysis of the hydraulic capacity of the Okanagan Falls collection and treatment system remains to be undertaken, however, a preliminary review of the system design drawings suggests that adequate collection and treatment capacity may be available for the present population of the Skaha Estates area.

A collection main presently services lakeshore development along Eastside Road immediately north of Okanagan Falls. The collection system comprises 0200 gravity sewer main and a series of three wastewater pumping stations. The addition of the Skaha Estates area to the Okanagan Falls collection system paralleling Eastside Road represents an increased peak sewage flow of about 9.0 L/sec (118 gpm). Pipeline components of the existing system including force and gravity mains appear to have adequate hydraulic capacity for the increased flow. Whether adequate pumping capacity is available in existing sewage lift stations 1 and 2 is uncertain, therefore, provisions have been made in system capital cost estimates for larger capacity pumps.

The Okanagan Falls sewage treatment works comprise an oxidation ditch (extended aeration) system followed by secondary clarification. Treated effluent is pumped to disposal by infiltration basins southeast of the community. Preliminary data for the treatment system suggests that it was designed for a service population of 2000 and a an average flow of 727 m^3/day (160,000 gpd). The present population and average sewage flow of the sewerage system service area are 1400 and 500 m^3/day (110,000 gpd) respectively. On this basis, there appears to be adequate reserve capacity in the Okanagan Falls system to accept sewage flow from the present Skaha Estates population. Sewerage system design drawings indicate that the system was designed to be expanded to accommodate service populations of the order of 3000.

The preliminary capacity analysis of the Okanagan Falls sewerage system suggests that adequate reserve capacity is available for the present Skaha Estates population. Inclusion of Skaha Estates in the system will utilize reserve system capacity which results in an acceleration of the date that an expansion of the system will be required.

8.2.5.2 System Design Criteria

The service populations for Skaha Estates with a connection to the Okanagan Falls sewerage system are the same as presented in section 8.2.4.2 for the disposal option in the McLean Creek Valley. The service population information presented previously is briefly summarized following:

	1987	2007
Serviced Residential Units	118	
Vacant Parcels	40	
Population	312	530
Average Daily Sewage Flow	155 m^3/day	250 m^3/day

Phosphorus loading reductions achieved with a connection to the Okanagan Falls community sewerage system have been calculated assuming that the present rapid infiltration disposal system averages 95% in terms of phosphorus removal efficiency. On the basis of this performance efficiency for the Okanagan Falls system, the anticipated phosphorus loading reductions are tabulated below:

	1987	2007
Total P Loading *	158.6	222.5
Residual P Loading from Unserviced Areas	13.1	3.7
Residual P Loading from OK Falls System	15.6	26.5
Total Residual	28.7	30.2
Total Reduction Achieved	129.9	192.3
Permanent Sector Population	348	541
Population Serviced	312	530
Residual with Individual Systems	36	11

*** All P Loadings expressed in kg/year**

The loading reduction estimates of 129.9 kg/year in 1987 and 192.3 kg/year in 2007 are essentially the same as previously described for the disposal option in the McLean Creek Valley. The year 2007 reductions are based on the Okanagan Falls infiltration system continuing to achieve an average removal efficiency of 95%. With the effluent transmission facilities constructed into the rural area southeast of Okanagan Falls, there is some possibility that disposal of some portion of the effluent volume by irrigation could be implemented in the future. Phosphorus loading reductions exceeding 95% could be anticipated, in this case, resulting in a reduction of the 26.5 kg/year estimated residual. Connection to the Okanagan Falls system also results in a relocation of the phosphorus loading residual from Skaha Lake to the Okanagan River south of Okanagan Falls. Whether this relocation represents a quantifiable benefit to the environment is uncertain.

8.2.5.3 Capital Cost Estimate

A capital cost estimate for a community sewerage system in the Skaha Estates area with collected wastewater discharged to the Okanagan Falls community sewerage system is presented in Table 8.4. The collection system capital costs for this disposal alternative are the same as described previously for the McLean Creek Valley disposal option. Collection system capital costs have, therefore, been taken directly from Table 8.2. The factors affecting the collection system capital costs remain valid as described in section 8.2.4.3.

Trunk sewerage components presented in Table 8.4 include the submerged forcemain from Skaha Estates to the connection point of the Okanagan Falls system. For preliminary estimating purposes, it is assumed that one half of the forcemain would be installed as a submerged pipeline and the other half as a forcemain in the shoreline area with cover provided. Allowances are made in the capital cost estimate to increase the pump capacity of lift stations number 1 and 2 of the Okanagan Falls sewerage system. Assuming that present reserve capacity in the Okanagan Falls system could be made available for the Skaha Estates area, no cost allowances have been made for capacity improvements to the treatment and disposal systems.

TABLE 8.4

SKAHA ESTATES SEWERAGE SYSTEM CONNECTED TO OKANAGAN FALLS

CAPITAL COST ESTIMATE

ITEM	DESCRIPTION	EST. COST
A. COLLECTION SYSTEM CAPITAL COST		
	From Table 8.2	$ 783,000
B. TRUNK SEWER COMPONENTS		
1.	Forcemain Connection to OK Falls 1300 m	$ 330,000
2.	Oversizing of Ex. Lift Stations 1 and 2	30,000
	Subtotal - Part B	**$ 360,000**
	Subtotal - Parts A & B	**$1,143,000**
	Contingencies & Engineering (allow #25%)	**285,000**
	TOTAL	**$1,428,000**

From the point of view of capital cost, the connection to the Okanagan Falls sewerage system is some $600,000 less expensive than the McLean Creek Valley disposal option. A more detailed analysis of system capital costs should address in more detail the construction of the forcemain in Skaha Lake to connect to the Okanagan Falls system. There is some possibility that construction cost estimates could be reduced as a result of this analysis.

The overall estimated project capital cost of $1,428,000 is equivalent to $11,000 per kg of reduced phosphorus loading to Skaha Lake.

8.2.5.4 User Rate Calculation

A net cost per benefiting lot in Skaha Estates has been undertaken on the basis of the alternative assistance formulae described in section 3.5. The user rates (or parcel taxes) for capital debt retirement are:

Benefiting Single Family Lots - 148

Approximate User Costs for Debt Retirement

Formula 1	-	$ 736.00/year
Formula 2	-	$ 405.00/year
Formula 3	-	$ 75.00/year
Formula 4	-	$1070.00/year

As with all other user rate calculations, the above costs per parcel do not include a monthly user fee for system operation and maintenance. The above per parcel costs are significantly lower than the disposal to McLean Creek options.

8.3 Lakeshore Area of Kaleden

8.3.1 Description

Phosphorus loading sources in the Kaleden area are discussed in detail in Section 4.3. From this discussion it was concluded that only the lakeshore area of Kaleden, generally located between Sycle and Ponderosa Points, warrants consideration for an alternative sewerage system. Figure 8.4 illustrates the Lakeshore Area of Kaleden and phosphorus transmission polygons in the area.

The objective of an alternative sewerage system is to provide service to residential units within the High to Very High polygons on the lakeshore. The total population to be served is relatively small, approximately 140 or 50 housing units.

8.3.2 Alternative System Planning Constraints

The linear nature of the Kaleden lakeshore area effectively eliminates a gravity sewerage system in terms of feasibility. High water table conditions along the lakeshore is another complicating factor. A low pressure system appears to offer the most promise in terms of feasibility, particularly when the relatively low design population is considered.

There are no apparent areas within the Kaleden Lakeshore Area which would be suitable for a community disposal system. All areas within the area have High or Very High phosphorus transmission classifications. Disposal options will, therefore, involve sites separated from the lakeshore on the Kaleden Bench area. This area is, however, intensively developed with orchards and low density subdivisions, therefore, some land use conflicts can be anticipated with this option.

8.3.3 Waste Management Options

The Kaleden Lakeshore Area appears to be more economically serviced by a low pressure sewerage system that will terminate at a lift station which will be designed to pump collected wastewater to a treatment and/or disposal site. Disposal options which warrant consideration are:

Option 1 - Pump to Disposal Site on Kaleden Bench

As discussed previously, the Kaleden Bench area is primarily Low and Moderately Low in terms of phosphorus transmission rating. Septic tank effluent from the lakeshore area could be pumped to a site on the bench for direct disposal to ground. This concept would relocate septic tank effluent from the soils at the lakeshore where soils have an average phosphorus removal efficiency of 16% to the bench area where the average is 90%.

Option 2 - Pump Across Lake to Skaha Estates

This option is based on the assumption that a sewerage system is constructed in Skaha Estates and that the system would include a connection to the Okanagan Falls sewerage system. In concept, collected wastewater is pumped across the lake from Ponderosa Point on the Kaleden lakeshore to Skaha Estates. The distance across the lake is about 800 metres.

