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DEPARTMENT OF ECOLOGY

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M E M O R A N D U M  
November 13, 1984

To: Charlie Tang, URS Company  
Through: Lynn Singleton *JS*  
From: Joy Michaud and William Chamberlain  
Subject: WDOE-Supplied Information for the Southern Puget Sound Water Quality Assessment

As per our agreement with the URS Company, the Washington State Department of Ecology (WDOE) has completed the following information for the Discharge Zone Classification System. This information includes a watershed inventory, a description of National Pollution Discharge Elimination System (NPDES) discharges, a compilation of land-use information, and a current water quality analysis for Southern Puget Sound. This information along with the URS results will eventually be compiled into the final URS Discharge Zone Classification report. The text and figures of this memorandum should be considered as a draft for your editorial staff to use.

SELECTED LOADING SOURCES TO SOUTHERN PUGET SOUND

A description of the drainage basins that flow into, and therefore influence, the southern portion of Puget Sound and a summary of the loadings from municipal and industrial discharge sources are presented below. This information provides a means for evaluating the magnitude and quality of present loads to this area.

Southern Puget Sound Drainage Areas

The area around Southern Puget Sound was divided into twelve regions; eleven of these are drainage basins, while the twelfth includes the major islands located in this part of Puget Sound (Anderson, McNeil, Hartstene, and Squaxin). Figure 1 shows the location of these regions, while Table 1 describes their size, the size of the first-order streams, and information on whether or not they are or have been gauged. Knowledge of drainage basin size and flow (obtained from the stream gauges) is important when determining the relative significance of each.

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All stream gauge locations and drainage areas for major rivers and some streams in the South Sound area (WDF, 1981) are noted in Table 1, and listed by river mile (r.m.). Some stream gauge location listings refer to historical sites not presently monitored. Additional watershed area data for selected smaller streams were taken from the Soil Conservation Service (SCS, 1969), U.S. Geological Survey (USGS, 1973), and WDOE (1981). They include:

Fort Lewis-Tacoma	Isabel Lake/Mill Creek
Henderson Inlet	Anderson Island
Woodland Creek	McNeil Island
McAllister Creek	Hartstene Island
McLane Creek	Shelton Area
Skookum Creek	Squaxin Island

Major drainages of unknown size were estimated using two methods: (1) drainage areas drawn on 15- and 7.5-minute USGS topographic maps were measured by planimeter; and (2) existing subbasin data were used to calculate major basin area by summation where possible. In some cases, both methods were combined to estimate watershed areas.

Planimeter readings were obtained by tracing over hand-drawn watershed areas, following map contour lines, then correlating the results to readings for areas of known size. Three replicates for each area were done to increase the accuracy of results. All results are illustrated in Table 1. Watershed areas for the creeks represent the difference between the sum of the unnamed, named creek watershed areas, less the total watershed area. Watershed areas for streams that are not calculated at the stream mouth are included with the unnamed creeks as ungauged areas.

Areas where established data existed were cross-checked using USGS "Water Resources Data for Washington State" (USGS, 1984) summarized data. These included all gauged sites listed from 1945 to 1980 water years. Data originating from the Soil Conservation Service Consolidated Basin Index (SCS, 1969) was not cross-checked for accuracy since no other data for those areas were found.

As an overall check on the total size of the Southern Puget Sound area size, summed areas from all twelve regions were compared to planimeter measurements for the same areas. These varied less than ten percent.

#### Land Use - Sources of Information

Land use within a drainage basin is important in determining the character and quality of surface runoff. In view of this, information on existing and projected land use should be considered when making decisions concerning future water use. Land use data have not been gathered as a part of this report because it is already available through other sources.

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Detailed information on land use in the south Sound area can be obtained from the Pierce and Thurston County Planning Agencies and the USGS through their National Cartographic Information Center. The Hazardous Waste section of WDOE is expected to complete a statewide land use report by December of this year. The product is being developed to determine suitability of potential hazardous waste disposal sites. The resulting maps will include information on nineteen different physical parameters, some of which are land use and cover types, population densities, geology, precipitation, and surface- and groundwater use. The reader is referred to these sources of land-use information for further details.

#### NPDES Permitted Discharges into Southern Puget Sound

Point-source loadings to southern Puget Sound were evaluated by examining all NPDES permits currently in effect in the area. These permits define effluent quantity and quality limits and the monitoring and reporting requirements for each discharger. The facilities collect and analyze effluent samples and then submit the results in the form of discharge monitoring reports (DMRs).

There were three objectives to this task. The first objective was to quantify point-source loads using available DMR data for fecal coliform bacteria (FC), suspended solids (SS), biochemical oxygen demand (BOD), and flow. The second objective was to note non-complying wastewater treatment facilities. The third objective was to provide a summary of the wastewater sources and loads to Southern Puget Sound.

#### NPDES Permits and Compliance

There are twenty NPDES permits currently on file for the South Sound area; however, not all of the permits are presently in use. Of the nineteen wastewater treatment plants (WTP) and one industrial discharger, two of the dischargers (Chambers Creek and Etloh Beach) are still under construction or are in the start-up mode of operation. The Chambers Creek plant began operation in mid-October 1984. It is unclear when the Etloh Beach plant will be operational. One privately owned treatment facility on Ketron Island is no longer in service, but still has an active permit (D. Anderson, WDOE, Southwest Region, personal communication). The two facilities on McNeil Island (McNeil Island Camp and McNeil Island Prison) share the same permit, but have separate outfalls and perform independent monitoring. Therefore, these facilities are treated individually in this report. The Boise Cascade Corporation has one discharge permit that covers three separate outfalls. The main outfall includes two different effluent sources, one source is an industrial waste stream, and the other is sanitary. Each has separate effluent limits and monitoring requirements and so maintain separate DMRs. They too are treated separately in this report. The remaining two small outfalls under the Boise Cascade permit have no monitoring requirements, and no data are available for either of them. The only effluent limit set for these outfalls is a suspended solids concentration of 30 mg/L.

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A discharge facility can be considered to be out of compliance if any of the effluent limits or monitoring requirements specified in the permit are not met. The purpose of this work is not to track each incidence of non-compliance, but instead to highlight possible problem areas.

