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DETECTION OF SEPTIC TANK LEACHATE INFLOWS  
FROM SHORELINE DEVELOPMENT - OSOYOOS LAKE

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1. INTRODUCTION

Osoyoos Lake is situated in the Okanagan Valley on the Canada-USA border. The study area is located on the east side of Osoyoos Lake. It begins approximately opposite Haynes Point and extends about half the distance to the USA border (See Figure 1). The dominant shoreline uses are recreational (campgrounds), residential and agricultural (orchards).

The use of septic tanks with drainfields near a lake shore can result in inadequate septic leachate treatment by the soil (refer to Figure 2). Water tables in such areas are often close to the soil surface and effluent may move with groundwater into the lake. Leachate plumes can emerge near lake shore. This may cause weed and algae growth due to increased nutrient inflows.

The east side of Osoyoos Lake was identified by the Okanagan Basin reports as potentially receiving significant quantities of phosphorus from septic tanks. Particular concerns have been expressed regarding the ability of the soils to adequately remove phosphorus from the peak loadings during summer months.

Direct evidence of nutrient inflows to the lake was desired to verify or allay the concerns. This survey was carried out in November, 1984 to attempt to detect leachate inflows from shoreline development. The details and results are discussed in this report.

2. METHODS

The shoreline in the study area was surveyed from a boat with a leachate detection system on November 6, 1984. The detection equipment consisted of a hand-held fluorometer (K-V Associates, Model 15 "Peeper Beeper") attached to a strip-chart recorder. Lake water was pumped continuously through the fluorometer as the boat