8.3.4 Pump to Disposal Site on Kaleden Bench

8.3.4.1 System Description

Figure 8.3 illustrates a collection system serving the Kaleden lakeshore area with collected septic effluent being pumped to a conventional subsurface disposal system on the Bench area. The elevation difference between Skaha Lake and the Bench area (minimum of 80 metres) effectively eliminates the consideration of options involving raw sewage collection.

The collection system on the Kaleden lakeshore is intended to provide service to areas (polygons) having phosphorus transmission ratings of Moderate or higher. In total, three wastewater pumping stations will be required to service the lakeshore area. A low pressure septic tank effluent collection system is proposed in polygon #63 (north end of service area). The access road in this area is essentially flat and at or near Skaha Lake level which effectively precludes a gravity flow collection system. Septic tank effluent is collected in polygon 63 to a septic tank effluent pump station which would pump to gravity flow components of the system between Lakehill Avenue and Fifth Street.

The central section of the Kaleden lakeshore area (polygons 62, 68 and 61) is serviced by a gravity flow septic tank effluent collection system. A gravity flow collection system simply eliminates the requirement for individual homeowners to own and operate a septic tank effluent pump. The central section of the collection system terminates at a major septic tank effluent pumping station (designated pump station #2) located at the south end of the community park. Septic tank effluent collected from the Ponderosa Point area would be pumped "back" to this main septic tank effluent station at the south end of the park.

The concept of disposal to ground on the Kaleden Bench area is illustrated by a conventional disposal field located near the intersection of Fir and Linden Avenues. While this disposal site has been selected somewhat arbitrarily, it does reasonably comply with site selection criteria including:

- site should be essentially flat; i.e., having ground slopes less than 5%
- site is ideally a pasture or unimproved lot as compared to orchards
- site should be separated from the east edge of the Bench area to minimize the possibilities of slope instability problems.

The disposal site selected for illustrative purposes is located at elevation 450 m which represents a static lift on the pump station of 113 m (372 feet).

The static lift to the disposal site of 113 m, relatively low volume and suspended solids in the collected septic tank effluent represent major design constraints for the septic tank effluent pumping station. The pumping head of 113 m can only be achieved with multi-stage pumps which typically have poor solids handling capabilities. Recognizing the pumping constraints, sand filtration to remove solids prior to pumping will be necessary. Backwash from the sand filters would be discharged to a holding tank adjacent to the station which would have to be removed periodically by pump and haul. Standby pumps and possibly a standby power source are other factors to be considered in the design of the pumping station.

The disposal field for the Kaleden lakeshore sewage collection system has been conceptually sized on the basis of a percolation rate of 10 minutes per 25 mm and typical septic tank effluent quality. The sand filtration system incorporated into the pumping station will result in an effluent quality exceeding typical septic tank effluent criteria which may justify some reduction in field size. Two conventional disposal fields, each providing about 2200 lineal metres of tile, will be required. A total site area for the two fields of about 2.0 ha or 4.8 acres will be necessary.

The preceding system description illustrates that pumping of septic tank effluent from the Kaleden lakeshore area to the Bench is not straightforward because of the elevation difference (generally exceeding 80 m) between the two areas.

8.3.4.2 System Design Criteria

Design population and flow criteria for the Kaleden lakeshore area septic tank effluent collection system with effluent pumping to the Bench area is summarized in Table 8.5. Data presented in Table 8.5 illustrates that the system will service all development on Moderate or higher rated polygons on the lakeshore. In total, the collection system will service 40 residential units and tourist commercial development on Ponderosa Point. Average sewage flows during the winter months are estimated to be 53 m^3/day (11700 gpd). Summer sewage flows will average 77 m^3/day (17,000 gpd) which include contributions from Ponderosa Point and the community park. Table 8.5 illustrates essentially no population growth in the lakeshore area except for house construction on presently vacant lots. The sewage collection, treatment and disposal systems would be designed for a projected 2007 permanent population of 155. No allowances have been made for increases in sewage flows from the park or seasonal use facilities on Ponderosa Point.

TABLE 8.5

SERVICE POPULATION - KALEDEN BENCH DISPOSAL

Present - 1987

Polygon	Residential Units/Pop.	Vacant	Parcel Total	Seasonal
63 - VH	17/ 49	4	21	
62 - H	4/ 12	0	4	
61 - VH	2/ 6	0	2	Park
60 - VH	4/ 12	0	5	24 units
68 - M	13/ 38	8	21	
	40/117	12	52	

Average Winter Sewage Flow - 53 m^3/day (11,700 gpd)
Average Summer Sewage Flow - 77 m^3/day (17,000 gpd)

Projected 2007

Polygon	Residential Units	Population	Seasonal
63 - VH	21	61	
62 - H	4	12	
61 - VH	2	6	Park
60 - VH	5	15	24 units
68 - M	21	61	
	52	155	

Average Winter Sewage Flow - 70 m^3/day (15,500 gpd)
Average Summer Sewage Flow - 95 m^3/day (20,800 gpd)

The proposed community disposal field on the Bench is located in an area having a moderately low phosphorus transmission rating. On the basis of a phosphorus removal efficiency of 90% for the proposed community disposal site, phosphorus loading reductions achieved are summarized following:

	1987	2007
Present Total Sector P Loading	165.4 kg/yr.	249.8
Lakeshore Area Reduction	(-)81.1 kg/yr.	(-)81.1
Residual from Community Disposal System	(+)12.4	(+)12.4
Net Phosphorus Reduction	68.7	68.7
Resulting Total Sector P Loading	96.7	181.1
Sector Permanent Population	820	1670
Lakeshore Area on Alt. System	117	117
Residual using Individual Systems	603	1553

The tabulation above illustrates that a net phosphorus loading reduction of 68.7 kg/year is achieved with the construction of a community sewerage system serving the Kaleden lakeshore area. This reduction does not increase in the future recognizing that the Community Plan does not envision population growth in the lakeshore area.

The community sewerage system presently services 20% of the Kaleden area population and 7.5% of the projected 2007 population. The average phosphorus removal efficiency of remaining individual septic tank and tile field systems is 90% in 1987 and 89% in 2007. These removal rates are consistent with Okanagan Water Quality Project objectives.

8.3.4.3 Capital Cost Estimate

The estimated capital cost of the community sewerage system serving the Kaleden lakeshore area with effluent pumped to disposal on the Bench is presented in Table 8.6. The collection system estimated cost is $219,000 which represents a cost of $4200 per benefiting lot or land parcel. This cost per lot is high by comparison to other areas described in previous sections and reflects the "single side" servicing of the system. Essentially, the entire collection system services houses on one side of the street only. If potentially serviceable lots or houses were fronted on each side of the proposed collection system, per lot capital costs would be reduced by about one half to $2500 per benefiting parcel.

The total estimated cost for the effluent pump station and disposal components is $440,000 of which approximately one half represents the cost for the pumping station. The pumping station costs include provisions for filtration prior to pumping as described in the previous section.

The overall project estimated cost of $659,000 is equivalent to $12,700 per benefiting lot. On a per kg of reduced phosphorus loading basis, the project capital cost equates to $9600 per kg/year. This cost is comparable to Skaha Estates and significantly higher than several sectors in Electoral Areas A and C.

TABLE 8.6
KALEDEN LAKESHORE COMMUNITY SEWERAGE SYSTEM AND EFFLUENT DISPOSAL TO THE BENCH CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		EST. COST
A. COLLECTION SYSTEM			
1.	Ø150 and Ø200 Gravity Sewer	680 m	$ 40,000
2.	Ø100 Low Pressure Collector	420 m	21,000
3.	Cleanouts		5,000
4.	Pressure and Gravity Services		20,000
5.	Ø 75 Forcemain	900 m	35,000
6.	Road Restoration		18,000
7.	Septic Tank Effluent Pumping Stations (2)		36,000
	Subtotal		**$ 175,000**
	Contingencies and Engineering (allow 25%)		**44,000**
	Total Collection		**$ 219,000**
B. EFFLUENT PUMP STATION AND DISPOSAL			
1.	Major Septic Tank Effluent Pump Station		$ 123,000
2.	Ø100 Forcemain to Disposal Site	950 m	55,000
3.	Road Restoration		10,000
4.	Disposal Field incl. Appurt.	3000 lm	116,000
	Subtotal		**$ 304,000**
	Contingencies and Engineering (allow 25%)		**76,000**
	Disposal System Land Acquisition		**60,000**
	Total Pump Station:Disposal		**$ 440,000**
	TOTAL SYSTEM		**$ 659,000**

8.3.4.4 User Cost Calculation

A user cost calculation for debt retirement of the project capital cost of $659,000 is presented in the tabulation below. The relatively high per lot capital costs are reflected in the user costs computed by formulae 1 and 2.

