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

STAGE ONE REPORT

Part I
Inventory

Regional District of Okanagan Similkameen

T.R. Underwood Engineering

MARCH, 1988

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Our File: 308-011

March 28, 1988

Regional District of
Okanagan-Similkameen
101 Martin Street
Penticton, B.C.
V2A 5J9

Attention: Ms. V. Sutton,
Administrator

Dear Madam:

Re: **Waste Management Plan for Electoral Areas A, C, and D**
Final Stage One Report

Submitted herewith is our Final Stage One Waste Management Plan Report for Electoral Areas A, C, and D. The Final Stage One Report has been prepared on the basis of comments received at a technical workshop session with government agencies on January 26, 1988, comments from staff members of the Okanagan Water Quality Project and input from public meetings held in the three Electoral Areas in February 1988.

For convenience, the Stage One Report is now presented as two separately bound volumes titled Part One, Inventory and Part Two, Analysis of Alternatives. Major content additions to the report arising from the review sessions include:

- more detailed description of other wastewater related concerns in the three Electoral Areas.

- expansion of report section 5 to include a description of general wastewater related policies or strategies which could be implemented by the Regional District to minimize phosphorus loadings and reduce the possibility of other wastewater related problems occurring.

- additions to the report sections 6, 7 and 8 representing descriptions and evaluations of collection and disposal alternatives not addressed in detail in the Draft Stage One Report.

General revisions have also been made to phosphorus loading and capital cost estimates throughout the report.

On the basis of this Final Stage One Report, our objective is now to proceed with the Stage Two Report. The Stage Two Report will include detailed assessments of identified preferred alternative sewerage systems and in depth discussions of general strategy options. Please contact the undersigned should questions arise concerning any aspect of this Final Stage One Report.

Yours truly,

T.R. Underwood, P.Eng.

TRU/db
enc.

cc: Okanagan Water Quality Project

STAGE ONE REPORT
WASTE MANAGEMENT PLAN
FOR ELECTORAL AREAS A, C, & D

REGIONAL DISTRICT OF OKANAGAN SIMILKAMEEN

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In September, 1987, a Waste Management Plan Progress Report was submitted to the Regional District which assessed:

- phosphorus source inventory from septic tank and tile field systems in the rural areas comprising Electoral Areas A, C and D.
- population projections to year 2007 together with projections of phosphorus loadings to receiving water courses.
- areas where alternative sewerage or waste management systems warrant feasibility assessments to reduce phosphorus loadings.

This Progress Report was used as a basis for discussion at a technical workshop session with Government Agency Representatives in September 1987 and public information meetings in the three electoral areas in October and November 1987.

This report represents completion of the Waste Management Plan to the Stage One Report. The basic format of the September 1987 report has been expanded and feasibility assessments of alternative sewerage systems in ten areas of concentrated development are presented. The assessments include descriptions of the components of each system, estimates of phosphorus loading reductions and capital cost estimates. Based on the assessments of alternative systems presented herein, decisions on preferred options may be made. A statement of priority for system construction throughout the three electoral areas may be considered based on estimated capital costs per kg/year of reduced phosphorus loading.

2.1 Study Area

The Waste Management Planning Area encompasses the Southern Okanagan Area from the southern boundary of the City of Penticton to the U.S. border (see Figure 2.1). The Waste Management Plan focuses on three rural Electoral Areas of the Regional District of Okanagan-Similkameen. These electoral areas are:

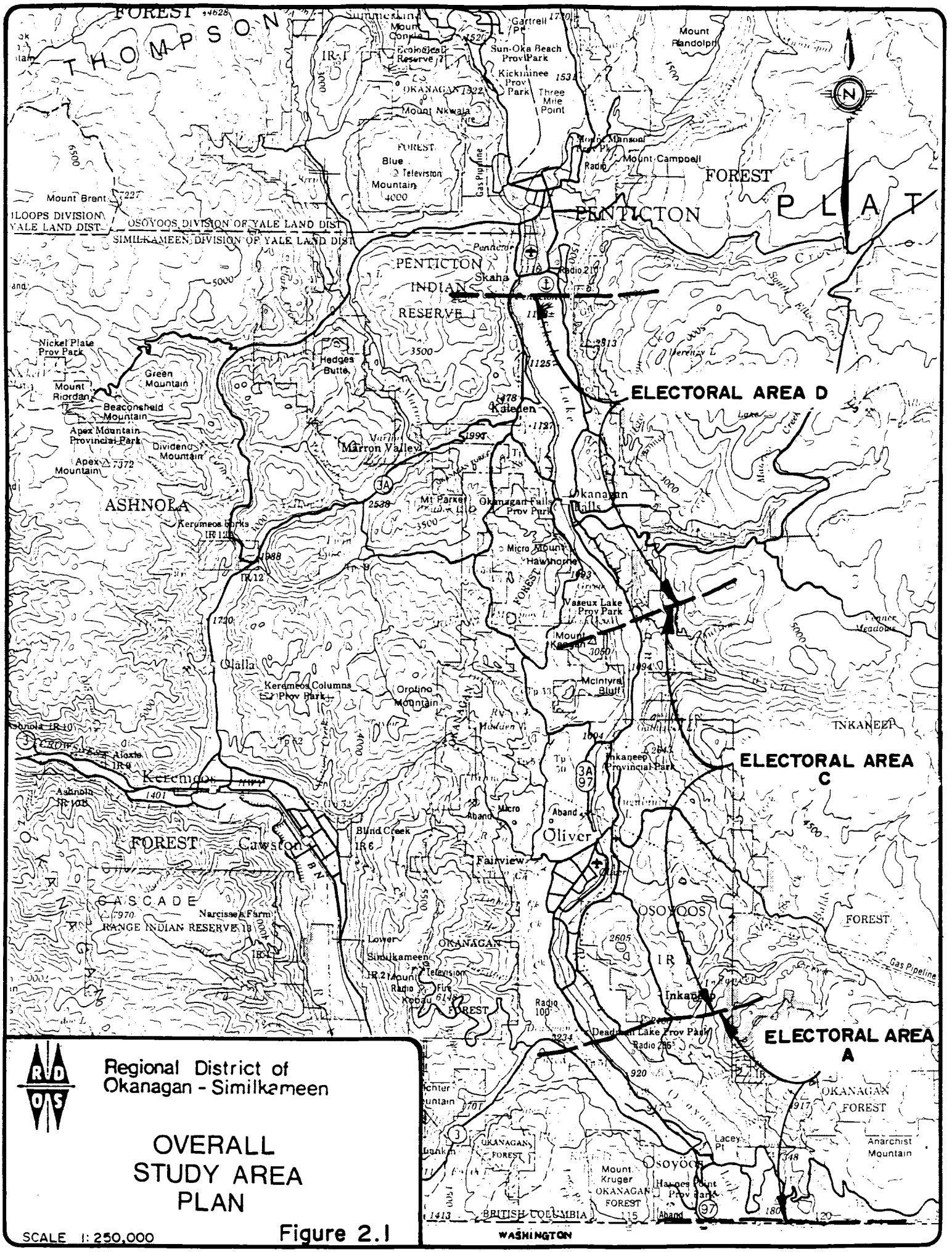
Electoral Area A - Osoyoos Rural Area extending from the U.S.A. border to and including the north end of Osoyoos Lake.

Electoral Area C - Extending from the north end of Osoyoos Lake to the south end of Vaseux Lake including the residential areas abutting the Village of Oliver.

Electoral Area D - Extending from the south end of Vaseux Lake to the north end of Skaha Lake including the communities of Okanagan Falls and Kaleden.

The Waste Management Planning Area does not include the incorporated municipalities of Oliver and Osoyoos. Generally, the planning area is limited to the coverage area of Phosphorus Transmission Mapping from Septic Tank Effluent prepared by the Ministry of Environment. (1) This mapping applies to sectors in the three Electoral Areas generally within 1 km of Okanagan Valley watercourses where phosphorus transmission from septic tank systems to receiving waters can be quantified.

The Waste Management Planning Area includes portions of the Osoyoos Indian Reserve #1 and the Penticton Indian Reserve #1. Recognizing


ELECTORAL AREA D
ELECTORAL AREA C
ELECTORAL AREA A
PENTICTON INDIAN RESERVE
OSOYOOS IR
Regional District of Okanagan - Similkameen
OVERALL STUDY AREA PLAN
SCALE 1: 250,000
Figure 2.1

that the Regional District does not have jurisdiction on these Reserves, the Plan does not address phosphorus reduction strategies on the Reserves. Present phosphorus loadings to receiving waters from development on the two Indian Reserves are, however, presented in the inventory of present loadings section.

2.2 Waste Management Plan Objectives

The Okanagan basin has been designated as an environmentally sensitive area with emphasis being placed on reducing the phosphorus loading to receiving waters from both point and non-point sources. An objective of this Waste Management Plan is to evaluate alternatives for reducing phosphorus loadings from septic tank and tile field systems. A second major objective of the Waste Management Plan is to define areas where septic tank and tile field systems do not function satisfactorily and/or other health related concerns may exist. Input from the Ministry of Health is important in defining areas where septic tank and disposal system operation is less than satisfactory.

The Ministry of Environment Phosphorus Transmission Mapping is the basis for determining where the major sources of phosphorus from individual septic tank and tile field systems are located. On the basis of this mapping, the following data collection activities were completed:

- definition of present phosphorus loadings from development in the three Electoral Areas
- delineation of major areas of concern which have an unacceptably high phosphorus loading
- in combination with Regional District Community Plans, project future phosphorus loadings.

Objectives of the Waste Management Plan with respect to the phosphorus loading inventory and other septic tank operating concerns are:

- phosphorus removal efficiencies for all existing septic tank and tile field systems should approach 80%

- phosphorus removal efficiencies for future septic tank and tile field systems associated with new development should approach 90%
- after definition of sectors or areas which do not meet the phosphorus removal efficiencies, alternative systems are to be evaluated which will resolve the deficiencies
- alternative sewerage systems are to be evaluated on the basis of capital costs, operating costs, phosphorus removal efficiency and alternative senior government assistance formulas
- the evaluation of alternative systems, where considered feasible, should also consider social and public health criteria
- where alternative systems are not economical or technically feasible, policy options are to be considered to achieve phosphorus loading reductions and/or a status quo situation. These policy statements may address housing density in areas of environmental concern, alternative system design criteria, operation and maintenance, etc.

The Waste Management Plan is intended to address population projections for a 20 year period (to year 2007).