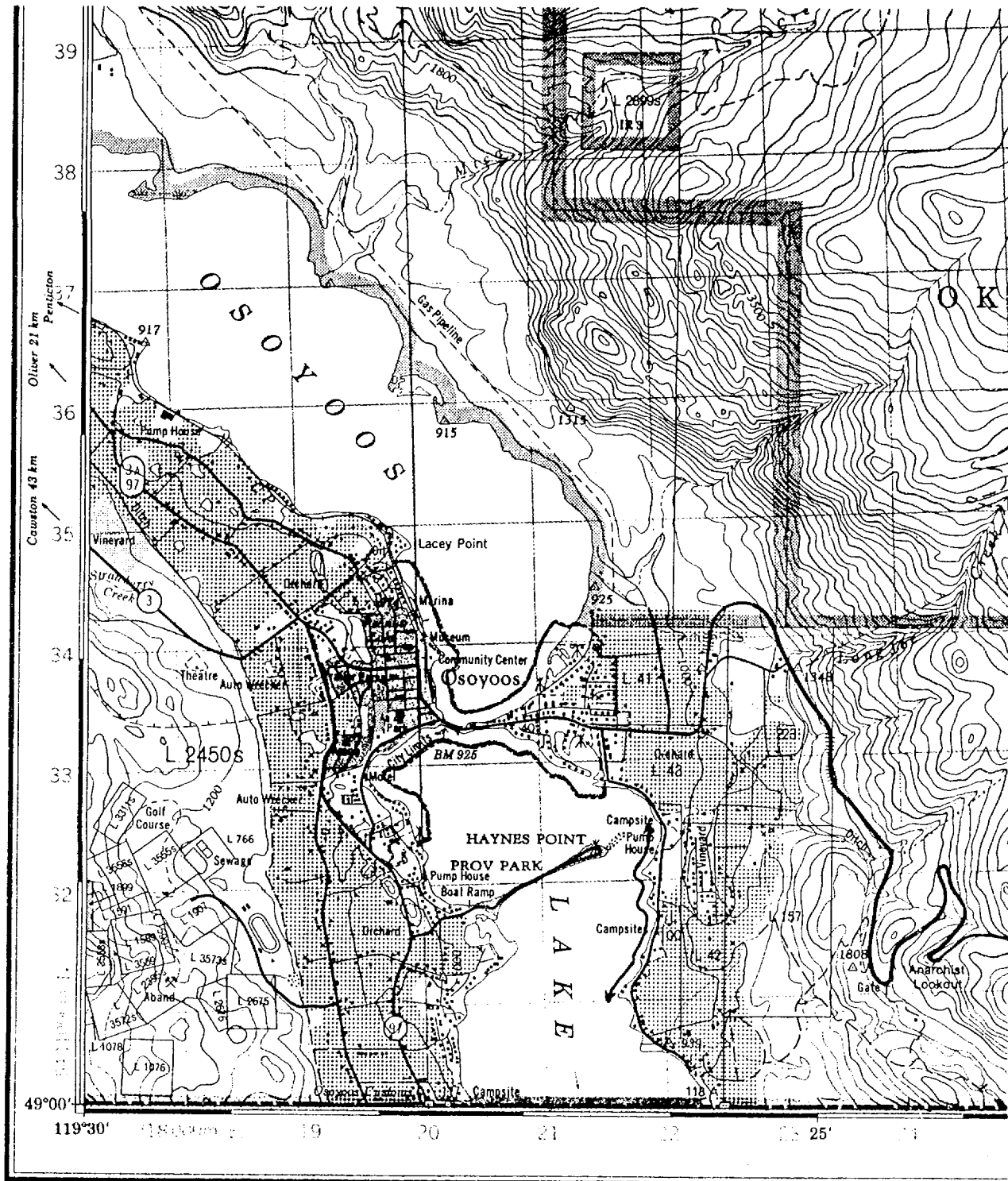


Figure 1. Location Map

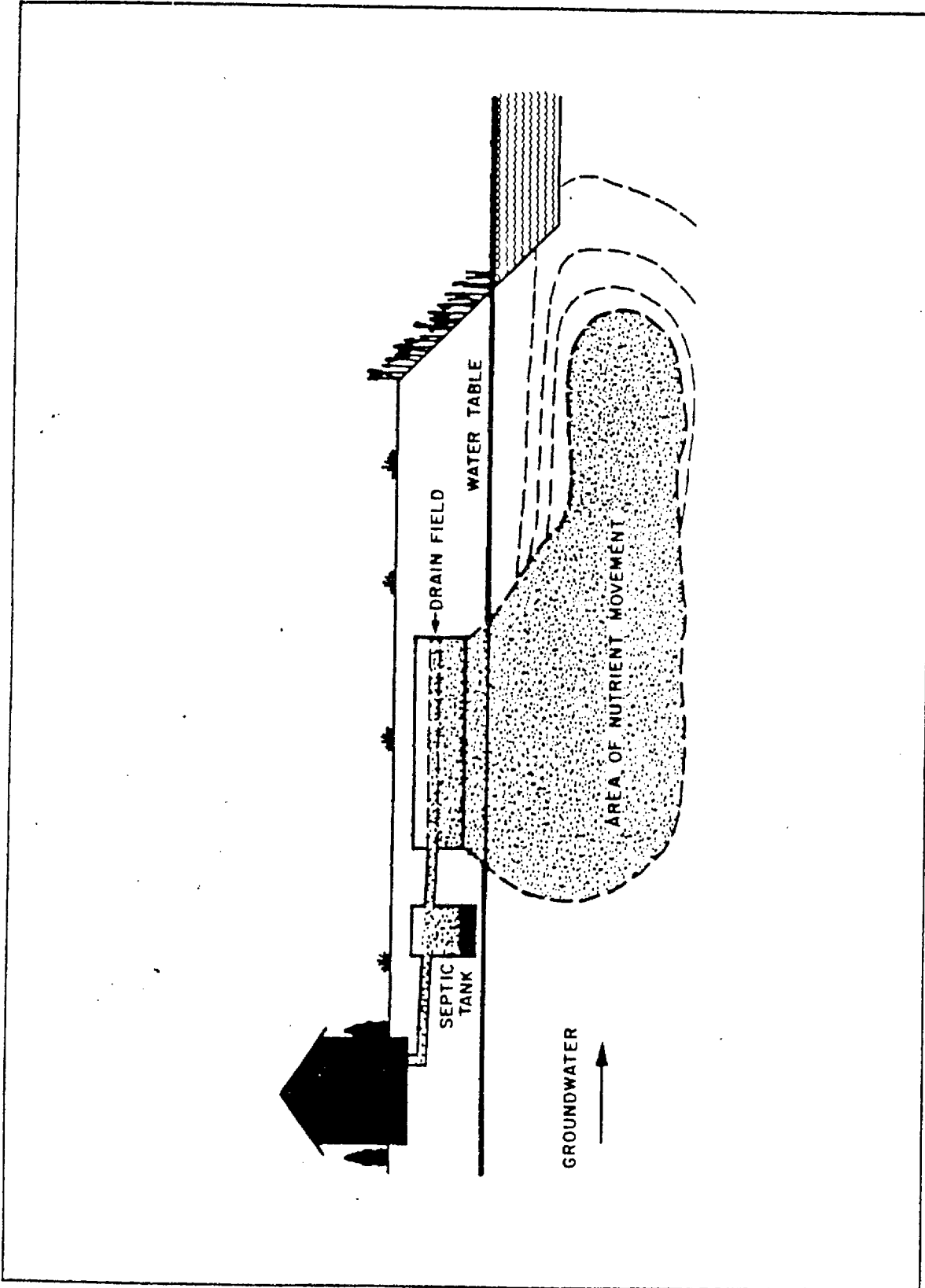


FIGURE 2: The Movement of Leachate From a Drainfield into a Lake

moved along the shoreline. Fluorescence was displayed visually on the meter and recorded on the strip-chart recorder.

The fluorometer is designed to respond to the degradation products of human urine, the fluorescence of which has shown to be enhanced by detergents. It is also sensitive to the whiteners found in laundry detergents. The Model 15 differentiates between contaminants of a septic nature and other organics by utilizing a unique pulsing exciter/emitter system.

Water from various sources contains different levels of compounds which may also fluoresce at the selected wavelengths. The equipment is, therefore, required to be calibrated at the start of the survey to compensate for this background level of fluorescence. This was done about 100 m off shore in the area where the scan was started. The fluorometer thus compared near-shore water to this background lake water. It is assumed that the latter is unaffected by shoreline development. Background fluorescence was set to read approximately 1.5 on the 0 to 10 scale to allow for the possibility of negative readings. Standard solutions ranging from 0.2% to 0.4% urine in background were prepared. The fluorescence of the standards was measured and recorded on the strip chart. Relative fluorescence of the lake shore water can be compared to these standards.

Water samples were taken at six locations. One water sample corresponds to background fluorescence. The other five samples were taken near shore and represent varying levels of fluorescence on the chart. The samples were placed in a cooler and shipped the same day to the Environmental lab in Vancouver for analysis.

### 3. RESULTS AND DISCUSSION

3.1 The complete strip chart record is given in Appendix A. It is important to note the limitations of leachate detector systems when interpreting the results. Some dissolved natural organics will fluoresce at wavelengths similar to those of whiteners and brighteners, thus increasing fluorometer readings or giving positive readings where none should occur. The Model 15 fluorometer has been designed to minimize these effects, but it may not have eliminated them entirely. Air entry into the system, such as when the pump is inadvertently lifted from the water, may also affect results. Entry of lake bottom sediments into the system generally causes a positive response. Known air or sediment responses are marked on the chart. Lake inflows such as springs or streams can dilute water in the area and thus cause negative chart readings.

There is also some fluctuation in the background and standards response records which is likely inherent in this fluorometer system. It may also be partially due to operation of the equipment at temperatures close to the operating minimum of 2°C. This background fluctuation has the effect of masking or enhancing minor variations, making interpretation of results more difficult.

#### 3.2 Background and Standards

The initial background reading on the strip chart was 20 plus or minus 2 at approximately 100 m offshore at Lot A, Plan 26614, (point 1, Figure 3). The 0.2% urine solution had a reading of 29 plus or minus 2 and the 0.4% urine solution had a reading of 40 plus or minus 3.