Benefiting Parcels - 52

Approximate User Cost for Debt Retirement

Formula 1 - $ 996/yr.

Formula 2 - $ 410/yr.

Formula 3 - $ 100/yr.

Formula 4 - $1440/yr.

8.3.5 Pump Across Lake to Skaha Estates

8.3.5.1 System Description

As noted in the introductory sections relating to the Kaleden area, the concept of pumping collected wastewater from the Kaleden lakeshore area to Skaha Estates is based on the assumption that a community system is constructed in Skaha Estates. As described in section 8.2, the most feasible approach for servicing Skaha Estates involves pumping wastewater to the Okanagan Falls community sewerage system.

The pipeline connecting Skaha Estates and the Kaleden lakeshore area is illustrated schematically in figure 8.2. Figure 8.4 illustrates the collection system leading to the pipeline crossing of Skaha Lake at Ponderosa Point which is designated as Option 2. The collection system for pumping to Skaha Estates is essentially the same as described previously in section 8.3.4. Major changes in the collection system are:

- wastewater pumping station 2 now becomes a relatively minor system component which pumps to a proposed gravity sewer draining toward Ponderosa Point.

- wastewater pumping station 3 on Ponderosa Point formerly pumping to the north into station 2 will now be designed to pump across the lake.
- the feasibility now is available to design the majority of the collection system (except contributing area to pump station #1) as a raw sewage collection system. The reduction in design static lift on the wastewater pumping station enables this change.
- the system hydraulic capacity is now not limited by the sizing of the disposal area, therefore, at relatively modest additional capital costs, service extensions to residential areas bordering the lakeshore area are proposed. Figure 8.4 illustrates three collection laterals into areas not serviced by the disposal system on the Bench.

The opportunities for enlarging the service area of the system are an important advantage of this alternative. The Kaleden Area Community Plan identifies the area west of the lakeshore access road for low density development (polygons 67 and 68). Any development in this area could be connected to and serviced by the proposed sewerage system.

The wastewater pipeline from Ponderosa Point connecting into pumping station 2 (see figure 8.3) in Skaha Estates would be about 750 metres in length. To minimize the possibilities of leaks developing in the pipeline, it is proposed that the pipeline would be continuous with welded joints if steel pipe were used or fused joints with a polyethylene pipe. Sections in the vicinity of the lakeshore at either end would be designed for a minimum of 1.2 to 1.5 m of cover and the deep water section simply installed on the lake bottom. Bathymetric maps for Skaha Lake indicate that the maximum lake depth between Ponderosa Point and Skaha Estates is 30 m with the average depth being about 20 m. Depending on the long term service potential of the system, either a 100 mm or 150 mm pipe would be installed across the lake.

Wastewater from the lakeshore area of Kaleden would be pumped to Okanagan Falls with collected wastewater from Skaha Estates as described in section 8.2.5. The addition of wastewater from a population of about 150 in Kaleden and 350 in Skaha Estates for a total population of 500 will likely load the Okanagan Falls treatment plant to at or near its maximum capacity. Capacity improvements to the Okanagan Falls system may, therefore, be necessary.

8.3.5.2 System Design Criteria

The principal objective of the sewerage system option involving pumping to Skaha Estates is to provide service to the Moderate, High and Very High phosphorus transmission areas on the Kaleden lakeshore. As described previously, service extensions into residential areas bordering the lakeshore area are proposed to increase the number of benefiting lots and achieve some economies of scale. On this basis, design population and flow criteria for the system are summarized in Table 8.7.

The collection system as illustrated in figure 8.4 would provide service to a population of up to 168 as indicated in Table 8.7. The projected 2007 service population of the system could approach 450 if residential growth in the area west of the lakeshore (polygons 64 and 67) occurs. Table 8.7 gives approximate population increases of 70 residential units in these areas. The projections given in Table 8.7 are considered somewhat approximate but illustrative of the growth potential of the area.

TABLE 8.7

SERVICE POPULATIONS - PUMPING FROM KALEDEN TO SKAHA ESTATES

Present - 1987

Polygon	Residential Units/Pop.	Vacant	Parcel Total	Seasonal
63 - VH	17/49	4	21	
62 - H	4/12	0	4	
61 - VH	2/16	0	2	Park
60 - VH	4/12	0	5	24 Units
68 - M	13/38	8	21	
64 - ML	8/23	4	12	
69 - MH	1/ 3	2	3	
80 - M	1/ 3	2	3	
67 - L	8/23	2	10	
	58/168	22	80	

Average Winter Sewage Flow - 77 m^3/day (17,000 gpd)
Average Summer Flow - 100 m^3/day (22,000 gpd)

Projected - 2007

Polygon	Residential Units	Population	Seasonal
63 - VH	21	61	
62 - H	4	12	
61 - VH	2	6	Park
60 - VH	4	12	24 Units
68 - M	21	61	
64 - ML	40±	116	
69 - MH	3	9	
80 - M	3	9	
67 - L	50±	145	
	148	443	

Average Winter Sewage Flow - 200 m^3/day (44,000 gpd)
Average Summer Sewage Flow - 227 m^3/day (50,000 gpd)

Phosphorus loading reductions increase with the pumping to Skaha Estates option because of the increase in the service population of the system as compared to the Bench disposal option. The increase in phosphorus loading reduction is, however, modest recognizing that the additional houses serviced are located on Moderately Low and Low transmission areas. Service population and phosphorus loading reduction data are summarized following:

	1987	2007
Present Total Sector P Loading	165.4 kg/yr.	249.8 kg/yr.
Lakeshore Area Reduction	(-)84.8 kg/yr.	(-)101.9
Residual from OK Falls System	(+) 7.8	(+) 22.4
Net Phosphorus Reduction	77.0 kg/yr.	79.5 kg/yr.
Resulting Total Sector P Loading	88.4 kg/yr.	170.3 kg/yr.
Sector Permanent Population	820	1670
Lakeshore Pop. on Alt. System	148	443
Residual using Individual Systems	672	1227

As shown in the tabulation, phosphorus loading reductions are estimated to be 77 kg/year in 1987 and 79.5 kg/year in 2007. The phosphorus reduction achieved does not increase significantly because all population growth is projected to occur in areas having Low or Moderately Low phosphorus transmission ratings. By year 2007, the sewer system could be expanded to service up to 26% of the population of Kaleden. Residual loadings from the Okanagan Falls sewerage system are based on an average removal efficiency of 95%.

8.3.5.3 Capital Cost Estimate

Estimated capital costs for an expanded collection system on the Kaleden lakeshore area with wastewater pumping to Skaha Estates is presented in Table 8.8. As compared to the previous alternative, the collection system cost estimate increases from $219,000 to $313,000. The increase in cost of $94,000 includes the service lateral extensions shown in figure 8.4 and raw sewage pumping stations. On a per parcel served basis, the collection system costs are $3900 which is some $300 per benefiting parcel lower than the previous option.

The estimated capital cost of wastewater pumping station #3 and the forcemain crossing Skaha Lake is $475,000. Included in this cost estimate is a proportionate share of the capital cost of the piping system from Skaha Estates to Okanagan Falls. The cost attributable to Skaha Estates of $1,428,000 as given in Table 8.4 reduces to $1,259,000.

TABLE 8.8

KALEDEN LAKESHORE COMMUNITY SEWERAGE SYSTEM AND WASTEWATER PUMPING TO SKAHA ESTATES CAPITAL COST ESTIMATE

ITEM	DESCRIPTION		EST. COST
A. COLLECTION SYSTEM			
1.	Ø150 and Ø200 Gravity Sewer	1320 m	$ 79,000
2.	Ø100 Low Pressure Collector	420 m	21,000
3.	Cleanouts		8,000
4.	Pressure and Gravity Services		33,000
5.	Ø 75 Forcemain	650 m	25,000
6.	Road Restoration		31,000
7.	Septic Tank Effluent/Wastewater Pump.Stas.		(2) 56,000
	Subtotal		**$ 253,000**
	Contingencies and Engineering (allow 25%)		**60,000**
	Total Collection		**$ 313,000**
B. PUMP STATION AND LAKE CROSSING			
1.	Wastewater Pump Station #3		$ 50,000
2.	Ø150 Pipeline Crossing of Lake		195,000
3.	Proportional Cost of Skaha Estates to Okanagan Falls System		135,000
	Subtotal		**$ 380,000**
	Contingencies and Engineering (allow 25%)		**95,000**
	Total Pump Station:Disposal		**$ 475,000**
	TOTAL SYSTEM		**$ 788,000**

The overall system estimated capital cost of $788,000 is equivalent to $10,200 per kg of phosphorus removed. This per kg cost is higher than the cost of $8220 for the Bench area disposal system, however, the larger service area and future expansion capabilities of the system should also be considered. Based on a total of 80 benefiting parcels, the per lot capital cost of the system is about $9,800, a reduction of about $1000 per lot as compared to the Bench area disposal system.