3.1 Phosphorus Sources

The Waste Management Plan focuses on phosphorus sources from individual on-site septic tank systems within the study area. Generally, the phosphorus sources which represent a significant environmental concern are residences in the Electoral Areas which are located adjacent to watercourses including lakes. Additional phosphorus sources in the planning area include:

- seasonal tourist-related facilities including campgrounds, motels, etc.
- the municipal sewerage systems in Osoyoos, Oliver and Okanagan Falls
- wastewater discharges from industries, residential housing developments, etc. which are authorized by Waste Management Permit
- agricultural sources and, in particular, livestock operations
- agricultural sources resulting from fertilizer use on orchards, vineyards, etc.
- natural runoff, forestry areas, urban storm sewer systems, etc.

3.1.1 Residential Septic Tank - Tile Field Systems

Phosphorus contributions from septic tank and tile field systems have been estimated from the previously described phosphorus transmission mapping prepared by the Ministry of Environment. The mapping considers horizontal distance to watercourses and vertical soil characteristics to establish a phosphorus transmission rating for a mapping sector. These mapping sectors or polygons have a phosphorus transmission rating which may range between Very High and Low. The map phosphorus transmission ratings, together with estimated percent phosphorus transmission to receiving water, are summarized as follows:

Very High	75 to 100%	average	87.5%
High	50 to 75%	average	62.5%
Moderately High	30 to 50%	average	40.0%
Moderate	15 to 30%	average	22.5%
Moderately Low	5 to 15%	average	10.0%
Low	0 to 5%	average	2.5%

Housing groups located in mapping areas with phosphorus transmission ratings of Moderately High to Very High are of principal concern in the Waste Management Plan.

Upon completion of the phosphorus transmission mapping, actual phosphorus loads were estimated by the Ministry of Environment by first computing the number of housing units in each polygon throughout the study area. Housing unit counts were done principally on the basis of air photographs. To estimate the phosphorus transmitted to receiving water, a per capita phosphorus generation of 1.0 kg/year and 2.9 people per dwelling unit were used. An average phosphorus contribution of 1.0 kg/year per capita was established in the "1980 Update, Nutrient Loadings from Non-Point Sources", prepared by Canadian Bio Resources Engineering Ltd.(2) An average household population of 2.9 has been derived from community planning documents for rural sectors within the study area.

The preceding criteria related to phosphorus from septic tank sources result in the following average transmissions to receiving waters per dwelling unit for the various transmission classes:

VH	Very High	-	2.40 kg phosphorus per year
H	High	-	1.81 kg phosphorus per year
MH	Moderately High	-	1.16 kg phosphorus per year
M	Moderate	-	0.65 kg phosphorus per year
ML	Moderately Low	-	0.29 kg phosphorus per year
L	Low	-	0.07 kg phosphorus per year

Septic tank systems throughout the Waste Management Planning Area are estimated to generate 7700 kg of phosphorus per year of which approximately 2000 kg (4400 lbs.) of phosphorus per year is transmitted to receiving waters.

3.1.2 Seasonal Sources

Seasonal phosphorus sources are campgrounds, motels, and hotels which provide accommodation to tourists, principally during the summer months. In addition, wastewater treatment and disposal facilities are septic tank and tile field systems. Phosphorus loadings from these sources have been estimated by combining population, per capita phosphorus criteria and the previously described phosphorus transmission mapping.

For seasonal phosphorus sources, an average population per campsite or accommodation unit of 3 persons and an annual phosphorus generation of 0.1 kg/person have been used. The 0.1 kg/capita phosphorus contribution is one tenth of the value for a person in a permanent residence. The lower value recognizes:

- people on vacation do not generate as much detergent or "soap" related phosphorus
- tourist accommodation occupancy is seasonal, assumed to be 80% of facility capacity for a 60 day period

Seasonal phosphorus sources are a particular concern when the facilities, such as a campground, are located immediately adjacent to the lakeshore on a polygon having a phosphorus transmission rating of moderately high to very high. Within the study area, potentially significant seasonal phosphorus sources include:

- campsites on east side of Osoyoos Lake south of Highway 3
- campsites adjacent to Tugulnuit Lake
- campsites-motel units at Gallagher Lake
- campsites-motels along north end of Skaha Lake generally located on the Penticton Indian Reserve.

Seasonal phosphorus sources are estimated to contribute 200 kg (440 lbs.) of phosphorus to receiving waters. An additional 120 kg/year is attributable to tourist facilities on the Skaha lakeshore on the Penticton Indian Reserve.

3.1.3 Major Municipal Sewerage Systems

There are three municipal sewerage systems, Osoyoos, Oliver and Okanagan Falls, operating under Waste Management Permit within the study area. Effluent from treatment plants in Osoyoos and Oliver is disposed of by spray irrigation of golf courses. Based on data in the 1985 report on "Phosphorus in the Okanagan Valley Lakes" prepared by the Ministry of Environment (3), both the Osoyoos and Oliver sewerage systems are considered to be "100% efficient" in phosphorus removal.

The Okanagan Falls community sewerage system is operated by the Regional District of Okanagan-Similkameen and comprises an oxidation ditch treatment plant and rapid infiltration basins for effluent disposal. Flow and quality data for 1986 provided by the Waste Management Branch for the Okanagan Falls system indicate system flows average 530 m^3/day (116,000 gpd) with phosphorus concentrations averaging 5.0 mg/l. Combining the average flow and phosphorus data results in a total of 960 kg of phosphorus being discharged to the rapid infiltration basins each year. The Okanagan Falls rapid infiltration basins are located about 2 km southeast of the community in an area having moderately low to low phosphorus transmission ratings from the Ministry of Environment Phosphorus Transmission Maps. The phosphorus loading from the Okanagan Falls treatment plant to receiving waters can therefore be expected to be between 2.5% and 10% of the total amount discharged, i.e., 24 to 96 kg per year.

In general, the three municipal sewerage systems within the study area are not major contributors of phosphorus to receiving waters.

3.1.4 Permitted Discharges under the Waste Management Act

Throughout the Waste Management Planning Area there are a total of fifteen (15) wastewater discharges which are permitted under the Waste Management Act. The major municipal systems previously described are not included in this total. The permits relate mainly to agricultural industries and, with one exception, all involve a wastewater discharge to ground. All permits are summarized in Table 3.1.

Only two of the permits listed in Table 3.1, Idle-O-Apartments south of Osoyoos and M. and T. Brower laundromat at Gallagher Lake represent a significant source of phosphorus. The remaining permits represent either wastewater discharges which do not result in an increase in phosphorus concentration in the wastewater or where no effluent quality data for phosphorus is available. Where no effluent quality data for phosphorus is available, it may be assumed that phosphorus is not a concern.

As shown by Table 3.1, limited data on the potential phosphorus loadings from small industries is available. Sampling and monitoring of wastewater for phosphorus should be undertaken by the Ministry of Environment to confirm industrial phosphorus loadings.

TABLE 3.1

PERMITTED DISCHARGES UNDER THE WASTE MANAGEMENT ACT

OSOYOOS RURAL AREA - ELECT. AREA A

Permit #	Name	Wastewater Characteristics	Est. P. Load	Polygon #
7295	Idle-O-Apartments	septic tank effluent	42.2 kg/yr.	003-27
4510	Osoyoos Ready Mix	concrete truck washout	n/c	n/a
2120	Monashee Co-op	fruit packing plant	n/c	003-36
2216	OK Similk. Coop	cooling water	n/c	Osoyoos

OLIVER RURAL AREA - ELECT. AREA C

Permit #	Name	Wastewater Characteristics	Est. P. Load	Polygon #
2217	OK-Similk. Coop	fruit processing/storage	n/c	Oliver
2826	OK-Similk. Coop	fruit storage	n/c	013-37
4503	Tree Fresh Storage	fruit processing/storage	n/c	013-48
4525	Oliver Ready Mix	concrete truck washout	neg.	013-59
5670	Vinitera Vineyards			
6316	Bright's Wines	winery	n/c	023-05
6878	Johnston Meats	slaughterhouse wastes		013-66
7790	Village of Oliver	pool backwash	neg.	013-82
2145	M & T Brower	laundromat	1.0	023-35

OKANAGAN FALLS-KALEDEN - ELECT. AREA D

Permit #	Name	Wastewater Characteristics	Est. P. Load	Polygon #
0581	Fish and Wildlife Br.	fish hatchery	n/c	033-53
6879	Sun Dew Foods	food processing	n/c	033-13

n/c - not calculated, insufficient data
neg. - negligible
n/a - not located within Phosphorus Transmission Mapping Area

003-56 - Map Sheet 003 - Polygon 56

3.1.5 Agricultural Sources Related to Livestock

An assessment study of phosphorus loadings to receiving waters from livestock operations in the Okanagan Valley was completed by Talisman Land Resource Consultants in a report titled "Agricultural Phosphorus Source Inventory" dated December 1986.(4) Within Electoral Areas A, C, and D the agricultural sources consisted principally of cattle-related operations. The subregional or sector boundaries established in the Talisman report did not follow Electoral Area boundaries and, therefore, direct utilization of their summary data is difficult. It appears that there are approximately 26 livestock operations within the planning area representing a total of about 5000 head of cattle.

The Talisman Study estimated the amount of phosphorus which may be contributed to receiving waters from these livestock operations as a result of direct discharge to receiving waters or by runoff. Runoff modes included rainfall and snowmelt events. A factor in the phosphorus loading methodology was recognition that the Okanagan River plain areas are used mainly for livestock wintering. For a 9 month period each year, cattle are moved to rangeland areas out of the valley bottom area.

The Talisman Study estimated that the total phosphorus production within the Waste Management Planning Area is 110,000 kg of phosphorus per year. On average, a mature animal produces or generates about 20 kg of phosphorus per year or twenty times the 1.0 kg per capita contribution given previously for the residential sources. Of the total of 110,000 kg per year of phosphorus produced by livestock operations, Talisman estimated that 194 kg per year is "lost" to receiving watercourses by either runoff modes and/or direct discharge. The 194 kg/year represents about 0.2% of the total amount of phosphorus produced per year.

The Talisman Study did not estimate the amount of phosphorus which may be discharged to receiving waters through the groundwater. In this case, animal waste in holding facilities, winter pasture, etc. would have phosphorus dissolved by rainfall or irrigation, and then infiltrate into the ground. As the water passes through the soil, phosphorus is removed by the soil (similar to the mechanism in a septic tank disposal field). Depending on soil characteristics and horizontal and vertical distance to the receiving watercourse, some percentage of the dissolved phosphorus may reach a receiving watercourse.

An estimate of the phosphorus loading from agricultural sources (principally cattle operations) by groundwater flow is presented in the March 1982 study by Canadian Bio Resources Engineering Ltd. These data derived from Table A-8 are summarized as follows:

Basin 9	Osoyoos Lake Area	56 kg/year
Basin 8	Okanagan River-Oliver Area	176 kg/year
Basin 7	Vaseux Lake Area	4 kg/year
Basin 6	Skaha Lake Area	48 kg/year
	TOTAL	**284 kg/year**

The above total of 284 kg of phosphorus per year represents only the estimated phosphorus component reaching receiving waters by the groundwater. A detailed assessment of the methodology used by Canadian Bio Resource Engineering to compute the phosphorus loadings of 284 kg/year has not been undertaken nor is such an analysis within the terms of reference of this plan. Discussions with the Ministry of Agriculture indicates that the methodology and results used by Canadian Bio Resources in 1982 to derive these phosphorus values are somewhat questionable based on more recent studies. The Canadian Bio Resource phosphorus loading estimates should be reviewed.