#### Methods

Monthly average effluent concentrations from the most recent twelve-month period (July 1983 to July 1984) were examined to determine whether a given discharge has been within its permit limits for flow, BOD, SS, pH, and FC. Any parameter above the permitted limits 20 percent of the time was considered to be "out of compliance" (Tables 2 through 22). In many cases, the monthly average was based on one or two observations and therefore must be used cautiously. Blanks present in the tables indicate that no data were reported in the DMR for that month.

As can be observed from reviewing the tables, there is substantial variation in the amount of information available for each facility. In cases where little data were available, a plant could have been considered out of compliance if it surpassed its permitted limits for just one month. To some extent, an effort was made to differentiate between facilities having definite problems from those not monitoring/ reporting frequently enough to accurately evaluate their effluent quality. Table 23 summarizes the effluent monitoring requirements for each of the discharge facilities. An asterisk marks cases where the monitoring/reporting requirements were not being met, although no effort was made to discuss the degree of non-compliance. In other words, an asterisk could mean that the parameter was never or rarely monitored/reported, or that it was just not monitored/reported as frequently as the permit required. This lack of data precludes making any assessment of the effluent quality.

#### Permit Compliance - Results Summary

##### Flow

Three of the WTPs; Hartstene Point, Rustlewood, and Steilacoom, have flows above their permitted limits on a regular basis. Taylor Bay Beach Club, Wallochett Harbor, Beverly Beach, and Seashore Villa treatment plants either have not been monitoring their flow or in the case of Beverly Beach, make only a rough monthly estimate of effluent flow. There is reason to doubt the accuracy of the flow meters used at Rustlewood, Steilacoom, and the McNeil Island Prison (D. Anderson, WDOE, Southwest Region, personal communication). If this is true, the BOD and SS load calculations are in error.

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### Biochemical Oxygen Demand and Suspended Solids

The Seashore Villa and Steilacoom WTPs exceeded their monthly average BOD and SS limits more than 20 percent during the time period examined. Wollochet Harbor WTP frequently exceeds its BOD limit, and the Tamoshan plant exceeds its SS limit. They are considered out of compliance by the criteria used here. It should be noted, though, that the Seashore Villa and Tamoshan plants have little data available (Tables 15 and 18). According to the available data, Hartstene Point and Carlyon Beach have not exceeded their loading limits for BOD or SS, but neither plant is monitoring these parameters as often as their permits require. Thus, there is not enough information available to accurately judge their effluent quality. The Taylor Bay Beach Club and Beverly Beach plants are not required to monitor BOD or SS, so again there is not enough information available to evaluate the quality of the effluent from these WTPs. The Boise Cascade sanitary outfall exceeded its BOD limit for all months examined. Although there is no requirement to monitor SS at this outfall, the high BOD indicates that this may be an area of concern.

### Fecal Coliforms

The Steilacoom facility is the only plant that has documented frequent FC violations. For Taylor Bay, Seashore Villa, Hartstene Point, Beverly Beach, and Carlyon Beach, there is not enough data available to provide an adequate assessment of the typical fecal coliform concentrations found in their effluents.

### pH

None of the plants that monitored pH were out of compliance. Taylor Bay Beach Club, Rustlewood, Tamoshan, Wollochet Harbor, Beverly Beach, and Seashore Villa do not monitor pH as frequently as required, but the available data indicate that pH is not a problem in any of them.

### Improving Permit Compliance

The Steilacoom plant represents the only case where there is a documented effluent quality problem. Steps have been made to alleviate this situation. The plant has recently been upgraded and will have new effluent quality limits. The proposed and current limits are shown on Table 17. The next step is to either continue the plant upgrade so that it meets the required secondary limits by 1988, or close the facility and pump the influent to the Chambers Creek plant for treatment (D. Anderson, WDOE Southwest Region, personal communication).

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The general lack of effluent quality data from many of the smaller treatment facilities is another area of concern. WDOE recognizes this problem and is taking measures to rectify it. These include tracking DMRs, regularly scheduling inspections of the wastewater treatment plants, and increasing the monitoring requirements of the smaller facilities when their permits are reissued. Therefore, more complete information on effluent quality should be available in the future.

#### Summary of NPDES Point-Source Loadings

The purpose of this work was to quantify and summarize effluent discharged to Southern Puget Sound. A distinction is made between the permitted and actual load. In most instances, the permitted load represents worst-case conditions as the majority of the dischargers operate below their permitted flows and concentrations.

#### Methods and Results

The respective NPDES permit limits were used to calculate the permitted loading of BOD and SS from each outfall. The permitted loadings were estimated by using the equation:

$$\text{Permitted loading (lb/d)} = \text{permitted flow (MGD)} \times 8.34 \times \\ \text{permitted BOD or SS concentration (mg/L)}$$

Observed loadings were calculated by using the same equation but substituting observed flow and concentration for the permitted values. If there were no flow data available for a given month, the observed loading was estimated by using the average of the observed flows for that outfall. In instances where no BOD or SS data were available, loading was estimated by using the average of the observed concentrations. If there were no reported data for both flow and BOD or SS, then no estimate of observed loading was made. The information in Tables 2 - 22 was used to calculate the observed loadings. Tables 24 and 25 contain the permitted and observed loading rates for BOD and SS, respectively. No estimates of observed loadings were made for Beverly Beach, Taylor Bay Beach Club, Seashore Villa, or Wollochet Harbor since there was not enough data available for any of these plants to determine an accurate average.

The location of each of the discharge sites is shown in Figure 2. The circled numbers correspond to those found next to the discharger's name in Tables 24 and 25. A more precise location of each of the outfall locations (latitude and longitude) is included in Tables 2 - 22. Other information regarding the outfall; e.g., diffuser depth, is also given in these tables, when available. This information was usually obtained from engineering reports and personal communications with the operators. Diffuser locations were not confirmed by field surveys.

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## WATER QUALITY EVALUATION OF SOUTHERN PUGET SOUND

Class AA, A, and B waters in Southern Puget Sound (Table 26) were evaluated for consideration as future effluent discharge sites. Areas were classified as not suitable for future discharge according to the frequency of violations of their respective dissolved oxygen (D.O.), pH, and FC standards. Historical and current data (1973 to present) from the Department of Social and Health Services (DSHS) and WDOE were used to make the evaluations. Areas experiencing frequent or regular water quality standard violations are delineated on Figure 3, along with the DSHS and WDOE water quality monitoring stations. These areas will not be considered for future wastewater discharge sites.