The background adjustment was apparently bumped while maneuvering around the second dock at Lot 25, Plan 1958 (point 5, Figure 3). This was confirmed when the readings did not

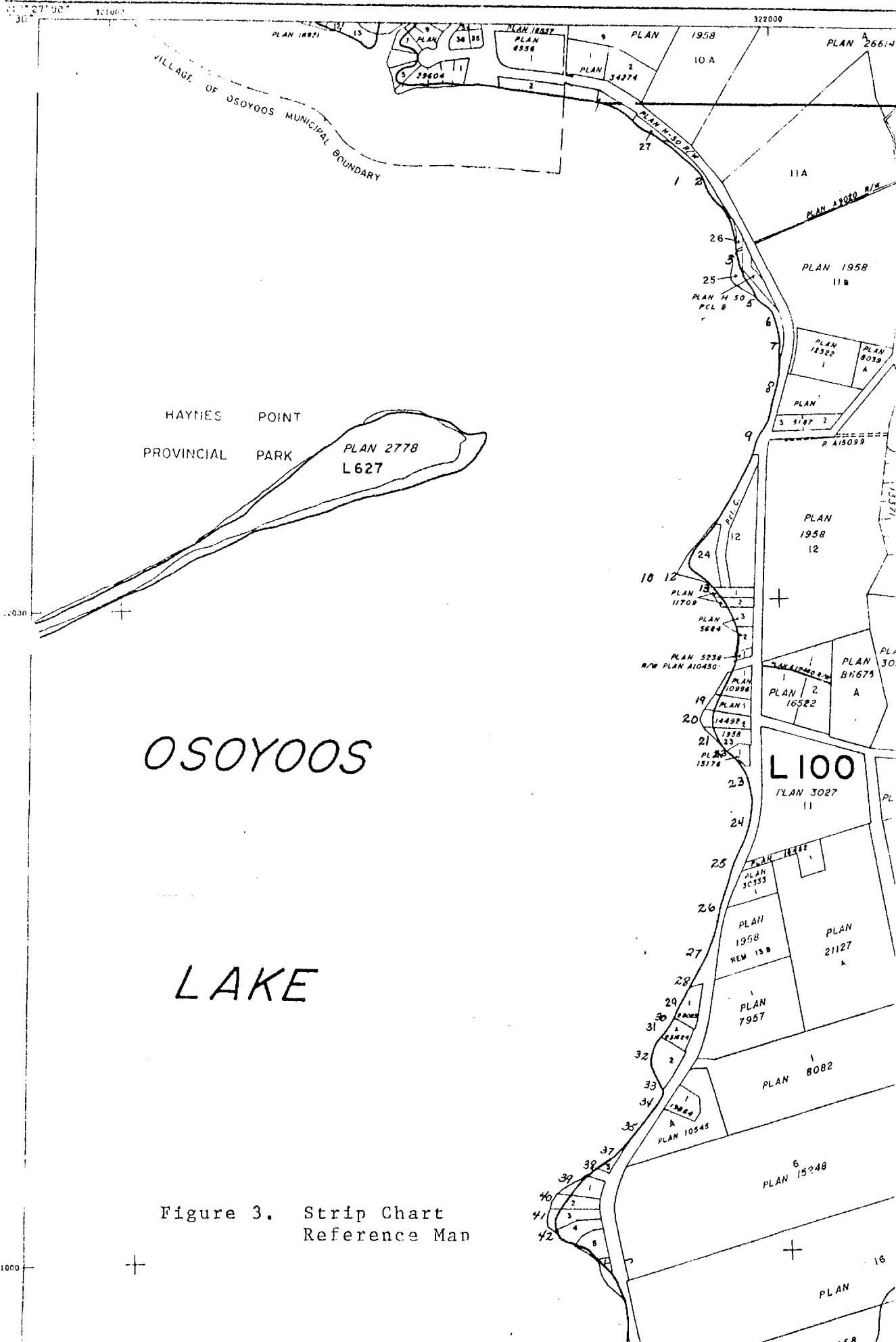


Figure 3. Strip Chart Reference Map

return to background levels along the subsequent undeveloped shoreline (points 7, 8, 9, Figure 3). A new background was then established off the point on Lot 24, Plan 1958 (point 10, Figure 3). This second background reading was set at 16. Apparent fluctuation is plus or minus 4. Background lake water was sampled about 100 m off shore at this point.