3.1.6 Agricultural Sources Related to Fertilizer Uses

Estimates of phosphorus losses resulting from fertilizer usage on agricultural areas are presented in the 1982 update report by Canadian Bio Resource Engineering Ltd.(2) Extrapolating information presented

in this study suggests that phosphorus losses resulting from fertilizer usage may approach 500 kg/year within the Waste Management Plan area. The Ministry of Agriculture again indicates that these fertilizer related phosphorus loading estimates are questionable and warrant further review.

The nitrogen component of fertilizers and the impact on groundwater quality is a concern within the Waste Management Planning Area. Throughout the lower Okanagan Valley area, groundwater is used extensively for community and individual residence water supplies. The Canadian Drinking Water Standards establish a maximum concentration of 10 mg/l for nitrate as nitrogen in domestic water supplies. There is evidence of elevated nitrate concentrations in groundwater supplies in the Osoyoos Area (5)(6) which is attributed to a significant degree to fertilizer usage on agricultural areas.

In the Osoyoos area, water wells serving the Town of Osoyoos have nitrate concentrations ranging between 1 and 6 mg/l. (5) The Water Management Branch has undertaken extensive quality assessment studies of wells in the Osoyoos area, focussing on nitrates in 1985 and 1986. (6) (7). In 1985, 8.6% of 70 sites sampled had nitrate concentrations greater than 10 mg/l and in 1986, 17.4% of the 86 wells sampled had nitrate concentrations of 10 mg/l or higher. While these studies relate specifically to the Osoyoos area, an evaluation of water quality data for major groundwater sources in the Oliver area should be undertaken to determine whether nitrate related concerns are widespread.

Nitrate concentrations in the groundwater is not a component of this Waste Management Plan, however, the potential impact of fertilizer use on groundwater quality should, at a minimum, be recognized. Compilation of data for groundwater sources north of Osoyoos may be appropriate to further assess relative scope of potential elevated nitrate concentrations in the groundwater.

3.1.7 Summary of Phosphorus Sources

In the preceding sections, an overview of the principal sources of phosphorus within the Waste Management Planning Area is presented. Other potential sources including "upstream" contributions, forestry related sources, natural runoff and rain-dustfall were not described.

Individual residential septic tanks and tile field systems are the largest source by group representing a loading of about 2000 kg/year. This Waste Management Plan will focus on phosphorus sources from residential septic tank and tile field systems, seasonal sources and permitted discharges under the Waste Management Act. Combined, these sources represent an estimated phosphorus loading to receiving waters of 2260 kg/year.

3.2 Planning Area Sectors and Population Criteria

The initial objective of this stage of the Waste Management Plan has been to prepare an inventory or summary of existing phosphorus loadings within the planning area which would then be used as a basis for future projections. This inventory of present loadings has been prepared on the basis of the Phosphorus Transmission Mapping. To facilitate the preparation of population and future phosphorus loading projections, the study area has been divided into sectors which coincide with the boundaries of Community and Settlement Plans prepared by the Regional District. By dividing the study area into sectors coinciding with Regional District planning area boundaries, population projection information can be used and referenced directly.

Generally, the future population values are of importance in a Waste Management Plan for a municipality with the assumption that the future population will be serviced by the sewerage system. In this Waste Management Plan, the location of the proposed future development in relation to the phosphorus transmission mapping is of more importance than the population projection numbers. Community Plan mapping has been used extensively in this Waste Management Plan to determine the probable location of future development and specifically the phosphorus transmission classification.

The population projections presented herein relate specifically to permanent dwelling units. Except where specifically addressed in a Community Plan document, no estimates have been made for growth of seasonal facilities including campgrounds, motels, etc.

3.3 Phosphorus Loading Calculation

Section 3.1 described the basic per capita phosphorus generation and transmission criteria used to estimate the phosphorus loading from permanent dwelling units in the planning area. The next step in the inventory process has been to compute a total for defined sectors in each of the planning areas. This total calculation has been prepared by numbering all polygons in each sector, computing loadings in each sector and then adding all polygon loads to give a total. This information is presented in the Appendix of this report. Information included in the Appendix includes:

- all phosphorus transmission maps applicable to the study area
- delineation of polygons with a present phosphorus loading by the assignment of an identifying number
- summaries of the loadings from all polygons within the study area by planning area sectors.

From a review of the information presented in the Appendix, it will become evident that not every phosphorus transmission polygon within the study area has been assigned an identification number and, therefore, these polygons are excluded from the inventory loading sheets. A polygon was not numbered nor included in the analysis if there is no development (present or proposed) within the polygon area.

3.4 Capital Cost Estimates

The Waste Management Plan presents capital cost estimates for sewerage system alternatives for defined areas in the three Electoral Areas to reduce phosphorus loading. Assumptions which have been made in the preparation of all preliminary system capital cost estimates presented in the Waste Management Plan are as follows:

- capital cost estimates include all system components of the proposed sewerage works; i.e., collection mains, road restoration where required, service connections to property line, manholes, pumping stations, trunk sewers, treatment and disposal facilities
- cost estimates include an allowance of 25% of the estimated construction cost to include contingencies, engineering and local government administration during construction
- where connection to an existing municipal or community system is proposed, no allowance for a connection fee has been made. If improvements to the municipal system are necessary to provide adequate capacity for the service or expansion proposed, capital costs for these works are identified.
- property acquisition will be necessary for treatment and disposal systems for several of the alternative systems evaluated in this Waste Management Plan. Generally, site requirements comprise a 0.5 to 1.5 ha area from an existing orchard or other agricultural operation. Land acquisition costs will vary depending on location and production. Based on discussions with realty firms in the South Okanagan area, land acquisition costs have been estimated using a cost of $30,000 per hectare. This cost includes the actual cost to the property owner and administrative items such as legal survey and conveyancing documents. Easement and right of way acquisition costs are more difficult to estimate on the basis of an average value. In general, easement purchase costs are considerably lower on a per hectare basis than site acquisition costs. Sufficient contingency allowances are provided in all cost estimates to include rights of way or easements.
- all capital cost estimates are based on tender results and unit prices for the 1987 construction season. Prediction of inflationary trends which may affect construction costs over the next 5 to 10 years is difficult, if not impossible, and is beyond the scope of this assignment.

The preceding assumptions related to capital cost estimates apply to all capital cost estimates presented in this Waste Management Plan.

3.5 Alternative Senior Government Assistance Formulae

A component of this Waste Management Plan will be the feasibility assessment of community sewerage system construction in concentrated development areas in the rural areas as a strategy to reduce phosphorus loadings. Conceptual designs of system alternatives are presented with capital estimates. A major factor in determining the feasibility of these systems is the final cost to the individual user of the proposed systems. Clearly, a system option which may be technically excellent in terms of phosphorus loading reductions, is not feasible if the end user costs are several times greater than what is considered as an acceptable range of sewer user rates.

Prior to 1983, senior government assistance available for sewer system construction including collection systems was equivalent to 93% of the estimated capital cost. The assistance comprised an annual grant from the Provincial Government equivalent to the ammortization of 75% of the project cost and a contribution from the Okanagan Basin Water Board equalling 24% of the Provincial Government assistance. Prior to 1983, therefore, the net cost to an individual homeowner was equivalent to 7% of the system capital cost.

Subsequent to 1983, the assistance for sewerage work available from the Provincial Government was reduced to 25% of the system capital cost. The 25% assistance is offered as a grant toward the system construction costs and is subject to sufficient funds being available. Unlike the period prior to 1983, the grant is now not universally available.

In 1985, the Provincial Government designated the Okanagan Basin as an environmentally sensitive area and increased the level of assistance available to 75%. The increased assistance is available for eligible costs only, which generally includes:

- proposed works must be in accordance with an approved Waste Management Plan.
- treatment plants and disposal systems including waste sludge systems which are designed to meet OK Water Control Project phosphorus removal standards.
- sewers and sewer connections are not funded under the Okanagan Water Quality Project.

There appears to be some uncertainty related to the eligibility of collection systems which are intended principally to reduce the phosphorus loading in the Basin.

With the increase in Provincial Government assistance to 75% for eligible capital costs, it is assumed that the Okanagan Basin Water Board would continue with assistance in an amount equivalent to 24% of the Provincial contribution. Discussions with the administrative staff of the Okanagan Basin Water Board suggests that the Board is increasingly concerned about being able to continue to provide assistance at the 24% rate. The revenue of the Board has remained constant while several large municipal treatment plant projects are proceeding to construction. A reduction in the Okanagan Basin Water Board assistance appears probable. A decision on revisions to the Okanagan Basin Water Board funding is not expected before the spring of 1988.

Recognizing the preceding uncertainties with respect to both the eligibility and amount of senior government assistance which may be available for sewerage works, several alternative assistance formulae have been considered. These alternative formulae are described following:

Formula #1 - No funding available under OK Water Quality Project. Assistance available from Ministry of Municipal Affairs under Revenue Sharing Act in amount of 25% of project cost with OK Water Board assistance of 24% of this amount also available. **Total assistance rate under Formula 1 is, therefore, 31% of the total project cost.**

Formula #2 - Funding assistance available under OK Water Quality Control project in the amount of 75% for trunk sewers, forcemains, disposal systems, and pumping stations only. It should be noted that OK Water Quality Project funding does not at the present time apply to forcemains, pump stations, etc. The 75% assistance would not apply to collection system components, however, 25% grant under Revenue Sharing Act would be available for collection systems. In both cases, Okanagan Water Board assistance in amount of 24% would apply. **Assistance rates in this case would be 93% on trunk sewers, forcemains, treatment, etc. and 31% on collection system components.**

Formula #3 - Assistance Formula 3 assumes that the Okanagan Water Quality project assistance in the amount of 75% of project cost and 24% equivalent Okanagan Basin share would apply. **In this case, the assistance is 93% of the total project cost.**

Formula #4 - This formula assumes that no assistance would be received from either the Okanagan Water Quality Project or the Okanagan Basin Water Board. **Under this formula, benefiting parcels of land would be responsible for 100% of the system cost.**

The preceding described assistance formulae provide a range of assistance rates ranging between 0% and 93% of project costs.

Several other assumptions which have been made with respect to the calculation of user fees from capital cost estimates are presented following:

- the estimated capital cost of the sewerage systems are financed by debentures ammortized over a 20 year period at an interest rate of 10%.