The areas that will not be considered for future discharge include: the lower portion of Budd Inlet, all of Oakland Bay (including the westerly portion of Hammersley Inlet), the south end of Eld Inlet, Henderson Inlet, and the upper portion of both Case and Carr Inlets (Figure 3). The specific rationale used to delineate each zone is discussed below.

### Budd Inlet

According to DSHS, the frequency and magnitude of FC violations are greatest at stations 33, 34, and 45 in the lower end of this inlet. At stations 35 and 36, the conditions improve, although the standard is still being violated about 30 percent of the time. WDOE data also indicate that there are frequent FC and D.O. violations. The WDOE data suggest that the water quality may be improving since there have been no FC violations for the last 30 months of data (through May 21, 1984). D.O. remains a problem in the lower end of the inlet, but seems to have improved at station BUD005.

### Oakland Bay

DSHS and WDOE data both show that there are frequent FC violations in this area, with the exception of DSHS stations 12, 16, and 17. Low D.O. levels have also been a problem in the past at WDOE station OAK004, although there have been no violations since November 1981.

### Eld Inlet

The data sources used in the water quality analyses do not indicate that routine water quality violations are occurring in Eld Inlet. Recent preliminary data from an extensive bacteriological study of Eld Inlet (Taylor, 1983) indicate an FC problem exists in the lower inlet. This area has, therefore, been classified as "not suitable for further discharge sites."

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#### Henderson Inlet

DSHS water quality stations in Henderson Inlet were sampled in May of 1981, August of 1982, and March of 1983. Only Sites 1 and 7 violated the FC standards during the May 1981 sampling trip. During the August 1982 trip, the southern and eastern sites were in violation. In March 1983, all sites were in violation. Whether this indicates a seasonal trend in water quality or steadily worsening conditions is difficult to determine. In either case, this inlet is considered to be "not suitable" for further discharge sites.

#### Case Inlet

DSHS data indicate that there are many FC violations at the nearshore stations (Figure 3) during the winter (January 1981). In an extensive survey done in July in Rocky Bay, over 30 percent of the samples taken violated the FC standard. Therefore, these areas are considered to be "not suitable" for further discharge sites.

#### Carr Inlet

Although DSHS has no routine sampling stations in Carr Inlet, extensive FC surveys have been done in the area. These surveys include eleven stations sampled in Minter Bay in June 1982 and a large survey done in January 1982 that included forty-one stations throughout Henderson Bay. Each of the surveys indicated that the FC levels are above the Class AA standards.

Two of the major shellfish-growing sites in the upper part of Carr Inlet have already been decertified due to FC contamination. The current plan is to restore these waters and eventually recertify the shellfish beds (Determan, et al., 1984). Restoration will include stringent control of discharges to the inlet, thus this area is "not suitable" for future discharge sites.

JM:WC:cp

Attachments

cc: Dick Cunningham

## LITERATURE CITED

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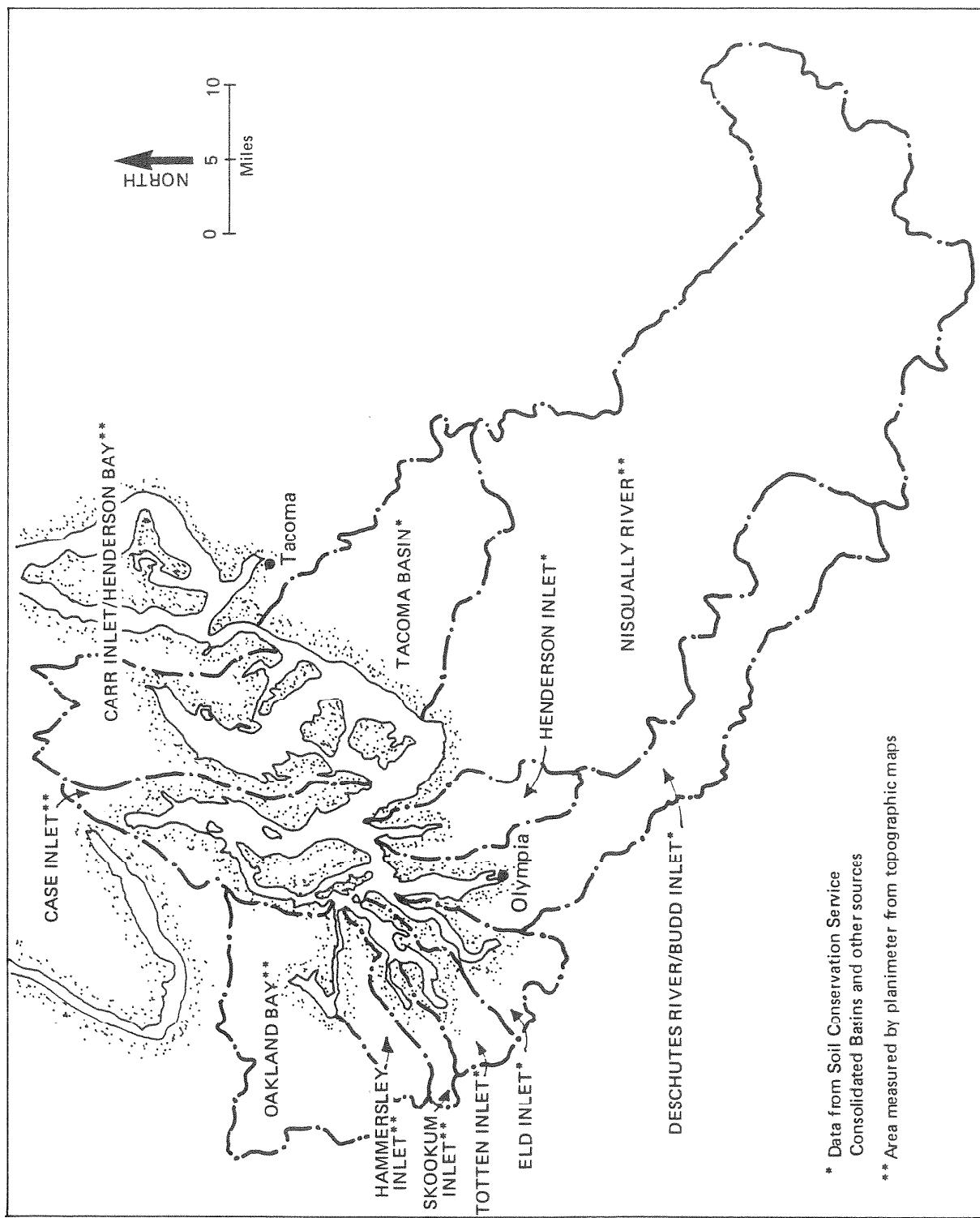