8.3.5.4 User Cost Calculation

User cost estimates for debt retirement of the system capital cost of $788,000 are as follows:

Benefiting Parcels - 80

Approximate User Costs for Debt Retirement

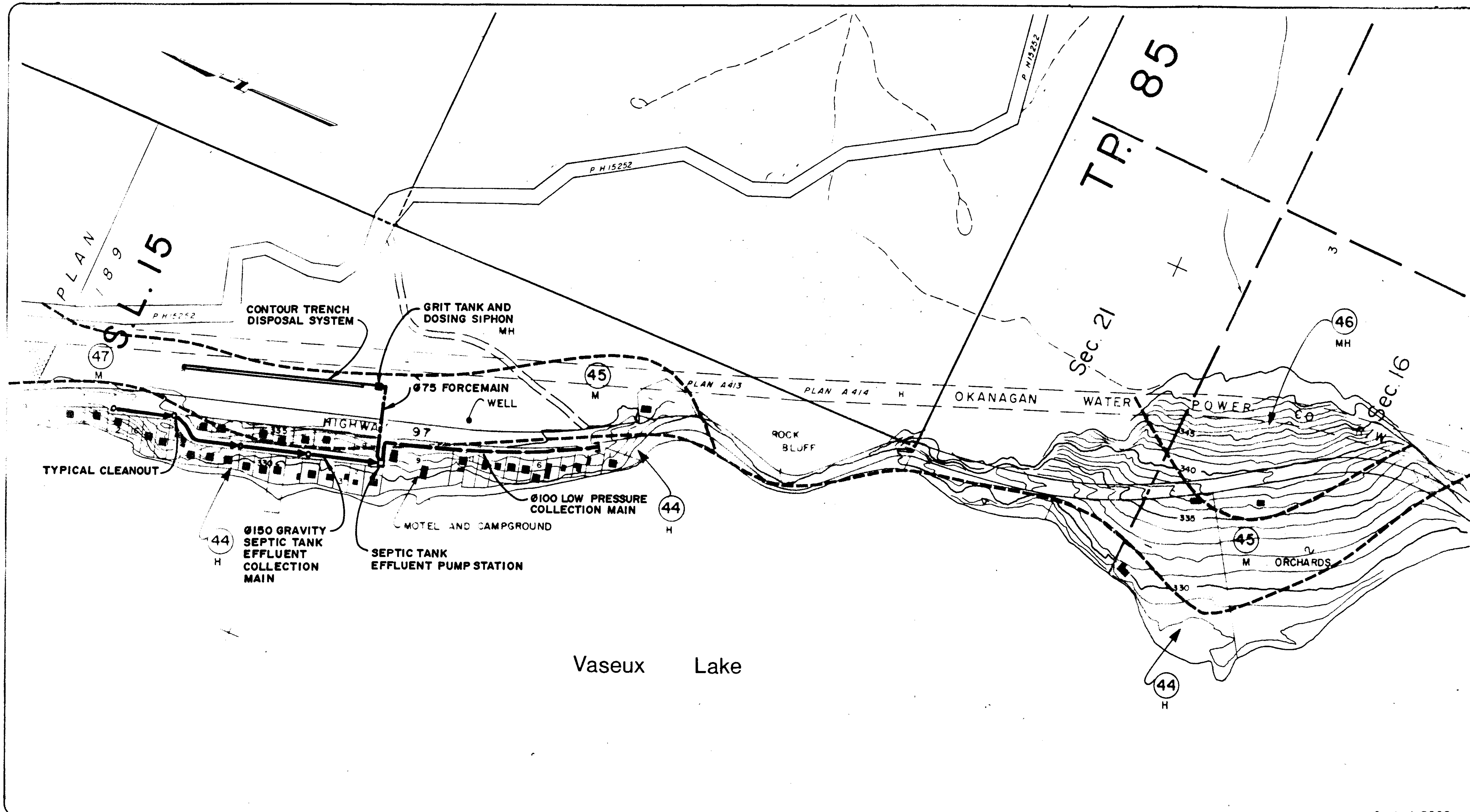
Formula 1 - $ 765

Formula 2 - $ 332

Formula 3 - $ 78

Formula 4 - $1110

The estimated annual costs do not include provisions for a monthly user fee or a connection fee.



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 8.1
East Vaseux Lake Area
Electoral Area D