- all components of the sewerage system cost are ammortized except individual service connections. Service connection costs are recovered by a service connection fee charged "once-only" to the homeowner at the time of connection.
- debenture payments are recovered through the levy of a parcel tax on benefiting properties.

The preceding assumptions apply to the debt retirement component of the project capital costs. In addition, benefiting homeowners would pay a monthly system user fee. The user fee would be set to recover annual system operation, maintenance and administrative costs.

4.1 Osoyoos Rural Area: Electoral Area A

4.1.1 Present Phosphorus Loadings and Other Wastewater Concerns

Electoral Area A encompasses the area from the U.S.A. border north to Deadman's Lake on Highway 97. The Osoyoos Rural Area has been divided into 3 sectors described as follows and as illustrated in Figure 3.1.

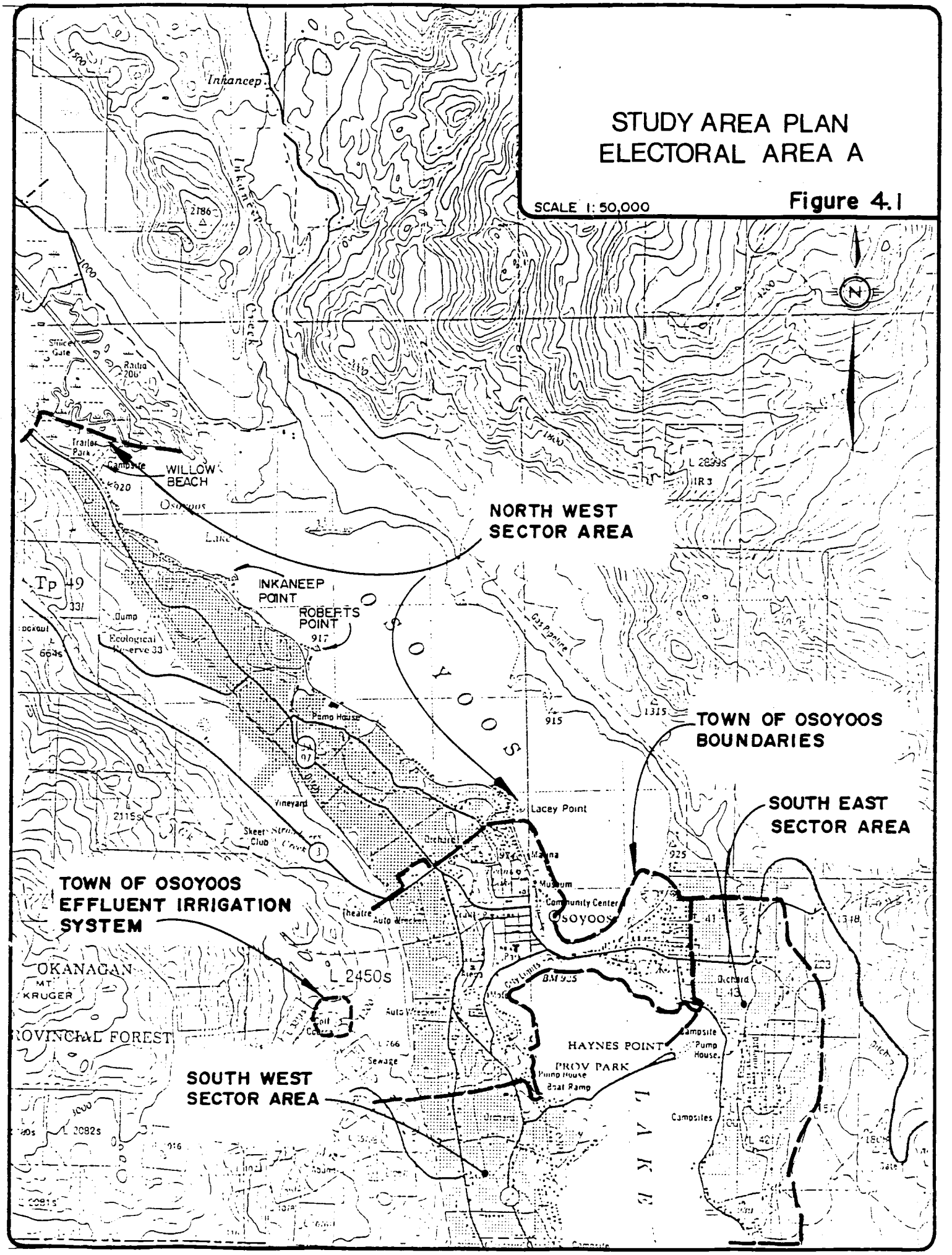
Northwest Sector - Includes all lakeshore development north of the Municipal boundary on the west side of the Lake, including the north end of Osoyoos Lake.

Southeast Sector - Includes all lakeshore development south of the Municipal boundary to the U.S.A. border on the east side of the Lake. Several large campsites are located in this sector.

Southwest Sector - Includes area on west side of Lake between Municipal boundary to U.S.A. border. Generally, the sector includes the area south of Haynes Point.

Phosphorus transmission data for each mapping polygon within each of the three sub-areas is presented in Tables A.1, A.2 and A.3 (Appendix). Total phosphorus loading data for the three sectors is summarized in Table 4.1.

On the basis of discussions with the Area Director and representatives of the Ministry of Health, the Northwest Sector is the primary area of concern in the Osoyoos Rural Area. The Northwest Sector includes six areas of relatively high housing density along the lakeshore (see sheet 003 - polygons 35, 37, 38, 48, 49, 50). In all cases the development is located on the lakeshore within 2 meters of the lake elevation. Phosphorus transmission from these six "pockets" of


STUDY AREA PLAN
ELECTORAL AREA A
SCALE 1: 50,000
Figure 4.1
NORTH WEST SECTOR AREA
INKANEEP POINT
ROBERTS POINT
WILLOW BEACH
TOWN OF OSOYOOS BOUNDARIES
SOUTH EAST SECTOR AREA
TOWN OF OSOYOOS EFFLUENT IRRIGATION SYSTEM
SOUTH WEST SECTOR AREA
HAYNES POINT
PROV PARK
OSOYOOS
OKANAGAN
LAKE

development range between Very High and Moderately High. The efficiency of existing disposal fields, in terms of removing phosphorus, average 43% in these six areas of concentrated development. The total phosphorus loading from these six polygons approaches 200 kg/year.

A major concern with the lakeshore development in the Northwest Sector is the size of lots and the property "depth" perpendicular to the lakeshore. Specific areas of concern include:

- lots being too small for an approved on-site sewerage system and water well
- lots not being "deep" enough to enable compliance with standard 30 m setback from lakeshore as specified by the Health Regulations
- separation distances often being inadequate for an individual well from disposal systems on neighbour's property.

Concerns related to lot size and the satisfactory performance of individual septic tank and tile field systems are put in better perspective by comparing actual lot sizes with the area requirements of the Osoyoos Area zoning bylaw. In the bylaw, parcel sizes for single family residential development should be at least 836 m^2 (9000 square feet) where a community water system is provided and 1672 m^2 (18000 square feet) where community water system is not available. The tabulation given below summarizes actual individual lot sizes in the previously described "development pockets" in the Osoyoos Northwest Sector:

EXISTING LOTS BY AREA RANGE

	<557m^2	557-836m^2	836-1254m^2	1254-1672m^2	>1672m^2	Total
Lacey Point*	1	5	24	5	6	41
104th Avenue	1	5	5	0	1	12
Roberts Point	2	12	2	0	1	17
Inkaneep Point	16	9	3	1	0	29
87th Street	5	3	1	3	5	17
194th Avenue	7	6	4	0	0	17
TOTALS	**32**	**40**	**39**	**9**	**13**	**133**

*** Note: See figures 6.1 to 6.3 for area locations**

The lot size tabulation illustrates the concern related to individual water and sewerage systems and lot area. The Lacey Point area is serviced in large part by a community water system and lot sizes generally comply with the R.D.O.S. standard minimum of 836 m^2 (9000 $ft.^2$). In the other five areas, only 7 parcels out of a total of 92 (8%) comply with the minimum area of 1672 m^2 (18000 $ft.^2$). Approximately 66 parcels out of 92 (72%) have areas of less than 836 m^2 which is 50% of the recommended minimum. This analysis does not consider houses which may be constructed on two or more lots which will increase the percentage of larger lot sizes. The tabulation does, however, indicate a significant concern with satisfactory long term operation of individual septic tank and tile field systems in the Northwest Sector.

Except for the development along the lakeshore, the remaining development in the Northwest Sector is rural in nature, "scattered" throughout the agricultural areas along Highway #97. Excluding the lakeshore areas, the population in the Northwest Sector is about 400. In these areas, existing septic tanks and tile field systems average 83% efficient in terms of phosphorus removal.

The second area of concern in the Osoyoos Rural Area is the Southeast Sector. This area has 6 large lakeshore campgrounds representing a combined seasonal population approaching 2300 people. The high percentage of seasonal uses in the area is a concern with respect to the water quality of Osoyoos Lake. The Ministry of Health samples lake water at public beaches at regular intervals throughout the summer months and testing is carried out for fecal coliforms. The beach area sampling results for the Southeast Sector for July and August are summarized as follows:

Total Number of Samples	- 18
MPN < 3 per 100 mls	- 11
MPN 4 per 100 mls	- 4
MPN 9 per 100 mls	- 2
MPN 43 per 100 mls	- 1

The 1987 quality data for beaches in the Southeast Sector suggests good water quality for recreational purposes. The Ministry of Health maximum standard for fecal coliforms in a bathing beach area is 200 MPN per 100 mls.

Table 4.1 is a summary of phosphorus sources in the Southeast Osoyoos area. Phosphorus contributions from permanent residences total 67.3 kg/year and from seasonal facilities 33.1 kg/year for a total of 100 kg/year. The large majority of permanent dwellings in the Southeast Sector are located on the east bench having a low phosphorus transmission rating. On average in the Southeast Sector of the Osoyoos Rural Area, existing septic tanks and tile fields are 88% efficient in removing phosphorus.

Of the three sectors comprising the Osoyoos Rural Area, the Southwest Sector is considered, based on discussions with the Area Director and Ministry of Health, to be of third priority in terms of an existing area of concern. As shown on phosphorus transmission mapsheet 003 (see Appendix) transmission ratings in this area are primarily Low and Moderately Low with only three polygons (number 27, 28 and 32) having a higher rating. Of these higher classification polygons, only polygon 32 located at east end of 22nd Avenue is developed at a single family unit density and has a population of 30 people or 7% of the total sector.