Figure 1  
Southern Puget Sound Drainage Basins

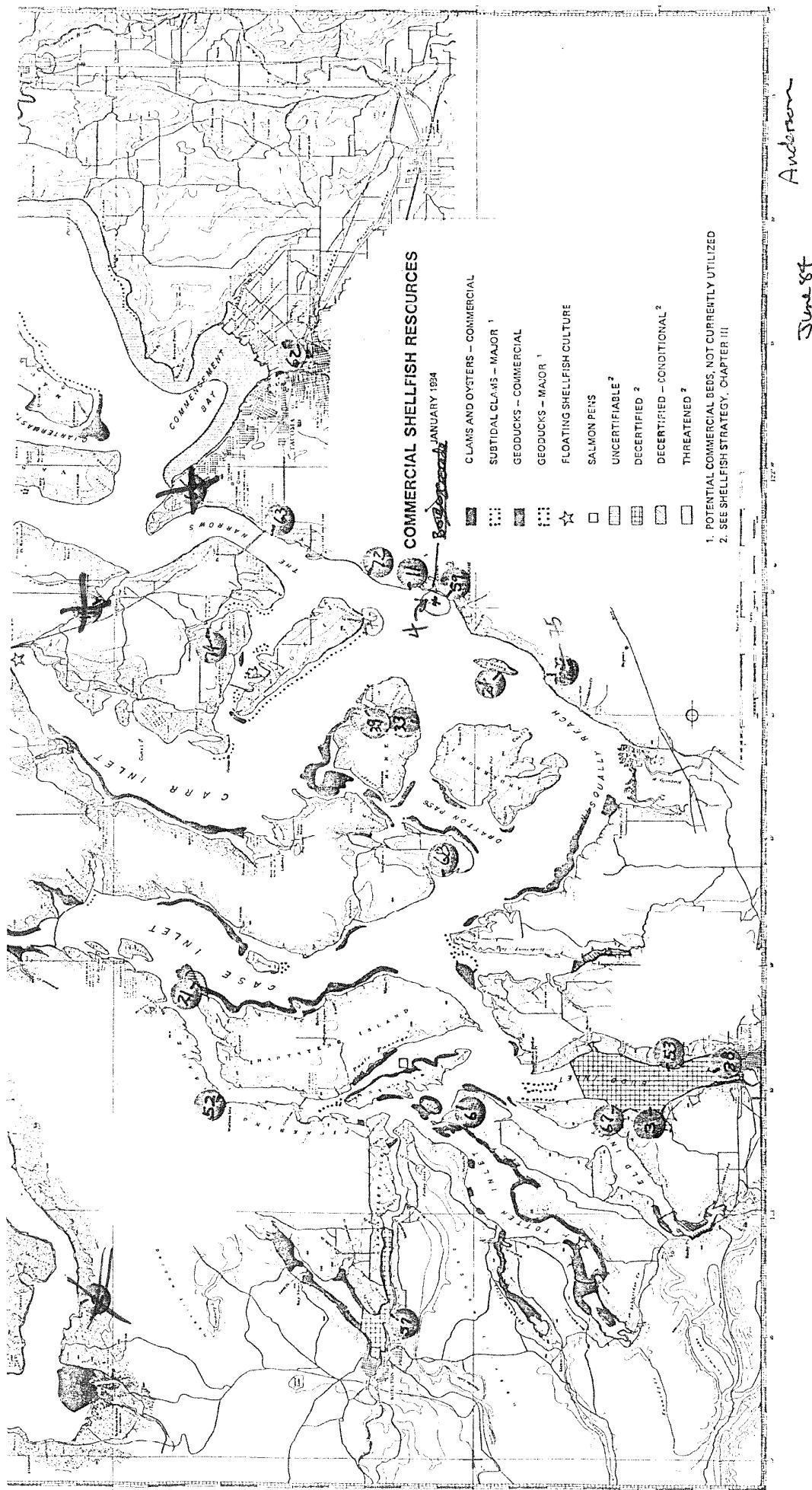


Figure 2. Location of NPDES discharge sites in Southern Puget Sound.