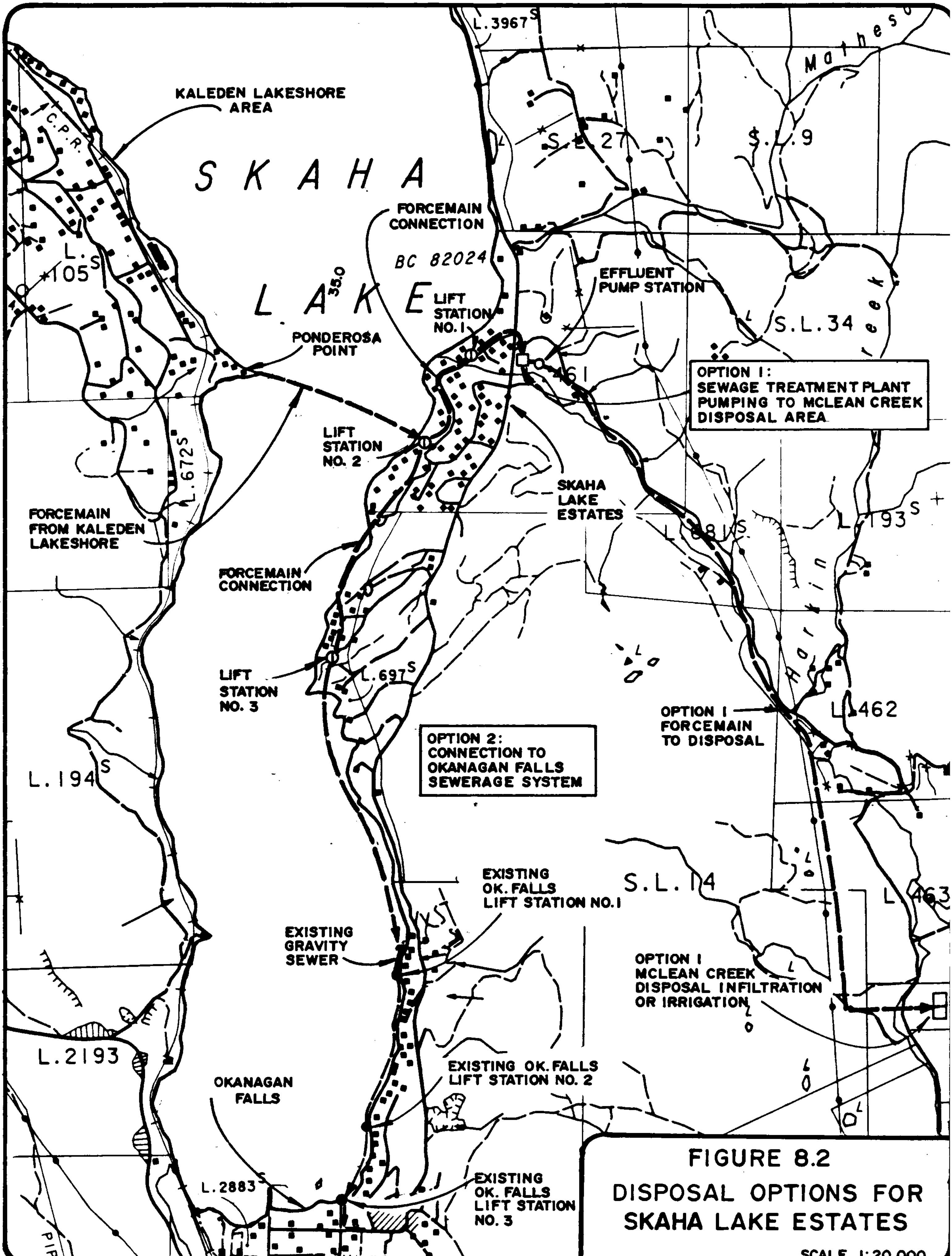
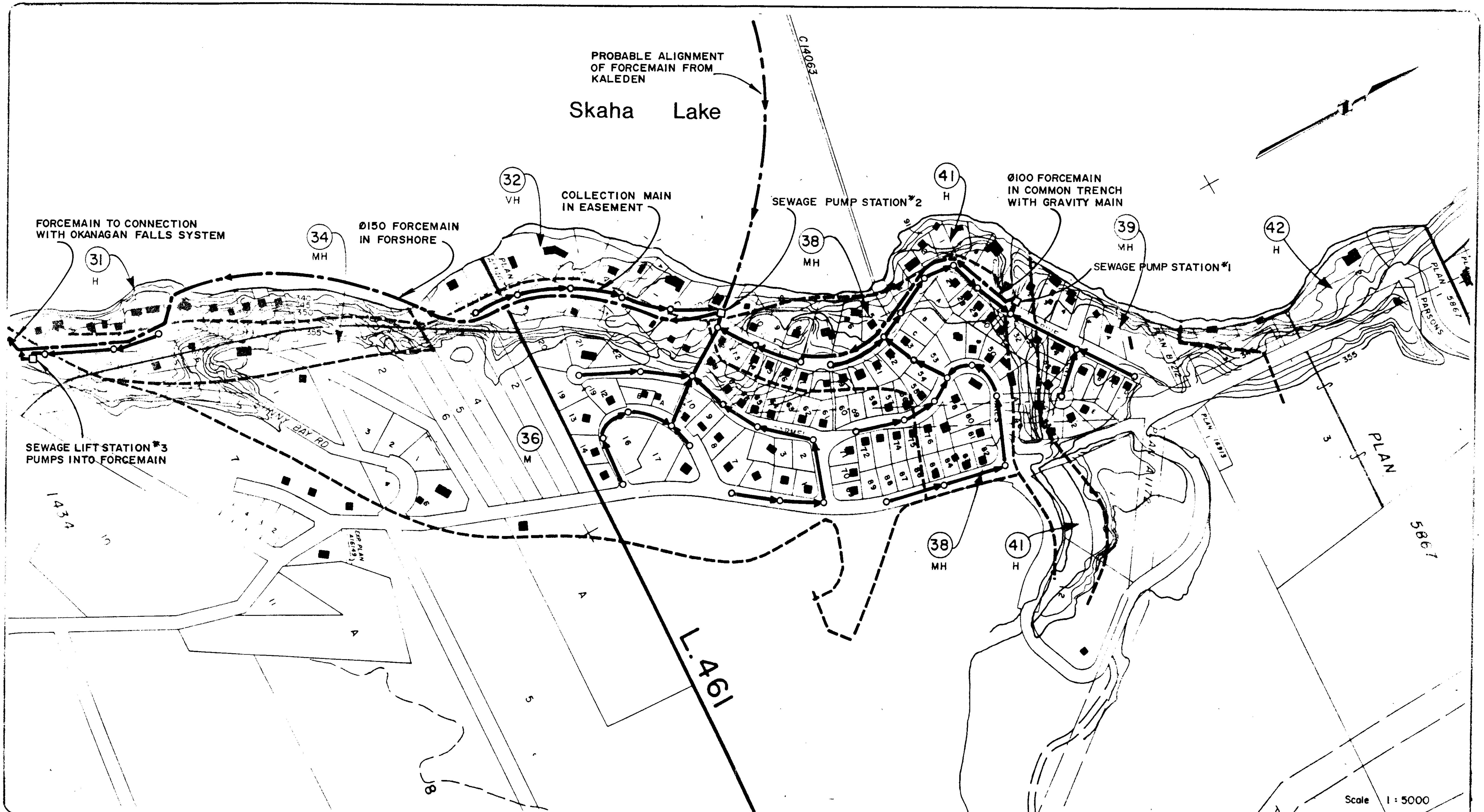


FIGURE 8.2
DISPOSAL OPTIONS FOR SKAHA LAKE ESTATES

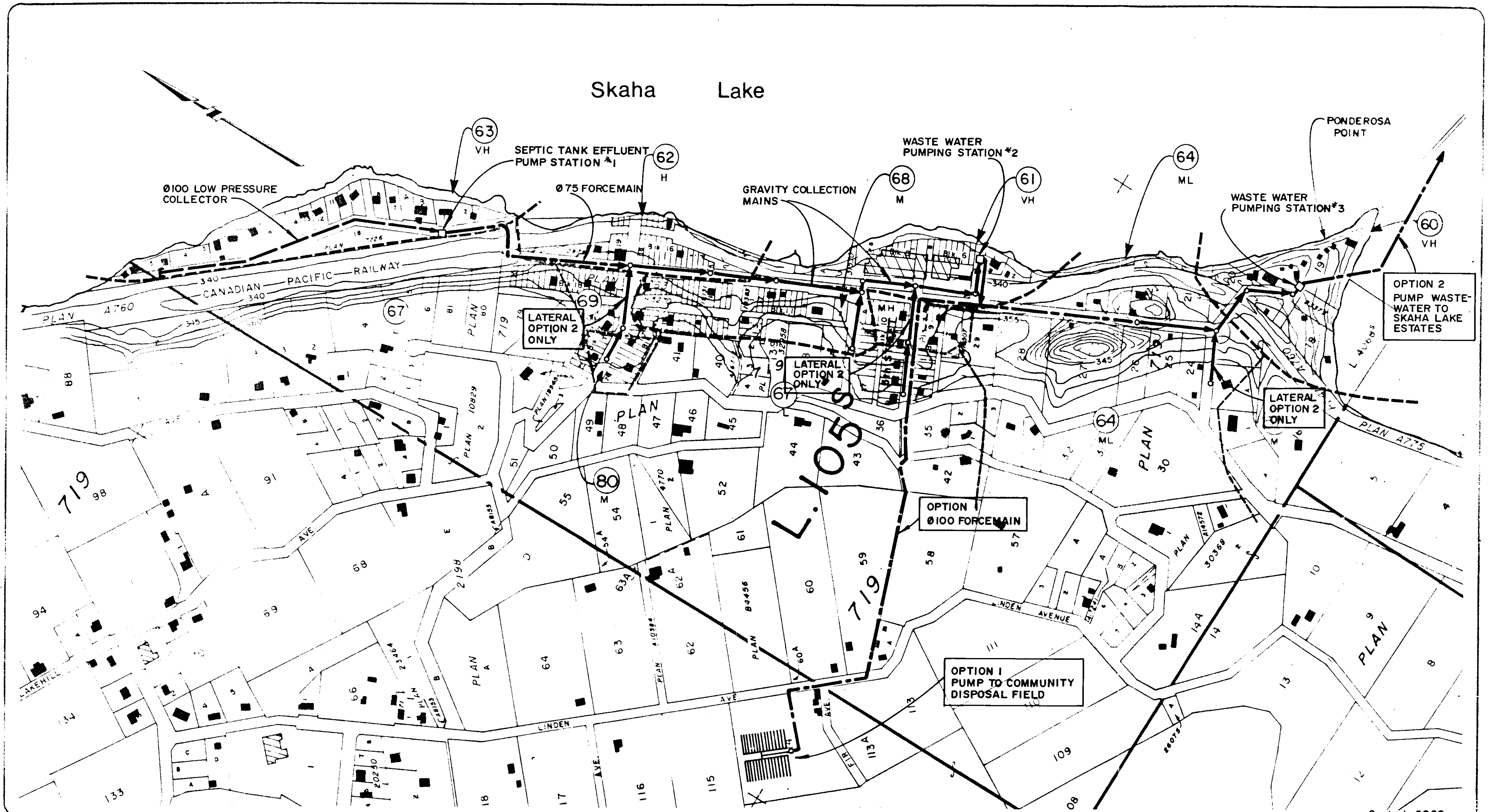
SCALE 1:20,000



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 8.3
Skaha Lake Estates
Electoral Area D



Regional District of Okanagan - Similkameen

Waste Management Plan
Electoral Areas A,C & D

Figure 8.4
Kaleden Lakeshore Area
Electoral Area D

9.1 Summary

Sections 4 and 5 of this report presented an overview analysis of the phosphorus removal efficiency of individual septic tank and tile field systems and other wastewater related concerns in Electoral Areas A, C, and D. On the basis of this assessment, areas were defined in each Electoral Area which had an unacceptably low efficiency for phosphorus removal and represented a concern from the point of view of public health factors. A total of ten such areas have been identified which warrant consideration for an alternative sewerage system.