Ministry of Health representatives have indicated that existing septic tank and field systems function satisfactorily in the Southwest Sector area. The VH rated polygon (number 32) has relatively new house construction, therefore, all on-site systems are also relatively new. Ministry staff indicate that all lots on the south half of polygon 32 had septic tank and tile field systems installed at the time of subdivision by the developer. This procedure was followed to ensure that disposal systems were constructed at preferred locations on each lot.

Overall, the phosphorus transmission from the Southwest Sector is estimated to be 96.5 kg/year. Existing septic tank and tile field systems in the Southwest Sector area average 86% efficient in terms of phosphorus removal. Table 4.1 includes a phosphorus contribution in the "other" category of 42.0 kg/year for the Idle-O-Apartment complex.

TABLE 4.1

PHOSPHORUS TRANSMISSION DATA
OSOYOOS RURAL AREA - ELECTORAL AREA A

	SECTOR			
	NORTHWEST	SOUTHEAST	SOUTHWEST	TOTAL
PRESENT:				
Population	687	571	710	1968
P. Loading (kg/year)	239.4	67.3	96.5	403.2
Seasonal P. Loading (kg/year)	23.6	33.1	5.8	62.5
Other Sources (kg/year)	0	0	42.2	42.2
TOTALS	263.0	100.4	144.5	507.9
AVERAGE REMOVAL EFFICIENCY	67%	88%	86%	
PROJECTED 2007				
Population	888	658	835	2381
P. Loading (kg/year)	317.7	92.4	107.2	517.3
Seasonal P. Loading (kg/year)	23.6	33.1	5.8	62.5
Other Sources (kg/year)	0	0	42.2	42.2
TOTALS	341.3	125.5	155.2	622.0
AVERAGE REMOVAL EFFICIENCY	65%	87%	87%	

4.1.2 Population and Phosphorus Transmission Projections

The community planning document for the Osoyoos Rural Area is dated February 1980 and is titled "Technical Supplement to the Osoyoos Community and Settlement Plan" (8). The technical supplement states that population growth within the rural area will average about 10 housing units per year. To year 2007, therefore, the population of the Osoyoos Rural Area can be expected to increase by 200 dwelling units to a total population of about 2,550.

A review of the community plan map (Schedule A, Bylaw 857) indicates that the Agricultural Land Reserve (ALR) represents a significant constraint to residential expansion in the Rural Area. Based on Schedule A, it does not appear possible that an additional 200 dwelling units over the next 20 years can be accommodated within the limits of the phosphorus transmission mapping. The community plan designates residential development areas west of Highway 3 in the Spotted Lake and Strawberry Creek area for long range population growth. Both these areas are outside the phosphorus transmission mapping area.

For purposes of the Waste Management Plan, the following assumptions have been made in terms of population growth and distribution:

Southwest Area - A total of 40 additional dwelling units to be provided in the area with the majority being located in the area bounded by 26th Avenue to the north, 91st Street to the east and 6th Avenue to the south. The majority of the new housing units will be infill development of existing vacant lots and subdivision of existing small holding parcels.

Southeast Area - A total of 30 additional dwelling units have been added to the east side of Osoyoos Lake. All units are assumed to be accommodated by infilling of existing residential areas.

Northwest Area - The community plan identifies two development areas in the Northwest Sector where new development could be accommodated. One area is the Willow Beach Mobile Home Park at the north end of the Lake, where 34 additional units are proposed. Some single family expansion in the Lacey Point area (polygons 33 and 34) is also identified representing up to 30 additional units. Infilling of existing vacant lots represents a further 6 units for a total of 70 in the phosphorus mapping area.

Further population growth, approximately 60 units, would occur on the long range development areas located east of Highway 3 outside of the phosphorus mapping area. Residential development on the hillside areas located east of Highway #3 will not represent an increased phosphorus loading in the Northwest Sector. Soils in these areas are finer grained as compared to soils in the phosphorus mapping area and may have a risk of hydraulic failure of individual disposal systems. Septic tank suitability mapping (17) prepared by the Ministry of Environment also indicate bedrock and topography as constraints affecting the feasibility of septic tank systems.

Phosphorus transmission associated with these population growth assumptions are given on Tables A.1, A.2 and A.3 (Appendix) by individual polygon. A summary of projected year 2007 phosphorus transmission is given in Table 4.1. In general, the majority of development will occur on polygons having phosphorus transmission ratings of moderate or lower. Average removal efficiencies for the Southwest and Southeast Areas remain essentially unchanged. The only significant growth on a high rating polygon is the proposed 34 unit expansion of the Willow Beach Mobile Home Park at the north end of the Lake. This development will be sited on a high rated polygon and will represent an additional phosphorus load of 20.5 kg/year. This proposed development results in the average permanent system phosphorus removal efficiency being lowered from the present 67% to 65% as given in Table 4.1.

4.2 Oliver-Gallagher Lake Area; Electoral Area C

4.2.1 Present Phosphorus Loading and Other Wastewater Concerns

Electoral Area C extends from the northern boundary of Electoral Area A at Deadman's Lake up to and including development at the south end of Vaseux Lake. Electoral Area C comprises three separate community planning areas as illustrated on mapsheets 013 and 023 (appendix) and Figure 4.2. The planning areas are briefly described as follows:

South Oliver Extended Fringe - The South Oliver Extended Fringe planning area includes agricultural and Okanagan River plain areas from Deadman's Lake to a point approximately 2 km south of the Village of Oliver boundary.

Oliver Fringe Area - This area includes rural and small holding development south of the municipality adjacent to the Okanagan River, the Tugulnuit Lake area, and rural area north of Tugulnuit Lake to Gallagher Lake.

Gallagher-Vaseux Lake Area - This planning area begins at a line drawn east-west through Gallagher Lake and extends north to include the northern portion of Vaseux Lake. Development on the east side of Vaseux Lake is within the Gallagher-Vaseux Lake planning area but is within Electoral Area D.

For purposes of the Waste Management Plan, Electoral Area C has been divided into the three sectors described above, each of which are described separately in sections following and are illustrated in Figure 4.2.

4.2.1.1 South Oliver Extended Fringe

The South Oliver Extended Fringe area is essentially completely agricultural in land use. Phosphorus transmission polygons adjacent to the Okanagan River throughout the South Oliver Extended Fringe area have high and very high ratings, however, these areas are largely undevelopable due to floodplain and septic tank feasibility constraints. Except for the areas immediately adjacent to the Okanagan River, all remaining sectors of the South Oliver Extended Fringe area have Moderate or lower transmission ratings.

Table 4.2 is a summary of population, phosphorus transmission and loadings for polygons in the South Oliver Extended Fringe area. Overall, the phosphorus transmission from all sources in the South Oliver Extended Fringe area is estimated to be 230 kg/year, which equates an average phosphorus removal efficiency of 83% throughout the area.

TABLE 4.2

PHOSPHORUS TRANSMISSION DATA
SOUTH OLIVER EXTENDED FRINGE

PRESENT - 1987

Population	1347
P. Loading (kg/year)	230.0
Seasonal P. Loading (kg/year)	1.2
Other Sources (kg/year)	0
TOTAL	**231.2**
AVERAGE REMOVAL EFFICIENCY	**83%**

PROJECTED - YEAR 2007

Population	1608
P. Loading (kg/year)	267.7
Seasonal P. Loading (kg/year)	1.2
Other Sources (kg/year)	0
TOTAL	**268.9**
AVERAGE REMOVAL EFFICIENCY	**83%**

4.2.1.2 Oliver Fringe Area

For purposes of the Waste Management Plan, the Oliver Fringe Area has been divided into three sub-areas, briefly described as follows:

Old Sawmill Road Area - Rural development south of Oliver paralleling the Okanagan River.

Tugulnuit Lake Area - Comprises rural, commercial and urban density development outside of the Village of Oliver boundary and bordering Tugulnuit Lake.

North Oliver Fringe - Comprises rural development from the north end of Tugulnuit Lake to the south boundary of the Gallagher-Vaseux Lake Settlement Plan area.

Phosphorus transmission data for each polygon within each of the above three areas is presented in Tables A.5, A.6 and A.7. (Appendix) A summary of the data is presented in Table 4.3.

TABLE 4.3

PHOSPHORUS TRANSMISSION DATA
OLIVER RURAL AREA - ELECTORAL AREA C

	SECTOR			
PRESENT 1987	**OLD SAWMILL ROAD**	**TUGULNUIT LAKE**	**NORTH OLIVER RURAL**	**TOTAL**
Population	396	1088	743	2227
P. Loading (kg/year)	190.3	226.6	193.8	610.7
Seasonal P. Loading (kg/year)	0.4	50.8	0	51.2
Other Sources (kg/year)	0	0	0	0
TOTALS	190.7	277.4	193.8	661.9
AVERAGE REMOVAL EFFICIENCY	52%	79%	76%	
PROJECTED - YEAR 2007				
Population	453	1654	1032	3139
P. Loading (kg/year)	229.4	301.4	306.0	836.8
Seasonal P. Loading (kg/year)	0.4	50.8	0	51.2
Other Sources (kg/year)	0	-	0	0
TOTALS	229.8	352.2	306.0	888.0
AVERAGE REMOVAL EFFICIENCY	50%	82%	70%	

The phosphorus transmission data given in Table 4.3 indicate that the three areas represent a combined phosphorus loading approaching 661 kg/year. While the Tugulnuit Lake area represents the highest loading on a sector basis, the population in this area is significantly higher than the other two areas. The phosphorus removal efficiencies of individual disposal systems vary considerably among the three areas. The poorest efficiency is 52% in the Old Sawmill Road area. Polygons in this sector are all rated higher than moderate with the majority in the High to Very High ratings. The highest existing system phosphorus removal efficiency is 79% in the Tugulnuit Lake area. This removal efficiency is expected, recognizing that except for the immediate lakeshore zone, transmission ratings in the Tugulnuit Lake area are Moderate or lower.

Discussions with Ministry of Health representatives suggest that there are no immediate concerns with the operation of septic tank systems in the Sawmill Road area. According to Ministry representatives, soils in the area are fine grained having percolation rates in the 10 to 15 minutes per 25 mm range. All homes in the Sawmill Road area derive water supplies from individual wells which are an average of 7 metres in depth. The small holding density in the Sawmill Road area is a factor which likely contributes to satisfactory operation of individual septic tank systems.

Ministry of Health representatives indicate no major operational concerns with individual septic tank and tile field systems in the Tugulnuit Lake area. A high groundwater table is a major constraint affecting the feasibility of septic tank and tile field systems at the north end of Tugulnuit Lake. Any system constructed in this area must be a raised mound-type system. Ministry staff anticipate some age failures of systems serving homes on the west side of Tugulnuit Lake. Reconstructed systems in this area will require pumping to replacement systems at the "rear" of the lots. Potential contamination of S.O.L.I.D. water supply wells at the south end of Tugulnuit Lake is a concern, however, regular water quality testing by the Ministry of Health indicates no interference problems.