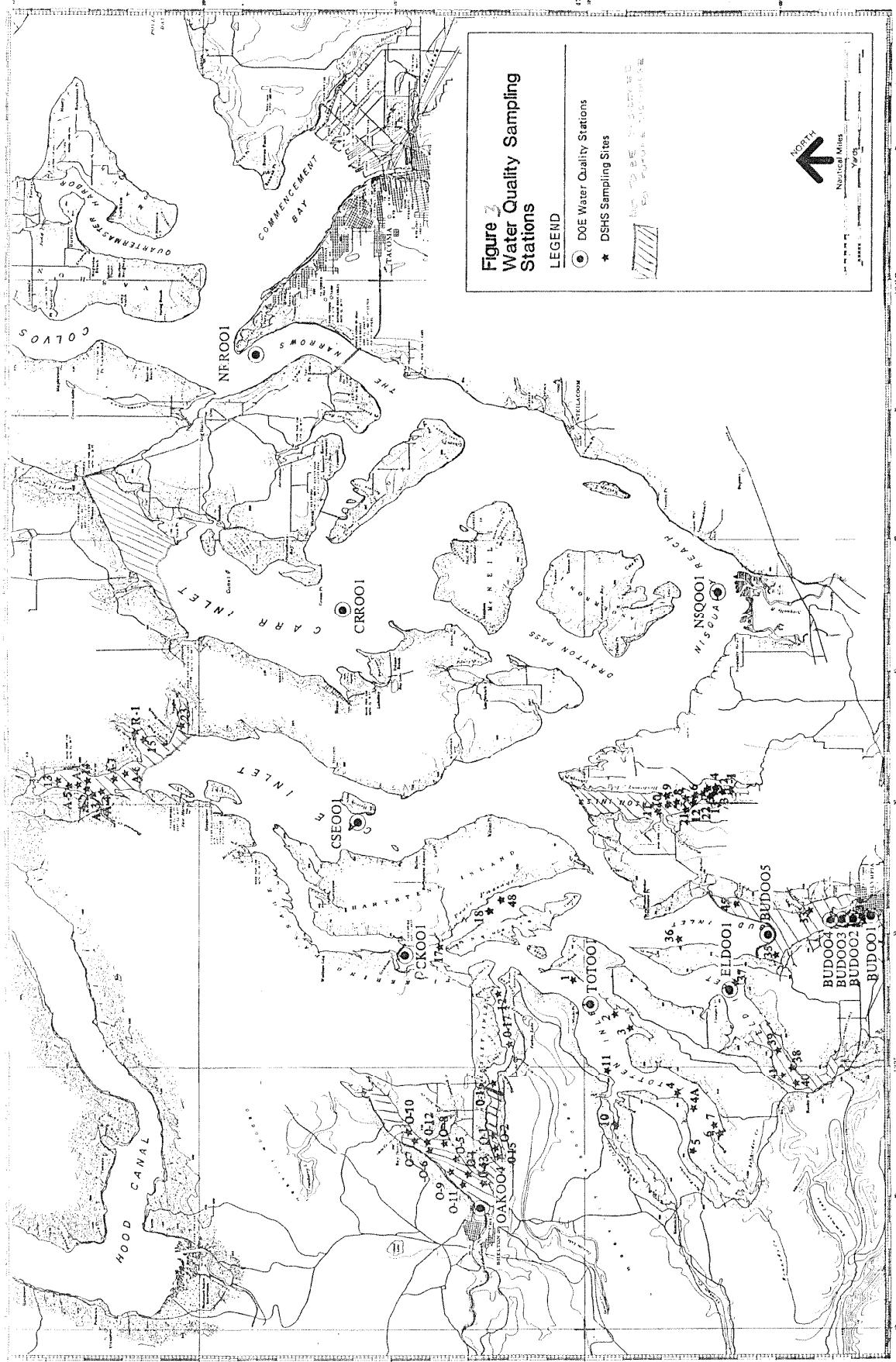


Table 1. South Puget Sound drainage basins, including all first-order streams or rivers discharging directly into Southern Puget Sound, their size, and the presence of current or historical gauging stations.

Drainage Basin	Area (mi <sup>2</sup> )	Gauging Station	Drainage Basin	Area (mi <sup>2</sup> )	Gauging Station
BUDO INLET (total)	213	--	CASE INLET (total)	76**	--
Deschutes River	170* at r.m. 0.0	Yes r.m. 2.4 (162)†	Sherwood Creek (upper)	11.0 at r.m. 13.2	Yes r.m. 13.2
Percival Creek	9.8	No	Coulier Creek	14.1	No
Ellis Creek	2.2	No	Rocky Creek	18.3	No
Indian Creek	3.2 at r.m. 1.0	No	Dutcher Creek	5.8**	No
Unnamed Creeks (6)	27.8	No	Unnamed Creeks (19)	27	No
ELD INLET (total)	40**	--	CARR INLET/HENDERSON BAY (total)	86.4*	--
McLane Creek	11.5	No	Lackey Creek	3.5**	No
Simmons Creek	1.2	No	Minter Creek	16.5**	No (gaged on Huge Cr.)
Perry Creek	6.1	No	Burley Creek	16.1* at r.m. 2.0	Yes r.m. 0.3 (10.7)
Unnamed Creeks (4)	21.2	No	Purdy Creek	3.4 at r.m. 0.02	Yes r.m. 0.02
TOTTEN INLET (total)	41**	--	McCormick Creek	2.1**	No
Kennedy Creek	20.3 at r.m. 0.0	Yes r.m. 0.5 (19.8)	Warren Creek	3.7**	No
Schneider Creek	10.0	No	Arlondale Creek	2.6**	No
Unnamed Creeks (2)	10.7	No	Sullivan Gulch	1.8**	No
SKOKUM INLET (total)	57.8**	--	Unnamed Creeks (15)	36.7	No
Skookum Creek	16.1 at r.m. 2.0	Yes r.m. 2.0	HENDERSON INLET (total)	53.5	--
Unnamed Creeks (3)	41.7	No	Woodland Creek	24.6 at r.m. 1.5	Yes r.m. 1.5
HAMMERSLEY INLET (total)	36.5**	--	Woodward Creek	3.8 at r.m. 3.6	Yes r.m. 3.6
Mill Creek + Isabella Lake	31.7* at r.m. 0.0	Yes r.m. 6.7 (20.0)	Unnamed Creeks (6)	25.0	No
Unnamed Creeks (4)	4.8	No	NISQUALLY REACH (total)	716	--
OAKLAND BAY (total)	203.7**	--	Nisqually River	672* at r.m. 0.0	Yes r.m. 21.8 (517)
Oldsborough Creek	51.4 at r.m. 0.85	Yes r.m. 0.85, 5.9	McAllister Creek	25.5	No
Sheilton Creek	1.2**	No	Unnamed Creeks (4)	18.5	No
Johns Creek	18.6 at r.m. 3.0	Yes r.m. 3.0	TACOMA BASIN (total)	210**+	--
Cranberry Creek	16.6 at r.m. 0.5	Yes r.m. 0.5	Chambers Creek	108.0 at r.m. 0.0	Yes r.m. 2.2 (104)
Deer Creek	13.3 at r.m. 0.6	Yes r.m. 0.6	Sequalitchew Creek	38.4	No
Malaney Creek	1.5**	No	Unnamed Creeks (2)	63.6	No
Uncle John Creek	1.7**	No	MAJOR ISLANDS (total)	41.2	--
Campbell Creek	4.6	No	Anderson Island	8.2*	No
Unnamed Creeks (2)	100.2	No	McNeil Island	6.9*	No
SOUTH SOUND (total)	1775	--	Hartstone Island	18.5*	No
Gauged area (total)	992 (56%)		Squaxin Island	2.3*	No
Un-gauged area (total)	779 (44%)		Fox Island	5.3**	No

\*SCS, 1979  
\*\*Planimeter  
\*\*\*WDOE (1981)  
†Area (mi<sup>2</sup>) gauged

All other data from WDF (1981) except unnamed creeks

Table 2. Permit limits and effluent quality for Beverly Beach WTP.