Sections 6, 7, and 8 of this report describe, in detail, alternative systems for the defined areas of concern in each of the three Electoral Areas. Alternative systems evaluated ranged from small community systems serving only major problem areas to large scale community systems connected to an adjacent municipal sewerage system. Paragraphs following summarize the alternative system evaluations presented in sections 6, 7 and 8.

9.1.1 Osoyoos Rural Area - Electoral Area A

Electoral Area A was divided into three sectors for assessment of alternative systems. Each of the three sectors are illustrated in Figure 4.1 and each contain a significant amount of lakeshore development.

The Northwest sector includes a 5.8 km length of the Osoyoos lakeshore extending from the Town boundary to the north end of the Lake. Alternatives involving a central collector system connected to the Town of Osoyoos system and small scale community disposal systems were evaluated for this area. The alternative system evaluation is summarized following:

OSOYOOS NORTHWEST SECTOR

	Central Collector	Small Scale Systems
Total System Cost	$ 1,106,000	$ 981,000
P Loading (1987)	263 kg/yr.	263 kg/yr.
P Reduction	205.6 kg/yr.	180.7 kg/yr.
Residual P Loading	57.4 kg/yr.	82.3 kg/yr.
Capital Cost per kg	$ 5,380	$ 5,430
Population Serviced	376	376
Residual on Indiv. Systems	311	311
P Removal Efficiency Residual Systems	82%	82%

The tabulation illustrates that the central collector system is some $120,000 more expensive than the option of constructing a small scale system.

Common features of the two alternatives for an alternative system in the Northwest sector are:

- both options would resolve present building restrictions resulting from inadequate lot area to provide a septic tank and disposal field in accordance with Ministry of Health standards.
- both options resolve Ministry of Health concerns with water supply wells and disposal fields being located on the same property and the potential interference between the two.
- the old CP Railway right of way is important as a pipeline corridor for both options.
- the Lacey Point area would be serviced by a connection to the Town of Osoyoos sewerage system in both alternatives.
- the construction of either alternative can be phased, although the phasing opportunities are different.

Major differences between the two options which should be considered in the final analysis and selection of a preferred alternative are:

- central collector system collects raw wastewater and the small scale systems provide for septic tank effluent collection. The public will likely prefer the central collector system because all existing septic tank and field systems can be abandoned.
- common collector system offers the flexibility to serve population growth in the area while the small scale system approach is sized only for existing subdivided properties.
- operating costs of four small scale systems are anticipated to be more than the connection to the Town and should be considered in the final selection.
- the life expectancy of proposed small scale community disposal systems should be considered.
- assuming arrangements can be made for use of the CP Rail right of way as a pipeline corridor, little or no land acquisition is required for the common collector option. A minimum of four community disposal field sites on lands currently used for orchards will be required to implement the small scale system option.

The second area in Electoral Area A considered for an alternative sewerage system is the southeast lakeshore extending from the Town of Osoyoos boundary south to the U.S.A. border. Campgrounds and other tourist-commercial facilities are a major land use in this sector. A connection to the Town of Osoyoos sewerage system is recommended as the ultimate solution for this area. Options were evaluated including a full connection to the Town system in west Osoyoos where adequate trunk main capacity is available, an interim connection in East Osoyoos which may require pump and haul of peak flows during the summer months and a community disposal field system. The evaluation of all options is summarized following:

OSOYOOS SOUTHEAST SECTOR

	Connection East Osoyoos	Connection West Osoyoos	Disposal Field in East Osoyoos
Total System Cost	$402,000	$615,000	$715,000
P Loading (1987)	100.4 kg/yr.	100.4 kg/yr.	100.4 kg/yr.
P Reduction	76.4 kg/yr.	76.4 kg/yr.	69.2 kg/yr.
Residual P Loading	24.0 kg/yr.	24.0 kg/yr.	31.2 kg/yr.
Capital Cost per kg	$ 5,280	$ 8,050	$ 10,300
Population Serviced	93	93	93
Residual on Indiv. Systems	478	478	478
P Removal Efficiency Residual Systems	95%	95%	95%

The option involving a community disposal system for the Southeast Sector area does not warrant further consideration. The alternative has a higher capital cost as compared to connecting to the Town of Osoyoos and a lower net phosphorus loading reduction. Operating and maintenance costs will be higher as compared to the connection to the Town of Osoyoos alternatives.

The only major difference between the two options for connection to the Town of Osoyoos is initial capital cost and the need for pump and haul for the connection in East Osoyoos to overcome capacity deficiencies in the Town collection system in the area. As flows increase in the service area of the system, it would be intended that the connection point be relocated to West Osoyoos by construction of a forcemain across Haynes Point. Both systems service the same initial population and achieve similar phosphorus loading reductions.

The third Osoyoos Rural Area is the Southwest sector which includes lakeshore areas from the Town boundary south to the U.S.A. border. The overall population of this area is about 700, but phosphorus loading to Osoyoos Lake is a concern only in two localized areas of this sector. Options considered for this sector included a small community system, sized for the phosphorus concern areas, connect the High and Very High phosphorus transmission areas to the Town of Osoyoos and a sewer system serving all urban density development in the area. The assessment of these options is summarized as follows:

OSOYOOS SOUTHWEST SECTOR

		Connection to Town	
	Small Scale System	High P Loading Areas Only	Service all Urban Density
Total System Cost	$178,000	$ 187,000	$ 509,000
P Loading (1987)	144.5	144.5	144.5
P Reduction	60.7	62.2	97.0
Residual P Loading	83.8	82.3	47.5
Capital Cost per kg	$ 2,930	$ 3,000	$ 5,250
Population Serviced	85	85	278
Residual on Indiv. Systems	625	625	432
P Removal Efficiency Residual Systems	87%	87%	88%

A range of capital costs from $178,000 to $509,000 is presented, although the phosphorus loading reductions and service populations are different for each.

The basic decision to be made for the Southwest sector is whether to construct a small scale community system or to connect to the Town of Osoyoos system. Factors which should be included in the analysis include:

- small community system collects septic tank effluent compared to raw wastewater for the connection options.
- small community system requires some property acquisition for the disposal field which is eliminated with a connection to the Town.

- there is no expansion capability with the small scale system other than provisions for existing vacant lots.

Although the capital costs for the small scale system are slightly lower than the connection to the Town, a connection to the Town is preferred to reduce operating costs and in recognition that it is a better long term solution.

9.1.2 Oliver Rural, Gallagher and South Vaseux Lake- Electoral Area C

The analysis of phosphorus sources in Electoral Area C identified four areas having unacceptably low phosphorus removal efficiencies. Two of the four are located immediately adjacent to the Village of Oliver boundary including the Sawmill Road and the Tugulnuit Lake areas. Other areas identified for assessments of alternative systems are in the Gallagher Lake and South Vaseux Lake areas. Electoral Area C and the areas described above are illustrated in Figure 4.2.

The Sawmill Road area includes Okanagan River plain land extending south of the Village of Oliver and bounded by the CP Railway right of way to the west and the Okanagan River to the east. Essentially all of the Sawmill Road area has a phosphorus transmission rating of Moderately High or higher. Alternatives considered for this area included a low pressure collection system connected to the Town of Oliver and a low pressure system with collected effluent being pumped to a separate community disposal field. The assessment of these options is summarized following:

SAWMILL ROAD AREA

	Connect to Oliver	Separate System
Total System Cost	$ 284,000	$ 578,000
P Loading (1987)	190.7 kg/yr.	190.7 kg/yr.
P Reduction	143.7 kg/yr.	123.0 kg/yr.
Residual P Loading	47.0 kg/yr.	67.7 kg/yr.
Capital Cost per kg	$ 1,980	$ 4,700
Population Serviced	207	207
Residual on Indiv. Systems	189	189
P Removal Efficiency Residual Systems	75%	75%

The preceding summary illustrates that both alternatives achieve relatively the same phosphorus loading reduction. An assumption in the assessment of a connection to the Village of Oliver system is that adequate reserve treatment plant capacity is available.

The option involving a connection to Oliver has a capital cost of about 50% of the estimated cost of the separate system. Connection to Oliver provides some reserve hydraulic capacity for future development in the Sawmill Road area and will have a lower operation and maintenance cost. All factors considered, a connection to the Village of Oliver is preferred as an alternative system for the Sawmill Road area.