Concern was expressed by members of the public about possible impact of lakeshore septic tank systems on the quality of Tugulnuit Lake for recreation purposes. Fecal coliform results for lake samples in 1987 by the Ministry of Health at the Tugulnuit public beach indicate satisfactory water quality for recreational purposes. The July and August 1987 sample results are:

Total Number of Samples - 6
MPN < 3 per 100 mls - 1
MPN 4 per 100 mls - 4
MPN 15 per 100 mls - 1

The Ministry of Health standard for public beaches is 200 MPN fecal coliform per 100 mls.

4.2.1.3 Gallagher and South Vaseux Lake

For purposes of the Waste Management Plan, the Gallagher and South Vaseux Lake areas are considered as separate areas. The Gallagher Lake Sector includes development adjacent to the north end of the Lake and areas north to Vaseux Creek. The south end of Gallagher Lake is located within Osoyoos Indian Reserve #1. The South Vaseux Lake area includes existing development at the south end of the Lake and land areas to the south. Present phosphorus transmission data for these two areas on an individual polygon basis is presented in Tables A.10 and A.11 (Appendix) with a summary presented in Table 4.4.

TABLE 4.4

PHOSPHORUS TRANSMISSION DATA
GALLAGHER-SOUTH VASEUX LAKE AREAS

	SECTOR		
PRESENT 1987	**GALLAGHER LAKE**	**SOUTH VASEUX LAKE**	**TOTAL**
Population	224	89	400
P. Loading (kg/year)	57.6	47.9	105.5
Seasonal P. Loading (kg/year)	32.3	3.2	35.5
Other Sources (kg/year)	1.0	0	1.0
TOTALS	90.9	51.1	142
AVERAGE REMOVAL EFFICIENCY	75%	46%	
PROJECTED - YEAR 2007			
Population	412	113	603
P. Loading (kg/year)	92.2	59.1	151.3
Seasonal P. Loading (kg/year)	51.1	3.2	54.3
Other Sources (kg/year)	1.0	0	1.0
TOTALS	144.3	62.3	206.6
AVERAGE REMOVAL EFFICIENCY	78%	48%	

The combined population of the Gallagher and South Vaseux Lake areas is about one half of the population of any of the planning sectors in the Osoyoos or Oliver Rural Areas. Existing septic tanks and tile field average removal efficiencies of 75% at Gallagher Lake and 46% at the south end of Vaseux Lake are low by comparison to other sectors. In both areas, development is concentrated on the lakeshore area on phosphorus transmission polygons having a rating of high or very high. This lakeshore development results in the low efficiency for the sectors as a whole.

Gallagher Lake has no inflow or outflow stream and is, therefore, dependent on groundwater for recharge. There is concern about the potential of deteriorating water quality in Gallagher Lake which may result from development on the Vaseux Creek alluvial fan "up gradient" of the Lake.

Ministry of Health representatives have no concern about the satisfactory operation (from hydraulic point of view) of septic tank systems in the Gallagher Lake area. Soil materials are granular and have high effluent acceptance characteristics. The South Vaseux Lake area and the homes along the lakeshore do represent a potential concern to the Ministry of Health. All homes derive their water from a shallow well on the north of their property near the lakeshore and dispose of effluent on the south end of their properties, (see figure 7.6 for layout of South Vaseux Lake subdivision). Properties at the south end of Vaseux Lake average 1080 m^2 in area which is about 64% of the present minimum Regional District lot area standard of 1672 m^2. Available site area could represent a major constraint to reconstructing failed or malfunctioning systems unless individual property owners make arrangements to site replacement systems on agricultural land to the south.

4.2.2 Population and Phosphorus Transmission Projections

4.2.2.1 South Oliver Extended Fringe

Population projections for the South Oliver Extended Fringe area have been derived from the "Technical Supplement to the Oliver South

Extended Fringe Community Plan" dated September 1986.(9) The community plan recognizes the ALR and floodplain restrictions along the Okanagan River as major development constraints. No significant new development areas are identified in the South Oliver Extended Fringe area. The community plan anticipates that land use will continue to be principally agriculture in the area and any new housing construction will be done on vacant lots and orchards.

The community plan projects population growth in the South Oliver Extended Fringe Area at a rate averaging 8 units per year. To year 2007, an additional 160 units would be constructed in this planning sector. Within the area covered by the phosphorus transmission mapping, there are about 80 building sites available. For purposes of the Waste Management Plan, it is assumed that 100 units of the projected 20 year growth will be accommodated within the phosphorus transmission mapping area and the remaining 60 units, sited north of Oliver in the bench area. Projected growth within the phosphorus transmission mapping area has been reasonably evenly spread out over all mapping polygons.

Table 4.2 illustrates the population of the South Oliver Fringe Area increasing from 1347 to 1608 over the next twenty years. The phosphorus loading increases proportionately with system removal efficiencies remaining at 83%.

4.2.2.2 Oliver Fringe Area

Population projections for the Oliver Fringe Area have been derived from the "Technical Supplement to the Oliver's Community and Settlement Plan" dated March 1980 and Map Schedule B to accompany Bylaw 955.(10) Of the three sub-areas included in the Oliver Fringe Area, only the Tugulnuit Lake area is anticipated to experience significant growth.

In the Old Sawmill Road Area, floodplain boundaries represent a major restriction to development. The community plan recognizes existing land use in the area and states that future population growth will occur as a result of infilling of existing vacant lots in the area.

For the Waste Management Plan, it is assumed that 20 additional units could be accommodated in the Old Sawmill Road Area, resulting in an increase in population from 396 to 453 over the next twenty years.

For the North Oliver Fringe Area, the community plan anticipates that growth will take place at a rate of about 10 housing units per year. This rate projected forward to year 2007 would result in an additional 200 housing units (population increase of 580) in the North Oliver Rural Area. The community plan identifies existing small holding and low density residential areas in the North Oliver Fringe Area and anticipates that infill development will occur. Major small holding and low density residential development areas are also identified on the east bench area. As with proposed bench area development in the Osoyoos Rural area, soil materials on the bench areas in the vicinity of Oliver are generally fine grained and depending on housing densities proposed, represent a risk of hydraulic failure. Ministry of Environment Septic Tank Suitability mapping does not encompass the hillside areas north of Oliver.

For the Waste Management Plan, even distribution of the anticipated 200 additional housing units between the bench area and the valley floor is assumed. The 100 units in the valley area are reflected in phosphorus transmission data given in Table 4.3. In general, the 100 additional housing units have been added to polygons containing development. A significant medium density development area is proposed on a high rated polygon adjacent to the River approximately 2.5 km north of Oliver. This development proposal results in the overall septic tank-tile field efficiency rating being reduced from 76% to 70% over the next 20 years. A recommendation of this Waste Management Plan will be that concentrated developments such as this proposal achieve 90% phosphorus removal objectives.

For the Tugulnuit Sector, it is assumed that all development areas between the Village of Oliver boundary and the south end of Tugulnuit Lake will be developed in accordance with land use designation in the community plan. Development proposals include infilling of existing low density residential areas between Belvue and Tuc-el-Nuit Drives

and medium density development bordering Park Drive. In total, growth in the Tugulnuit Lake Sector over the next 20 years could represent an additional 200 housing units and a population increase of 580 people. The Tugulnuit Lake area has been the subject of boundary expansion evaluations by the Village of Oliver.

The growth potential of the Tugulnuit area is reflected in a population increase of 570 in Table 4.3 and an increase in phosphorus loading from the present 277.4 kg/year to 352.2 kg/year. Because development is proposed to occur on polygons having moderate or lower phosphorus transmission classifications, the effect of population growth is a general trend toward increased average phosphorus removal efficiencies for the sector as a whole.

The population projections for the Tugulnuit Sector do not include allowances or provisions for growth on the Osoyoos Indian Reserve #1. Increased population on the Reserve would result in projected phosphorus loadings higher than values given in Table 4.3.

4.2.2.3 Gallagher and South Vaseux Lake

Population projections and future land use pattern information for the Gallagher and South Vaseux Lake areas has been derived from the "Technical Supplement to the Gallagher-Vaseux Lake Settlement Plan" dated August 1985 and Map Schedule A of Bylaw No. 892.(11) In general, the Settlement Plan identifies significant growth potential in the Gallagher Lake area, and proposes little or no growth in the Vaseux Lake area. For the South Vaseux Lake area, therefore, population growth over the next twenty years is anticipated to be restricted to infilling of existing vacant parcels. At the south end of Vaseux Lake, population growth representing 5 additional units or 15 people has been provided for.

The settlement plan envisions a significant population growth and development from the north end of Gallagher Lake to Vaseux Creek. All of the proposed development area is outside of the ALR which is generally a major development constraint. Development proposals in

the Gallagher Lake area include low density subdivisions, mobile home parks and additional campgrounds. At an average growth rate of 5 units per year, the population in the Gallagher Lake area can be expected to increase by 100 units and a population of about 200 over the next twenty years. This growth can be accommodated on vacant developable land north of the Lake. Population projections for the Gallagher Lake area are based on an average of 2.0 people per unit, reflecting an extension of the present mobile home retirement land use.

The growth potential in the Gallagher Lake area is reflected by a phosphorus loading increase from 90.9 kg/year to 144.3 kg/year in year 2007. The removal efficiency of septic tank and tile field systems increases slightly from 75% to 78% because proposed development will be located on polygons having better phosphorus ratings than the existing development.

4.3 Okanagan Falls-Kaleden Area; Electoral Area D

4.3.1 Present Phosphorus Loadings and Other Wastewater Concerns

Electoral Area D encompasses the area from Vaseux Lake north to the City of Penticton boundary at the north end of Skaha Lake. The main community areas within the Electoral Area are Kaleden and Okanagan Falls which includes Skaha Estates. Small sectors in the Electoral Area include development on the east side of Vaseux Lake and the East Penticton Fringe Area on the east side of Skaha Lake.

For the Waste Management Plan, Electoral Area D has been divided into five sectors in accordance with RDOS planning area boundaries as illustrated in figure 4.3. The Okanagan Falls central community area is serviced by a sewerage system operated by the Regional District of Okanagan-Similkameen. The treatment plant comprises an oxidation ditch followed by secondary clarification. The oxidation ditch system operates as an extended aeration system and provides a minimum hydraulic retention time of 24 hours. Treated effluent from the plant

is pumped via a 200 mm forcemain to a rapid infiltration disposal site located about 2.6 km southeast of the treatment plant. The location of the Okanagan Falls treatment plant and infiltration basins is shown in figure 4.3. The infiltration site is located approximately 680 m due west of the Okanagan River and about 72 m higher in elevation.