Parameter	Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Monthly Average
Flow (MGD)	0.005	0.003*	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
pH (S.U.)	6-9	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliforms (#/100 mL)	200	-	-	-	-	-	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	30	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	-	-	-	-	-	-	-	-	-	-	-	-	-

\* = All flows are estimated.

Table 3. Permit limits and effluent quality for Boise Cascade industrial WTP.

Industry Type:	Thermo-mechanical paper mill													
Population Served:	Near the mouth of Chambers Creek; south of the Narrows													
Receiving Water:	390 feet offshore; 40 feet deep at mean low low tide; 30-inch diameter pipe with 10 ports													
Diffuser Location:	47°11'08" N 122°33'05" W (See Figure 2, Discharge 4, for general location.)													
Parameter	Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
FLOW (MGD)		4.504	4.512	4.195	4.087	4.207	4.104	3.881	3.952	4.032	4.254	4.407	4.194	
pH (S.U.)	6-9	7.1	7.1	7.3	6.4	6.4	6.7	6.9	7.0	6.9	6.9	7.0	7.0	
Fecal Coliforms (#/100 mL)		-	-	-	-	-	-	-	-	-	-	-	-	
Suspended Solids (lbs/day)	9,900	8541	7295	6806	7489	6729	5122	4287	5437	11,259	10,018	8001	7362	
Biochemical Oxygen Demand (lbs/day)	6,500	2609	3033	2806	2790	3408	3200	5760	3312	3837	2933	2262	3268	

Table 4. Permit limits and effluent quality for Boise Cascade sanitary WTP.

Treatment:	Secondary	Monthly Average													
Population Served:		Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
Receiving Water:	Year mouth of Chambers Creek; south of the Narrows														
Diffuser Location:	390 feet offshore; 40 feet deep at mean low low tide; 30-inch diameter pipe with 10 ports														
Outfall Location:	47°11'08"N 122°33'05"W (See Figure 2, Discharge 4, for general location.)														
FLOW (MGD)		0.013	0.001	0.025	0.028	0.003	0.003	0.002	0.003	0.004	0.004	0.003	0.003	0.008	
pH (S.U.)		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliforms	200 (#/100 mL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	79	69	58	68	32	37	42	35	42	38	59	51	51	



Table 6. Permit limits and effluent quality for Chambers Creek WTP.

Treatment: Secondary - not in operation  
 Population Served:  
 Receiving Water: Near mouth of Chambers Creek; south of the Narrows  
 Diffuser Location: 785 feet offshore; 116 feet deep at slack low tide  
 Outfall Location: 47°11'20"N  
 122°34'45"W (See Figure 2, Discharge 11, for general location.)

Parameter	Permit Limit	Monthly Average						Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.	
FLOW (MGD)	12.0	-	-	-	-	-	-	-
pH (S.U.)	6-9	-	-	-	-	-	-	-
Fecal Coliforms (#/100 mL)	200	-	-	-	-	-	-	-
Suspended Solids (mg/L)	30	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	-	-	-	-	-	-	-



Table 8. Permit limits and effluent quality for Fort Lewis WTP.

Treatment:	Secondary	Monthly Average												
Parameter	Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
FLOW (MGD)	7.6	4.4	4.2	3.6	3.1	3.8	4.8	5.9	4.7	5.8	5.3	4.6	2.9	4.4
pH (S.U.)	6.0-8.5	6.3-	6.4-	6.5-	6.3-	6.3-	6.2-	6.3-	6.3-	6.5-	6.7-	6.4-	6.4-	6.6-
Fecal Coliforms (#/100 mL)	200	14	9	6	4	4	5	18	6	6	3	2	8	7
Suspended Solids (mg/L)	30	26	26	22	25	21	16	21	26	22	25	27	24	-
Biochemical Oxygen Demand (mg/L)	30	24	23	23	21	26	23	20	20	24	20	23	23	23

Table 9. Permit limits and effluent quality for Hartstene Point WTP.

Treatment Primary  
Population Served: 100+  
Receiving Water: Case Inlet; northern tip of Hartstene Island near Dougall Point  
Diffuser Location: 610 feet offshore at Mean Low Low Water; 6-inch pipe with diffuser; 39 feet deep at MLLW low tide  
Outfall Location: Approximately 47°17'57"N 122°50'40"W (See Figure 2, Discharge 21, for general location.)

Parameter	Permit Limit	Monthly Average						Average					
		July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
FLOW (MGD)	0.056	0.044	0.035	0.026	0.018	0.113	0.099	-	0.103	0.087	0.076	0.076	0.068
pH (S.U.)	6-9	6.8-	6.9-	6.9-	6.9-	6.9-	6.5-	4.4-	6.4-	6.4-	6.3-	6.3-	6.5-
Fecal Coliforms (#/100 mL)	200	7.0	7.0	7.0	7.0	7.0	6.9	6.7	6.7	6.8	6.7	6.8	6.9
Suspended Solids (mg/L)	30	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	-	-	-	-	-	-	-	-	-	-	-	-
		9	8	8	23	12							

Table 10. Permit limits and effluent quality for Ketron Island WTP.

Treatment: Secondary (no longer discharging)  
 Population Served: <5 homes  
 Receiving Water: Nisqually Reach; west side of Ketron Island  
 Diffuser Location:  
 Outfall Location: 47°09'54"N 122°38'00"W (See Figure 2, Discharge 24, for general location.)

Parameter	Permit Limit	Monthly Average						Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.	
FLOW (MGD)	0.009	-	-	-	-	-	-	-
pH (S.U.)	-	-	-	-	-	-	-	-
Fecal Coliforms (#/100 mL)	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	-	-	-	-	-	-	-	-

\*Darrel Anderson, personal communication

Table 11. Permit limits and effluent quality for McNeil Island (Camp) WTW.