The second area evaluated for an alternative system is the lakeshore of Tugulnuit Lake. Lakeshore areas of Tugulnuit Lake have phosphorus transmission ratings of Very High and High. Because of the proximity to the Village of Oliver, a connection to the Village of Oliver was evaluated on the basis of serving the entire Tugulnuit Lake area and only the lakeshore having High and Very High phosphorus transmission ratings. A separate system using a conventional subsurface disposal system was also assessed for the lakeshore areas. The assessment is summarized following:

TUGULNUIT LAKE AREA

	Separate System	Connect to Oliver	
		Lakeshore Only	Complete Area
Total System Cost	$ 750,000	$ 645,000	$1,437,000
P Loading (1987)	277.4	277.4	277.4
P Reduction	160.5	197.5	218.1
Residual P Loading	116.9	79.9	59.3
Capital Cost per kg	$ 4,670	$ 3,270	$ 6,580
Population Serviced	200	252	637
Residual on Indiv. Systems	888	836	451
P Removal Efficiency of Indiv. Systems	90%	90%	90%

The evaluation of options for the Tugulnuit Lake area indicates that connection to the Village of Oliver is the least cost alternative. As compared to a separate system, a connection to the Village has the advantage of future expandability, ability to collect raw sewage and probable lower overall operation and maintenance costs. Service to the lakeshore areas of Tugulnuit Lake is a priority from the point of view of reduced phosphorus loadings and possible bacteriological impact on lake water quality.

Residual population not addressed in the Tugulnuit Lake area are primarily located on the Osoyoos Indian Reserve #1.

An alternative sewerage system for areas at the north end of Gallagher Lake having Moderately High to Very High phosphorus transmission ratings was assessed. In concept, the system includes a conventional sewage collection system with collected effluent pumped to a treatment plant and disposed to ground by infiltration basins. A treatment plant site north of Gallagher Lake is proposed. Some consideration was given to an alternative site on the Osoyoos Indian Reserve, however, no significant increased phosphorus removals and/or reductions in capital costs were achieved with this siting alternative. The assessment of the Gallagher Lake system is summarized following:

GALLAGHER LAKE AREA	
Total System Cost	$ 588,000
P Loading (1987)	90.9
P Reduction	77.4
Residual P Loading	13.5
Capital Cost per kg	$ 7,600
Population Serviced	220
Residual on Ind. Systems	4

The Gallagher Lake system would service essentially 100% of the present population in the area. Significant population growth is anticipated in the Gallagher Lake area, all of which can be accommodated by extensions of proposed collection mains and an expansion of the treatment and disposal system. Operation and maintenance costs have not been addressed in the analysis.

In the South Vaseux Lake sector, the objective is to provide an alternative system for development at the south end of the Lake located in a Very High phosphorus transmission area. Options evaluated for this area include a small community subsurface disposal system and a connection to the Gallagher Lake system described previously. In both cases, a low pressure septic tank effluent collection system would be provided. The assessment of the two options is summarized following:

SOUTH VASEUX LAKE AREA

	Separate System	**Connection to Gallagher**
Total System Cost	$ 159,000	$ 215,000
P Loading (1987)	51.1 kg/yr.	51.1 kg/yr.
P Reduction	39.2 kg/yr.	42.0 kg/yr.
Residual P Loading	11.9 kg/yr.	9.1 kg/yr.
Capital Cost per kg	$ 4,060	$ 5,100
Population Serviced	47	47
Residual on Indiv. Systems	42	42
P. Removal Efficiency of Indiv. Systems	84%	84%

The feasibility of connecting to the Gallagher Lake system assumes prior construction of that system. The separate system has a lower capital cost than the connection to the Gallagher system. The connection to the Gallagher Lake system has the advantages of future expandability and a slightly higher phosphorus loading reduction.

Based on the preliminary analysis of options for the South Vaseux Lake area, there is no clear preferred alternative. The stated advantage of the connection to Gallagher Lake in terms of expandability may result in pressure to develop lands currently in the ALR. The community disposal system, on the other hand, resolves the current area of concern without providing capacity for additional development.

9.1.3 East Vaseux, Skaha Estates and Kaleden - Electoral Area D

Figure 4.3 illustrates Electoral Area D and the various sub-areas which have been assessed in terms of present phosphorus removal efficiencies and loadings. The overall assessment in sections 4 and 5 identified the East Vaseux Lake, Skaha Estates and the Kaleden lakeshore areas as having unacceptably low phosphorus removal efficiencies and other wastewater related concerns.

Topographic constraints in the East Vaseux Lake area effectively reduce the community sewerage alternatives to a single option. A low pressure and small diameter gravity septic tank effluent collection system is proposed to service existing development on the east side of the Lake. Collected wastewater would be pumped to a contour trench disposal system located on the east side of Highway 97. The contour trench system is proposed to minimize complications from topography and to take maximum advantage of phosphorus removal characteristics of the soil. Performance criteria for the system is summarized as follows:

EAST VASEUX LAKE AREA	
Total System Capital Cost	$ 211,000
P Loading (1987)	69.9
P Reduction	30.5
Residual P Loading	39.4
Capital Cost per kg	$ 5,300
Population Serviced	101
Residual on Ind. Systems	9

The above summary illustrates that essentially all of the existing population in the East Vaseux Lake area would be serviced by the system. Although the system as proposed would service only existing development in the area, there is flexibility to increase the service area to include the adjacent Provincial Park and other public facilities planned for the area.

Skaha Estates is located about 3.0 km north of Okanagan Falls on the east side of Skaha Lake. Of the 10 areas considered for alternative systems in the Waste Management Plan area, the Skaha Estates area proved to be the most difficult to define reasonable alternative servicing options for. High groundwater table conditions, bedrock and existing services are factors which will escalate construction costs of a collection system in the area. A conventional gravity sewer system was evaluated for the Skaha Estates area with collected wastewater being pumped to the McLean Creek Valley or Okanagan Falls for treatment and disposal. The evaluation of these options is summarized following:

SKAHA ESTATES

	McLean Creek Valley	Connect to OK Falls
Total System Cost	$ 2,035,000	$ 1,428,000
P Loading (1987)	158.6 kg/yr.	158.6 kg/yr.
P Reduction	131.5 kg/yr.	129.9 kg/yr.
Residual P Loading	27.1 kg/yr.	28.7 kg/yr.
Capital Cost per kg	$ 15,500	$ 11,000
Population Serviced	312	312
Residual on Indiv. Systems	36	36
P Removal Efficiency of Residual Systems	75%	75%

The preceding summary illustrates a clear cost advantage for the connection to the Okanagan Falls system. Phosphorus loading reductions and service populations for both options are essentially the same. The connection to the Okanagan Falls system has an advantage of a single centralized system from the point of view of operation and maintenance.

The capital cost per kg for the Skaha Estates area is significantly higher than any other area in Electoral Areas A and C. The high cost reflects difficult site conditions in the Skaha Estates area and the distance to Okanagan Falls. The connecting pipe from Skaha Estates to Okanagan Falls is proposed to be installed as a submarine pipeline in Skaha Lake.

Phosphorus transmission ratings for the lakeshore area of Kaleden between Ponderosa and Sycle Points range between Moderately High and Very High. Alternative systems have been considered for this lakeshore area. The linear nature of the area along the Lake necessitates a collection system combining low pressure septic tank effluent and gravity flow collection mains and a minimum of three wastewater pumping stations. Options considered for wastewater disposal include pumping to a disposal system on the bench area or pumping to the Skaha Estates system. Pumping to Skaha Estates is only feasible with prior construction of the Skaha Estates system. The assessment of these two options is summarized as follows:

KALEDEN LAKESHORE AREA

	Disposal on Kaleden Bench	Pump to Skaha Estates
Total System Cost	$ 659,000	$ 788,000
P Loading (1987)	165.4 kg/yr.	165.4 kg/yr.
P Reduction	68.7 kg/yr.	77.0 kg/yr.
Residual P Loading	96.7 kg/yr.	88.4 kg/yr.
Capital Cost per kg	$ 9,600	$ 10,200
Population Serviced	117	148
Residual on Indiv. Systems	703	672
P Removal Efficiency of Residual Systems	90%	90%

Disposal on the Kaleden Bench is estimated to be some $120,000 less expensive than pumping to Skaha Estates. Factors which have relevance in the final selection analysis include:

- operation and maintenance costs associated with pumping to the Bench are expected to be significant. The effluent pump station static lift approaches 113 m and screening facilities will be incorporated into the station.
- disposal to the Bench requires a septic tank effluent collection system. A raw wastewater collection system can be provided with pumping to Skaha Estates.
- the option involving pumping to Skaha Estates has significantly better expansion capabilities than the Bench disposal system.

These factors considered, there is a preference for ultimately servicing the Kaleden Lakeshore area by the connection to the Skaha Estates system.

9.2 Alternatives for Stage Two Analysis

The Draft Stage One Report describing the alternative sewerage system options was reviewed in detail by representatives of government agencies, Okanagan Water Quality Project staff, the Electoral Area Directors and the R.D.O.S. administrative staff. In addition, public information meetings were held in February 1988 in each Electoral Area to describe the alternative systems considered and seek comment and input. Arising from these reviews, a preferred alternative sewerage system has been identified for each of the ten defined concern areas.