The reported (18) design capacity of the Okanagan Falls treatment plant is a population of 2000. At the present time the system services a population of about 1470 with some relatively small flow contributions from a food processing industry. There is an immediate reserve capacity available in the system for population growth of 500 (approximately 175 housing units). According to system design drawings (19), provisions were made to lengthen the oxidation ditch and thereby increase the service capacity of the system beyond a population of 2000.

The four rural area sectors in Electoral Area D are illustrated in figure 4.3 and described as follows:

East Vaseux Lake - **Includes development on the east side of Vaseux** Lake roughly located midway along the Lake length.

Okanagan Falls - Includes the area from the north end of Vaseux Lake north to Skaha Estates, west to the Okanagan River and east to include the rural development fringe of Okanagan Falls.

Kaleden - Includes the area on the west side of Skaha Lake from the south end of Skaha Lake north to the Penticton Indian Reserve boundary.

East Penticton Fringe - This area is relatively small and is located south of the Penticton Municipal boundary on the east side of Skaha Lake to the northern boundary of Skaha Estates.

Phosphorus transmission data and mapping for these four sectors are presented in the Appendix. This data is briefly summarized in sections following for each sector.

4.3.1.1 East Vaseux Lake

A small "pocket" of principally single family residential development on the east side of Vaseux Lake is included in this sector. Table 4.5 summarizes the population and phosphorus data for this sector. The development is situated between Highway 97 and Vaseux Lake on polygons having Moderate to High transmission ratings. The area is serviced by a community water system with a well located on the east side of Highway #97 being the source.

Similar to the South Vaseux Lake area, lot area may become a constraint affecting the ability of residents to reconstruct failed or malfunctioning septic tank systems. The average size of 38 single family lots including 29 on the lakeshore, is 860 m^2 (9200 $feet^2$).

TABLE 4.5

PHOSPHORUS TRANSMISSION DATA
EAST VASEUX LAKE AREA

PRESENT - 1987

Population	110
P. Loading (kg/year)	58.3
Seasonal P. Loading (kg/year)	11.6
Other Sources (kg/year)	0
TOTAL	**69.9 kg/year**
AVERAGE REMOVAL EFFICIENCY	**47%**

PROJECTED - YEAR 2007

Population	125
P. Loading (kg/year)	67.6
Seasonal P. Loading (kg/year)	11.6
Other Sources (kg/year)	0
TOTAL	**79.2 kg/year**
AVERAGE REMOVAL EFFICIENCY	**46%**

4.3.1.2 Okanagan Falls Area

For descriptive purposes the Okanagan Falls area has been divided into two sub-areas. One sub-area is designated as the Okanagan Falls Rural Area and includes generally rural and agricultural development both east and south of the main community area. Phosphorus data for this area is summarized in Table 4.6.

From an Okanagan Falls Rural Area population of about 250, the estimated phosphorus loading is 54.2 kg/year. On average, existing septic tank and tile field systems in the Okanagan Falls Rural Area are 77% efficient in phosphorus removal. This value is comparable to values presented earlier for the Oliver and Osoyoos Rural Areas.

The second sub-area in the Okanagan Falls Area is designated as the Skaha Estates Sector. This sector only includes the Skaha Estates development area. From Table 4.6, the present population and phosphorus loading from Skaha Estates is estimated to be 348 and 158.6 kg/year respectively. The Skaha Estates development is situated on polygons having moderate to very high transmission ratings which is reflected in an average phosphorus removal efficiency for the sector of 55%.

Discussions with the Area Director and representatives of the Ministry of Health identified the Skaha Estates development as an area of concern with respect to the renovation characteristics of the soils for septic tank effluent. From a hydraulic point of view, individual septic tank and tile field systems in the Skaha Estates area function satisfactorily although it should be noted that the area contains relatively new housing.

TABLE 4.6

PHOSPHORUS TRANSMISSION DATA
OKANAGAN FALLS AREA

	SECTOR		
PRESENT 1987	**OK FALLS RURAL**	**SKAHA ESTATES**	**TOTAL**
Population	253	348	601
P. Loading (kg/year)	59.2	158.6	217.8
Seasonal P. Loading (kg/year)	0	0	0
Other Sources (kg/year)	0	0	0
TOTALS	59.2	158.6	217.8
AVERAGE REMOVAL EFFICIENCY	77%	55%	
PROJECTED - YEAR 2007			
Population	311	541	852
P. Loading (kg/year)	72.3	222.5	294.8
Seasonal P. Loading (kg/year)	0	0	0
Other Sources (kg/year)	0	0	0
TOTALS	72.3	222.5	294.8
AVERAGE REMOVAL EFFICIENCY	77%	59%	

4.3.1.3 Kaleden Area

The Kaleden Area includes rural, single family and orchard development on the benchland paralleling Highway #97 and a relatively small "strip" of lakeshore development on Skaha Lake. Phosphorus transmission ratings for the bench areas of Kaleden are generally Moderate or lower and the lakeshore area, High to Very High.

For purposes of the Waste Management Plan, the Kaleden Area is divided into two sectors; one including all bench areas and the second comprising the lakeshore development generally located between Sycle and Ponderosa Points. On the basis of discussions with the Area Director, Ministry of Health and Ministry of Environment, a primary area of concern in the Kaleden area is the lakeshore area. The lakeshore area includes a group of 21 single family lots at the north end of the area (see figure 8.4 for location). This specific area is a concern because the development and house construction predates septic tank design standards and inspection services by the B.C. Government. Of the 21 lots at the north end of the Kaleden lakeshore area, 15 parcels have site areas less than 836 m^2 (9000 $ft.^2$).

Table 4.7 illustrates that 81.1 kg of phosphorus originates along the lakeshore area of Kaleden between Sycle and Ponderosa Points. This represents 50% of the total phosphorus loading from Kaleden and about 15% of the total area population. Septic tank and tile field systems in this lakeshore area are approximately 36% efficient in removing phosphorus, while on-site systems in the remainder of the Kaleden area have an average 89% efficiency.

TABLE 4.7

PHOSPHORUS TRANSMISSION DATA
KALEDEN AREA

	SECTOR		
PRESENT 1987	**LAKESHORE AREA (SYCLE TO PONDEROSA POINTS)**	**BENCH AREA**	**TOTAL**
Population	117	683	800
P. Loading (kg/year)	74.8	76.3	151.1
Seasonal P. Loading (kg/year)	6.3	8.0	14.3
Other Sources (kg/year)	0	0	0
TOTALS	81.1	84.3	165.4
AVERAGE REMOVAL EFFICIENCY	36%	89%	
PROJECTED - YEAR 2007			
Population	117	1553	1670
P. Loading (kg/year)	74.8	160.7	235.5
Seasonal P. Loading (kg/year)	6.3	8.0	14.29
Other Sources (kg/year)	0	0	0
TOTALS	81.1	168.7	249.8
AVERAGE REMOVAL EFFICIENCY	36%	90%	

4.3.1.4 East Penticton Fringe Area

A relatively small section of the east shore of Skaha Lake between the City of Penticton boundary and Skaha Estates is included in the Waste Management Plan area. This area comprises single family residential and small holding development and is generally rural in characteristic. Phosphorus transmission and population data for this sector is presented in Table 4.8.

By comparison to other sectors in the Waste Management Planning Area, the population of the East Penticton Fringe Area is relatively small, estimated to be 121. Existing development is situated on polygons having Moderate or lower phosphorus transmission classifications which is reflected in an overall septic tank and tile field efficiency for the area of 87%.

TABLE 4.8

PHOSPHORUS TRANSMISSION DATA
EAST PENTICTON FRINGE AREA

PRESENT - 1987

Population	121
P. Loading (kg/year)	14.0
Seasonal P. Loading (kg/year)	0
Other Sources (kg/year)	0
TOTAL	**14.0 kg/year**
AVERAGE REMOVAL EFFICIENCY	**87%**

PROJECTED - YEAR 2007

Population	208
P. Loading (kg/year)	27.6
Seasonal P. Loading (kg/year)	0
Other Sources (kg/year)	0
TOTAL	**27.6 kg/year**
AVERAGE REMOVAL EFFICIENCY	**87%**

4.3.2 Population and Phosphorus Transmission Projections

4.3.2.1 East Vaseux Lake

Future land and population projection information for the East Vaseux Lake Sector has been obtained from the Gallagher-Vaseux Lake Settlement Plan Technical Supplement.(11) Similar to the South Vaseux Lake area, no significant population growth for the East Vaseux Lake area is anticipated. The settlement plan recognizes the area as having important waterfowl and wildlife habitat and, therefore, no expansion of the present developed area is proposed. Population growth in the East Vaseux Lake area will be limited to infilling of existing vacant lots. In Table 4.5, population growth to Year 2007 equivalent to five additional housing units in the existing development area has been provided for.

4.3.2.2 Okanagan Falls Area

Population projections for the Okanagan Falls Area have been derived from the "Technical Supplement to the Okanagan Falls Settlement Plan" dated May 1982 and Map Schedule A of Bylaw 630.(12) The Okanagan Falls community plan forecasts population growth of 2100 people (695 housing units) by 1991. This growth rate is significantly higher than other sectors of the Regional District and would result in a population approaching 4000 in the Okanagan Falls planning area by 1991. Results of the 1986 census suggest that the actual growth rate in the Okanagan Falls Area was considerably lower than the Settlement Plan projections.

For purposes of the Waste Management Plan, it is assumed that the population in the Okanagan Falls Area will increase at an average rate of 20 housing units per year resulting in a total community population of about 3000 (400 additional housing units) by year 2007. The Settlement Plan divides the Okanagan Falls area into sectors and

describes the probable distribution of population growth in the area. The population increase of 400 housing units to year 2007 has been distributed in accordance with the Settlement Plan. This distribution is summarized as follows:

Skaha Estates Area - 66 units (190 pop.)
Okanagan Falls Rural Area - 44 units (128 pop.)
Okanagan Falls Sewered Area - 300 units (870 pop.)

Population growth anticipated in the Skaha Estates and Okanagan Falls Rural Areas is of importance to the Waste Management Plan because these areas are serviced by individual septic tank and tile field systems. To accommodate population growth in the sewered area of 870 people over the next 20 years, capacity improvements at the Okanagan Falls treatment plant will be required at a population of 2000.

The preceding population growth assumptions for the Okanagan Falls area are reflected in phosphorus loading projections given in Table 4.6. For the rural area, population growth has been reasonably evenly distributed with the result that the average phosphorus removal of existing septic tank and tile field systems remains constant at 77%. In the Skaha Estates Area, the phosphorus loading increases from 158.6 kg/year to 222.5 kg/year and the average phosphorus removal efficiency increases from 55% to 59%. This increase in efficiency results from the fact that new development in the area will not be sited in the immediate vicinity of Skaha Lake.