Treatment: Secondary - Intermittent  
 Population Served: 100  
 Receiving Water: Carr Inlet; northwest side of McNeil Island  
 Diffuser Location: 1300 feet offshore; approximately 60 feet deep  
 Outfall Location: (See Figure 2, Discharge 3G, for general location.)

Parameter	Permit Limit	Monthly Average										Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
FLOW (MGD)	0.055	0.039		0.012	0.008	0.056	0.058*					0.022*
pH (S.U.)	6.5-8.5	7.0		7.2	7.0	6.9-	7.0-	7.0-	7.0-	6.8-	7.0-	7.2-
Fecal Coliforms (#/100 mL)	200	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	80	20	52	41	14	33	20	13	17	20	20	103
Biochemical Oxygen Demand (mg/L)	60	9	29	18	5	18	10	12	12	9	12	23
												14

\*Flow meter was broken from December 20 through April 11.

Table 12. Permit limits and effluent quality for McNeil Island (Frison) WTP.

Treatment:	Secondary	Monthly Average												
Parameter	Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
FLOW (MGD)	0.314	0.05	0.06	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
pH (S.U.)	6.5-8.5	7.4-	7.4-	7.1-	7.0-	6.8-	6.9-	6.9-	6.9-	7.1-	7.1-	7.0-	7.0-	6.6-
Fecal Coliforms (#/100 mL)	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	80	33	20	27	25	21	26	16	9	21	21	32	15	22
Biochemical Oxygen Demand (mg/L)	80	7	5	6	7	19	104	9	4	5	9	86	9	23

Table 13. Permit limits and effluent quality for Olympia (LOTT) WTP.

**Treatment:** Secondary  
**Population Served:** 49,000  
**Receiving Water:** Lower Budd Inlet, southwestern side  
**Diffuser Location:** Two outfalls: #001 - 275 feet offshore, 10 to 20 feet deep, 30-inch diameter pipe with 11 ports; #002, 48-inch pipe at shoreline

Parameter	Permit Limit	Monthly Average											
		July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
FLOW (MGD)	16.3	7.69	7.48	7.33	7.45	11.78	10.6	11.04	10.03	10.40	8.94	9.68	9.31
pH (S.U.)	6.9	6.0-	6.3-	6.0-	5.9-	6.0-	6.0-	6.1-	6.1-	6.0-	6.1-	6.3-	6.2-
Fecal Coliform (#/100 mL)	200	40	15	2	3	10	3	4	30	164	12	17	96
Suspended Solids (mg/L)	30	15	12	10	9	10	8	9	8	9	5	7	8
Biochemical Oxygen Demand (mg/L)	30	21	20	13	16	16	15	14	16	13	12	15	16

Table 14. Permit limits and effluent quality for Rustlewood WTP.

Treatment:	Secondary
Population Served:	140
Receiving Water:	Pickering Passage; mid-way on west side
Diffuser Location:	575 feet offshore - 11-foot diffuser length; 25 feet deep at mean low tide
Cutfall Location:	$47^{\circ}16'55''N$ $122^{\circ}55'30''W$ (See Figure 2, Discharge 52, for general location.)

Table 15. Permit limits and effluent quality for Seashore Villa WTP.

Treatment:	Secondary - extended air
Population Served:	70
Receiving Water:	Lower Budd Inlet; east side
Diffuser Location:	No diffuser present; outfall is at a minimum of 10 feet at low tide - proposed plan
Outfall Location:	$46^{\circ}06'30''N$ $122^{\circ}53'35''W$ (See Figure 2, Discharge 53, for general location.)

Table 16. Permit limits and effluent quality for Shelton WTP.

Treatment: Secondary  
 Population Served: 7,700  
 Receiving Water: Hammersly Inlet near Miller Point  
 Diffuser Location: No diffuser present; outfall is a 20-inch concrete line; 1250 feet into bay;  
 45 feet below MSL  
 Outfall Location: 47°12'38"N  
 123°04'15"W (See Figure 2, Discharge 57, for general location.)

Parameter	Permit Limit	Monthly Average						May	June	Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.			
FLOW (MGD)	3.3	2.05	1.97	2.01	1.98	3.72	3.30	3.61	3.04	3.29
pH (S.U.)	6-9	6.5-	6.7-	6.8-	6.7-	6.8-	6.7-	6.7-	6.5-	6.7-
Fecal Coliform (#/100 mL)	200	1	2	6	2	3	5	2	3	2
Suspended Solids (mg/L)	30	6	7	12	9	14	13	12	14	11
Biochemical Oxygen Demand (mg/L)	30	2	8	2	2	2	3	2	2	3

Table 17. Permit limits and effluent quality for Steilacoom WTP.

Treatment: Primary  
 Population Served: 7,950  
 Receiving Water: South of Chambers Creek near the town of Steilacoom  
 Diffuser Location: Approximately 1000 feet out and 100 feet deep  
 Outfall Location: 47°10'37"N  
 122°25'32"W (See Figure 2, Discharge 59, for general location.)

Parameter	Permit Limit	Monthly Average						June	Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.		
FLOW (MGD)	1.35 (1.9)†	0.958	0.905	0.922	0.618	0.874		1.423	1.418
pH (S.U.)	6-9	6.8- 8.1	7.2- 8.4	7.1- 8.1	7.2- 8.3	7.0- 8.5	6.8- 8.4	7.1- 9.1	6.8- 8.7
Fecal Coliforms (#/100 mL)	700 (200)†	TNTC*	TNTC	667	TNTC	333	840	350	2200
Suspended Solids (mg/L)	75 (79)†	106	85	65	103	50	26	51	47
Biochemical Oxygen Demand (mq/L)	120 (153)†	196	151	117	150	77	108	70	68

\*Too numerous to count.

†Proposed effluent limits for the upgraded primary plant.

Table 18. Permit limits and effluent quality for Tamoshan WTP.

Treatment: Secondary  
 Population Served: 73 homes  
 Receiving Water: Mid-Budd Inlet; west side  
 Diffuser Location: 395 feet (from bulkhead)  
 Cutfall Location: 47°07'26"N  
 122°55'25"W (See Figure 2, Discharge 67, for general location.)