A second consideration related to the alternative sewerage systems is the establishment of a relative priority for implementation. As a means to describe relative priority, three priority groupings are proposed. While it should be recognized that the priority groupings are somewhat subjective, factors considered in assigning priorities include:

- reduced phosphorus loading reduction values.
- existence in the defined area of other wastewater related concerns as described in section 4.
- overall capital cost of the system and capital cost per reduced kg/year phosphorus loading.
- population growth potential in each area.

Table 9.1 summarizes the preferred alternative sewerage system for each of the ten concern areas and the relative priorities by group. Data on system capital cost, reduced phosphorus loading and cost per kg/year of reduced loading is also presented in Table 9.1.

Higher priority areas for alternative systems are the Osoyoos Northwest Sector and the Tugulnuit Lakeshore and Sawmill Road areas bordering the Village of Oliver. All three areas either have a defined "other" wastewater concern or the potential of concerns occurring. The three areas combined represent a potential phosphorus loading reduction of 546.8 kg/year which is 50% of the total loading reduction achievable by alternative systems in the three Electoral Areas as a whole.

TABLE 9.1

ALTERNATIVE SYSTEM SUMMARY

AREA	ALTERNATIVE SYSTEM	CAPITAL COST	OTHER WASTE-WATER CONCERN	PHOSPHORUS LOAD. REDUCTION	COST PER kg/yr.
GROUP 1					
Osoyoos Northwest	Connect to Osoyoos	$1,106,000	Yes	205.6	$ 5380
Tugulnuit Lakeshore	Connect to Oliver	645,000	Yes	197.5	$ 3270
Sawmill Road	Connect to Oliver	284,000	Potential	143.7	$ 1980
Subtotals		**$2,035,000**		**546.8**	
GROUP 2					
Osoyoos Southeast	Connect to Osoyoos	$ 402,000	Potential	76.4	$ 5280
South Vaseux Lake	Community Disposal Field	159,000	Potential	39.2	$ 4060
East Vaseux Lake	Community Disposal Field	211,000	Potential	30.5	$ 5300
Subtotals		**$ 772,000**		**146.1**	
GROUP 3					
Gallagher Lake	Treatment & Disposal Vaseux Creek Area	$ 588,000	No	77.4	$ 7600
Kaleden Lakeshore	Connect to Okanagan Falls	788,000	Yes	77.0	$10200
Skaha Estates	Connect to Okanagan Falls	1,428,000	Potential	129.9	$11000
Osoyoos Southwest	Connect to Osoyoos	187,000	No	62.2	$ 3000
Subtotals		**$2,991,000**		**346.5**	
TOTALS		**$5,798,000**		**1039.4**	

Medium priority has been given to the two Vaseux Lake areas and the Osoyoos Southeast Sector. In all cases, the potential has been established for other wastewater concerns to develop. All three areas have a per kg of reduced phosphorus loading capital cost in the range of $4,000 to $5,300. As noted in sections 7 and 8, the implications of phosphorus loadings from septic tank systems on the water quality in Vaseux Lake requires study before a final decision is made on the construction of alternative sewerage systems. The three Group 2 areas represent a combined phosphorus loading reduction of 146.1 kg/year, or 14% of the total possible in the three Electoral Areas.

The lower priority areas in terms of implementing an alternative sewerage system include Gallagher Lake, Southwest Osoyoos, Kaleden Lakeshore and Skaha Estates. The Gallagher Lake alternative system has a relatively high per kg capital cost of $7600. There is no other identified wastewater related concern for the Gallagher Lake area. The relationship between phosphorus loading and water quality in Gallagher Lake requires study before consideration of a community sewerage system. Skaha Estates and Kaleden Lakeshore areas have been included in the lower priority grouping because of the high capital cost expressed on a per kg of reduced phosphorus loading. In both cases, the capital cost for the alternative system exceeds $10000 per kg of reduced loading. Concerns related to the construction and age of existing septic tank and tile field systems in the north part of the Kaleden Lakeshore area warrants detailed study. The Osoyoos Southwest Sector is included in the low priority group because no other wastewater concerns have been identified and the system would service a relatively small population, approximately 80 people.

The preferred alternatives identified in Table 9.1 represent the focus of more detailed system evaluations in the Stage Two Report.

9.3 General Wastewater Related Strategies

The analysis of alternative systems in the ten concern areas indicates that alternative systems will not be constructed in all ten areas over the short term future. Accordingly, the importance of general wastewater related policies to reduce phosphorus loadings or, at a minimum, maintain at present levels is emphasized. As described in section 5, areas not considered for alternative systems also have areas with housing on Moderately High or higher rated phosphorus transmission polygons. Wastewater related policy strategies would also apply to these areas.

The range of wastewater related policies which could be implemented by the R.D.O.S. are described in detail in section 5 and were discussed at length at the technical workshop session and subsequent meetings with OK Water Quality Project staff, the Area Directors and the R.D.O.S. administrative staff. An objective of the Stage Two Report is to discuss policy options in detail, describe potential implications and define a method for implementation by the Regional Board.

Specific general strategies which appear to warrant priority consideration include:

- recognition of Moderately High to Very High phosphorus transmission areas as environmental control zones in community planning documents.
- specification of increased minimum parcel size (lot area) criteria in the designated control zones to minimize phosphorus loadings and provide the opportunity to implement alternative on-site disposal system design criteria.
- preparation of design criteria for septic tank and disposal systems which will achieve acceptance efficiencies of phosphorus removal.

- amendments to community plan and zoning bylaw documents which require wastewater aspects to be adequately addressed by agricultural (livestock) operation. The intention is that Ministry of Agriculture guidelines would be formally recognized by the Regional District.

The other policy options summarized in section 5 will be addressed in the Stage Two Report, however, the preceding represent what appears to be the priorities based on review meetings with Ministry of Environment and Okanagan Water Quality Project representatives.

BIBLIOGRAPHY

(1) "Phosphorus Transmission from Septic Tank Effluent", Ministry of Environment.

(2) "1980 Update; Nutrient Loadings from Non-Point Sources, Okanagan Basin Implementation Agreement", Canadian Bio Resources Engineering Ltd., March 1982.

(3) "Phosphorus in the Okanagan Valley Lakes: Sources, Water Quality objectives and Control Possibilities", Water and Waste Management Branches, Ministry of Environment, May 1985.

(4) "Agricultural Phosphorus Source Inventory for the Okanagan Water Quality Control Project", Talisman Land Resource Consultants, December 1986.

(5) "Water System Study and Computer Analysis", Urban Systems Ltd., January 1986.

(6) "Assessment of Water Quality and Identification of Water Quality Concerns and Problem Areas - Osoyoos", Water Management Branch, Ministry of Environment, December 1985.

(7) "Assessment of Water Quality and Identification of Water Quality Concerns and Problem Areas - 1986", Water Management Branch, Ministry of Environment, December 1986.

(8) "Technical Supplement to Osoyoos' Community and Settlement Plan", Regional District of Okanagan Similkameen, February 1980.

(9) "Technical Supplement to the Oliver South Extended Fringe Community Plan", Regional District of Okanagan-Similkameen, September 1986.

(10) "Technical Supplement to Oliver's Community and Settlement Plan", Regional District of Okanagan-Similkameen, March 1980.

(11) "Technical Supplement to the Gallagher-Vaseux Lake Settlement Plan", Regional District of Okanagan-Similkameen, August 1985.

(12) "Technical Supplement to the Okanagan Falls Settlement Plan", Regional District of Okanagan-Similkameen, May 1982.

(13) "Technical Supplement to the Kaleden Settlement Plan", Regional District of Okanagan-Similkameen, July 1983.

(14) "Technical Supplement to the Penticton Fringe Settlement Plan", Regional District of Okanagan-Similkameen, January 1985.

(15) Draft Report "Expansion Area Study: The Village of Oliver", Urban Systems Ltd., April 1987.

(16) "Sewer and Water Study, The Village of Oliver", Urban Systems Ltd., February 1986.

(17) "Soil Suitability for Septic Tank Effluent Absorption", Ministry of Environment, Project No. 83-021 PC.

(18) "Technical Assessment for Permit Application, Regional District of Okanagan Similkameen, (Okanagan Falls)", Ministry of Environment, March, 1978.

(19) "Okanagan Falls Sanitary Sewer System", As-Constructed Drawings, Underwood and McLellan and Associates Ltd., Project Number 2155-022, December 1978.