4.3.2.3 Kaleden Area

Population projection information for the Kaleden area has been obtained from the "Technical Supplement to the Kaleden Settlement Plan" dated July 1983 and Schedule A of Bylaw #952.(13) The Kaleden Settlement Plan examines moderate and high growth rate options for the Kaleden Area for the period 1981 to 1991. The moderate growth alternative results in a population increase of 200 (1200 population total) by 1991 which is equivalent to an additional 105 dwelling units. The high growth rate projection results in an additional 537 people by 1991 (to population 1535) or 235 additional housing units.

The 1986 census population for the Kaleden area is 994 which suggests that the area population has remained relatively constant since 1981. The population projections given in the Settlement Plan are, therefore, more indicative of a 20 year period. For purposes of the Waste Management Plan, the Settlement Plan high growth option has been used to project the area population to year 2007. In total, 300 additional dwelling units (population increase of 870) have been provided in Table 4.7 for the Kaleden Area to year 2007.

The population increase for the Kaleden Area has been distributed in general accordance with land use proposals in the Settlement Plan. It is important to recognize that little or no population growth is anticipated in the lakeshore area. As a result, no increase in phosphorus loading from this sector is shown in Table 4.7. All population growth is anticipated to occur in the bench area generally in accordance with the Settlement Plan recommendations. Table 4.7 indicates that population growth in the Kaleden bench area does not reduce the overall phosphorus removal efficiency of existing septic tank and tile field systems.

4.3.2.4 East Penticton Fringe

Population projection information for the East Penticton Fringe Area has been obtained from the "Technical Supplement to the Penticton Fringe Settlement Plan" and Schedule A of Bylaw 849.(14) The portion of the East Penticton Fringe Area located within the Waste Management Plan area is only a small sector of a large planning area lying east of the east boundary of the City of Penticton. In general, the Settlement Plan recognizes modest expansion of existing development on the east side of Skaha Lake. The plan recommends a "small holding" density for this development which requires a minimum lot size of 0.2 ha (1/2 acre) where a community water system is provided and 0.8 ha (2 acres) where community water service is not available.

For purposes of the Waste Management Plan, a population increase in the East Penticton Fringe Area of 87 people (to population 208) is assumed. The housing units would be distributed in accordance with the Settlement Plan and generally involve phosphorus transmission polygons having a moderate or lower rating classification.

4.4 Penticton Indian Reserve #1

The Penticton Indian Reserve #1 is technically outside of the Waste Management Planning Area, recognizing that the RDOS has no jurisdiction on the Reserve. Discussions at the outset of the planning process identified several areas at the north end of Skaha Lake on Indian Reserve #1 as being potential concerns. The inventory of existing phosphorus loadings has been extended to include the shoreland zone on Penticton Indian Reserve #1 with data summarized in Table 4.9.

Development on Penticton Indian Reserve #1 west of the Okanagan River channel includes several campgrounds and mobile home parks. The development is situated for the most part on phosphorus transmission polygons having Very High and High classifications. These relatively high transmission classifications result in an overall average phosphorus removal efficiency of 62% which is generally lower than the majority of other sectors in the Waste Management Plan area. The overall phosphorus loading of 388 kg/year is the highest of any sector considered in any of the three Electoral Areas.

Seasonal phosphorus sources represent a major contribution on the lakeshore area of Skaha Lake on the Penticton Indian Reserve. The area includes seven campgrounds which have a combined capacity of about 750 sites.

Recognizing that the Penticton Indian Reserve is outside the Waste Management Planning Area, no attempt at preparing population projections has been made.

TABLE 4.9

PHOSPHORUS TRANSMISSION DATA
PENTICTON INDIAN RESERVE #1 - SKAHA LAKESHORE AREA

PRESENT - 1987

Population	696
P. Loading (kg/year)	267.1
Seasonal P. Loading (kg/year)	121.5
Other Sources (kg/year)	0
TOTAL	**388.6 kg/year**
AVERAGE REMOVAL EFFICIENCY	**62%**

4.5 Summary of Phosphorus Loading Inventory

In this section, the Waste Management Plan area has been divided into sectors corresponding to RDOS planning area boundaries and present and year 2007 projected phosphorus loadings calculated. All population and present and projected phosphorus loading data for each sector are summarized in Tables 4.10 and 4.11.

An objective of the Waste Management Plan is to evaluate alternatives for reducing phosphorus loadings to receiving waters from individual septic tank and tile field systems and resolving other wastewater related concerns. The information presented in Tables 4.10 and 4.11 is fundamental to defining the major areas of concern which will then become the focus for evaluation of alternative systems. A column is provided in Table 4.10 which summarizes the assessment of other wastewater related concerns based on discussion with the Area Directors and the Ministry of Health. A subjective rating is given for other concerns recognizing the general nature of the background data. In total, three (3) areas have been assessed as having concerns in addition to phosphorus loading related to septic tank and field systems. An additional five areas have the potential of becoming concerns in the future and have, therefore, been given a "potential" rating.

From Table 4.10, permanent residences using individual septic tank and tile fields for wastewater disposal contribute a total of 1790 kg of phosphorus per year to Okanagan Basin watercourses. Overall, existing systems throughout the three Electoral Areas have an average phosphorus removal efficiency of about 75%. By comparison, the phosphorus removal objective for municipal sewage treatment plants in the Okanagan Basin is 95%.

Table 4.11 presents data indicating that the population in Electoral Areas A, C and D using individual septic tanks and disposal fields for wastewater disposal will increase from 7487 in 1987 to about 10500 in year 2007. Corresponding to the population growth, phosphorus

loadings from permanent residences is projected to increase from 1790 kg/year to 2400 kg/year. If all of the sectors as summarized in Table 4.11 remained serviced by individual septic tank and tile field systems, overall average phosphorus removal efficiency in year 2007 would be 77%. The trend to a higher efficiency of removal in year 2007 is attributable to planning recommendations in each sector which recognize floodplain and other septic tank construction limitations. As a result, future growth areas have greater separation distances to receiving watercourses.

TABLE 4.10

SUMMARY OF INVENTORY OF
PRESENT PHOSPHORUS LOADINGS AND OTHER
WASTEWATER CONCERNS

SECTOR	POPU-LATION	PHOSPHORUS LOADINGS				
		PERMANENT RESIDENCES	SEASONAL & PERMIT SOURCES	TOTAL	P. REMOVAL EFFICIENCY	OTHER WASTEWATER CONCERNS
ELECTORAL AREA A						
o Northwest Osoyoos Rural	687	239.4	23.6	263.0	67%	Yes
o Southeast Osoyoos Rural	571	67.3	33.1	100.4	88%	Potential
o Southwest Osoyoos Rural	710	96.5	48.0	144.5	86%	No
ELECTORAL AREA C						
o South Oliver Ext.Fringe	1347	230.0	1.20	231.2	83%	No
o Old Sawmill Road	396	190.3	0.4	190.7	52%	Potential
o Tugulnuit Lake	1088	226.6	50.8	277.4	79%	Yes
o North Oliver Rural	743	193.8	0	193.8	76%	No
o Gallagher Lake	224	57.6	33.3	90.9	75%	No
o South Vaseux Lake	89	47.9	3.2	51.1	46%	Potential
ELECTORAL AREA D						
o East Vaseux Lake	110	58.3	11.6	69.9	47%	Potential
o OK Falls Rural	253	59.2	0	59.2	77%	No
o Skaha Estates	348	158.6	0	158.6	58%	Potential
o Kaleden Lakeshore	117	74.8	6.3	81.1	36%	Yes
o Kaleden Bench Area	683	76.3	8.0	84.3	89%	No
o East Penticton Fringe	121	14.0	0	14.0	87%	No
TOTALS - ALL ELECTORAL AREAS	7487	1790.6	219.5	2010.1		
PENTICTON INDIAN RESERVE	696	267.1	121.5	388.6	62%	

TABLE 4.11

SUMMARY OF PROJECTED (YEAR 2007)
PHOSPHORUS LOADINGS

SECTOR	POPU-LATION	PHOSPHORUS LOADINGS				P. REMOVAL EFFICIENCY
		PERMANENT RESIDENCES	SEASONAL SOURCES	OTHER	TOTAL	
ELECTORAL AREA A						
o Northwest Osoyoos Rural	888	317.7	23.6	0	341.3	65%
o Southeast Osoyoos Rural	658	92.4	33.1	0	125.5	87%
o Southwest Osoyoos Rural	835	107.2	5.8	42.2	155.2	87%
ELECTORAL AREA C						
o South Oliver Ext.Fringe	1608	267.7	1.2	0	268.9	83%
o Old Sawmill Road	453	229.4	0.4	0	229.8	50%
o Tugulnuit Lake	1654	301.4	50.8	0	352.2	82%
o North Oliver Rural	1032	306.0	0	0	306.0	70%
o Gallagher Lake	412	92.2	51.1	1.0	144.3	78%
o South Vaseux Lake	113	59.1	3.2	0	62.3	48%
ELECTORAL AREA D						
o East Vaseux Lake	125	67.6	11.6	0	79.2	46%
o OK Falls Rural	311	72.3	0	0	72.3	77%
o Skaha Estates	541	222.5	0	0	222.5	59%
o Kaleden Lakeshore	117	74.8	6.3	0	81.1	36%
o Kaleden Bench Area	1553	160.7	8.0	0	168.7	90%
o East Penticton Fringe	208	27.6	0	0	27.6	87%
TOTALS - ALL ELECTORAL AREAS	10508	2398.6	195.1	43.2	2636.9	

SOUTH VASEUX LAKE AREA

GALLAGHER LAKE AREA

TUGULNUIT LAKE AREA

OSOYOOS I.R. #1

SAWMILL ROAD AREA

GALLAGHER-VASEUX LAKE SETTLEMENT PLAN AREA

NORTH OLIVER RURAL AREA

VILLAGE OF OLIVER BOUNDARY

OLIVER FRINGE AREA

SOUTH OLIVER EXTENDED FRINGE

Regional District of Okanagan - Similkameen

STUDY AREA PLAN ELECTORAL AREA C

SCALE 1:50,000

Figure 4.2

OKANAGAN FALLS RURAL AREA

OKANAGAN FALLS SETTLEMENT PLAN BOUNDARY

EAST VASEUX LAKE AREA

TREE FARM LICENCE 15

SKAHA LAKE ESTATES AREA

OKANAGAN FALLS INFILTRATION BASINS

EAST PENTICTON FRINGE

PONDEROSA POINT

OKANAGAN FALLS TREATMENT PLANT

CITY OF PENTICTON

KALEDEN LAKESHORE AREA

SYCLE POINT

OKANAGAN FALLS COMMUNITY SEWER SYSTEM SERVICE AREA

PENTICTON I.R. 1

KALEDEN SETTLEMENT PLAN AREA

Regional District of Okanagan - Similkameen

STUDY AREA PLAN ELECTORAL AREA D

SCALE 1:50,000

Figure 4.3