### 3.3 Major Peaks

Major peaks are defined as being approximately equal to or greater than the flourometer response for the 0.2% urine solution. Six major peaks were recorded. These occurred at:

1. near Plan A9020 R/W (point 3, Figure 3). Campground. Reading was 10 above average background. Water sampled.
2. Lot 23, Plan 1958 (past point 21, Figure 3). House. Reading was 8 above average background.
3. Lot 11, Plan 3027 (point 23, Figure 3). Campground. Reading was 8 above average background.
4. Lot 13B, Plan 1958 (point 27, Figure 3). Campground. Reading was 10 above average background. Water sampled.
5. Lot 1, Plan 8023 (point 29, Figure 3). Campground. Reading was 10 above average background. Water sampled.
6. Lot A, Plan 31524 (point 31, Figure 3). Campground, boat house, Reading was 8 above average background. Water sampled.



### 3.4 Minor Peaks

Minor peaks are defined as being above the background fluctuation (4 above average background) and less than major peaks (8 above average background). Six minor peaks were recorded.

1. Lot A, Plan 26614 (before point 2, Figure 3). House and orchard. Reading was 6 above average background.
2. Lot 11, Plan 3027 (point 24, Figure 3). Campground. Reading was 6 above average background.
3. Lot A, Plan 10545 (point 35, Figure 3). Campground. Reading was 6 above average background. Water sampled.
4. Lot 3, Plan 10545 (point 38, Figure 3). Reading was 6 above background.
5. Lot 1, Plan 15248 (point 39, Figure 3). House. Reading was 6 above background.
6. Lot 3, Plan 15248 (point 41, Figure 3). House. Reading was 6 above background.

### 3.5 Lab Analyses

The results of the laboratory analyses of the six water samples are given in Table 1. There is a general increase in specific conductivity, nitrogen (particularly ammonia) and sulphates. Phosphorus shows a slight elevation at several locations, pH does not appear to be affected.

TABLE 1

Lab Analyses - Osoyoos Lake - November 6, 1984

PARAMETER	Background	Site 3	Site 27	Site 29	Site 31	Site 35
pH	8.2	8.2	8.2	8.2	8.1	8.2
Specific Conductivity	280	325	313	323	286	310
Nitrogen:Ammonia	0.012	0.005	0.020	0.025	0.033	0.031
Nitrogen:NO <sub>2</sub> NO <sub>3</sub>	0.20	0.21	0.25	0.24	0.16	0.18
Nitrogen:NO <sub>2</sub>	0.005	0.005	0.005	0.006	0.006	0.006
Nitrogen:NO <sub>3</sub>	0.19	0.21	0.24	0.23	0.15	0.17
Nitrogen:Kjeldahl	0.25	0.28	0.27	0.26	0.27	0.28
Nitrogen:Organic	0.24	0.28	0.25	0.24	0.24	0.25
Nitrogen: Total	0.44	0.49	0.51	0.50	0.43	0.46
Phosphorus:Ortho-phosphate	0.006	0.005	0.006	0.006	0.007	0.008
Phosphorus:Total Dissolved	0.013	0.012	0.013	0.013	0.014	0.015
Phosphorus:Total	0.026	0.032	0.024	0.022	0.022	0.024
Chloride	2.4	2.6	2.4	2.5	2.7	2.4
Sulphate	29.7	31.6	31.0	32.1	30.7	31.0

4. CONCLUSIONS

Septic tank leachates appear to be entering the lake at several locations along this shoreline. Most of the major plumes occur directly in front of campgrounds. Water sampling indicates noticeable changes in specific conductivity, sulphates and nitrogen (particularly ammonia). Sampling was done in November, approximately 2 months after the end of the camping season. This may account for the minor changes in phosphorus compared to background.

Further work to pinpoint the sources of the leachates may be required. Groundwater sampling in conjunction with groundwater flow determinations are recommended.

Appendix A