Parameter	Permit Limit	Monthly Average						May	June	Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.			
FLOW (MGD)	0.035	0.015	0.016	0.016	0.015	0.021	0.022	0.019	0.020	0.019
pH (S.U.)	6-9	-	-	-	-	-	-	-	-	-
Fecal Coliforms (#/100 mL)	200	<3	<23	<30	<23	<23	240	<23	0	<46
Suspended Solids (mg/L)	30	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	-	-	-	-	-	-	-	-	-
		16	19	22	40	21	24			

Memo to John Bernhardt from Tim Determan, subject: Effects of Tamoshan STP outfall on water quality at Silver Spit, Budd Inlet. "According to the plot of our field bearings, the location of the discharge appears to be about 100 m offshore or nearly half the distance shown in the design drawings. The high density and compact nature of the emergent dye patch suggested lack of a diffuser. The outfall line may be broken at this point, or the absence of a diffuser altogether."

Table 19. Permit limits and effluent quality for Taylor Bay Beach Club WTP.

Treatment:	Secondary													
Population Served:	36													
Receiving Water:	Near Taylor Bay north of Devil's Head													
Diffuser Location:														
Outfall Location:	47°11'04"N 122°46'34"W (See Figure 2, Discharge 68, for general location.)													
Parameter	Permit Limit	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
Flow (MGD)	0.029	-	-	-	-	-	-	-	-	-	-	-	-	-
pH (S.U.)	6-9	7.0	7.0	7.0	7.0	-	-	-	-	-	-	-	-	7.0
Fecal Coliforms (#/100 mL)	200	-	-	-	-	-	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	30	TR	TR	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	<0.5
Biochemical Oxygen Demand (mg/L)	30	2	2	2	2	2	2	2	2	2	2	2	2	2

TR = trace.

Table 20. Permit limits and effluent quality for Western Slopes (Tacoma #2) WTP.

Treatment: Primary  
 Population Served: 23,000  
 Receiving Water: East side of the Narrows; just south of the bridge  
 Diffuser Location: No diffuser present; outfall is approximately 80 feet deep (City of Tacoma datum), approximately 450 feet offshore  
 Outfall Location: 47°15'59"N  
 122°32'52"W (See Figure 2, Discharge 63, for general location.)

Parameter	Permit Limit	Monthly Average												Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
FLOW (MGD)	3.0	1.56	1.48	1.45	1.76	1.95	1.83	1.80	1.81	1.77	1.58	1.68	1.68	-
pH (S.U.)	6-9	6.9-	7.0-	7.0-	7.0-	6.9-	6.8-	6.9-	7.0-	7.0-	7.0-	7.0-	7.0-	-
Fecal Coliform (#/100 mL)	200	50	49	72	72	56	103	42	29	48	20	51	68	55
Suspended Solids (mg/L)	125	72	78	81	102	86	93	90	92	77	86	92	79	86
Biochemical Oxygen Demand (mg/L)	170	123	127	126	152	137	140	134	130	118	140	146	148	135

Table 21. Permit limits and effluent quality for Westside Sewer District WTP.

Treatment: Secondary - activated air sludge  
 Population Served: 7,122  
 Receiving Water: Near Sunset Beach; south of the Narrows  
 Diffuser Location: No diffuser present; outfall is 355 feet offshore from rock reef; 45 feet deep MSL  
 Outfall Location: 47°12'47"N 122°34'37"W (See Figure 2, Discharge 72, for general location.)

Parameter	Permit Limit	Monthly Average										Average
		July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
T-LOW (MGD)	0.75	0.489	0.479	0.462	-	-	-	-	-	-	-	0.449
pH (S.U.)	6-9	7.0-	7.0-	7.0-	7.0-	-	-	-	-	-	-	-
Fecal Coliforms (#/100 mL)	200	-	-	-	-	-	-	-	-	-	-	0.470
Suspended Solids (mg/L)	75	18	11	8	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand (mg/L)	30	31	37	20	-	-	-	-	-	-	-	-
					20	18	24	34	26	28	22	26

Table 22. Permit limits and effluent quality for Wollochet Harbor WTP.

Treatment:	Secondary																			
	Population Served:	Receiving Water:	Diffuser Location:	In Wollochet Bay; continuous with Hole Passage and The Narrows																
Parameter				Monthly Average			Permit Limit	Permit Limit			Monthly Average			Permit Limit	Permit Limit					
				July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average				
FLOW (MGD)				0.015																
pH (S.U.)				6-9												7.0				
Fecal Coliforms (#/100 mL)				200			TNTC	0												
Suspended Solids (mg/L)				30			27	54			12		22		23	27				
Biochemical Oxygen Demand (mg/L)				30			34	9			10				52	28				

(See Figure 2, Discharge 74, for general location.)

Table 23. Effluent monitoring requirements for the NPDES permitted discharges to Southern Puget Sound. Asterisks mark cases where the monitoring requirement was not being met. D = daily; W = weekly; M = monthly; Q = quarterly, C = continuously; WD = when discharging; 2 - 7 = number of times per week; B = bi-monthly.

Plant Name	Flow	Fecal Coliforms	BOD	Suspended Solids	pH
Beverly Beach	D*	M*			W*
Boise Cascade (industrial)	C		5	D	C
Boise Cascade (sanitary)		W*	B*	B	
Carlyon Beach	WD*	Q*	Q*	Q*	WD*
Chambers Creek		Not presently discharging			
Etloh Beach		Not presently discharging			
Fort Lewis	D	D	D	D	D
Hartstene Point	D	W*	M*	M*	5
Ketron Island		Not presently discharging			
McNeil Island (Camp)	C	3*	W	W	D*
McNeil Island (Prison)	C	3*	W	W	D
Olympia (LOTT)	D	D	W	W	D
Rustlewood	D*	M	M	M	5*
Seashore Villa	M*	M	Q*	Q*	W*
Shelton	D		3-5		D
Steilacoom		M	M	M	5
Tamoshan	D	M*	M*	M*	2*
Taylor Bay Beach Club	D*				W*
Western Slopes	D	5-7	W	W	5
Westside Sewer District	D	W*	W*	W*	5
Wollochet Harbor	M*	M	M	M	W*

Table 24. Biochemical oxygen demand loading into Southern Puget Sound.

Discharger Name (Location on Figure 2)	Average Flow (MGD)	Per- mitted Loading (#/d)	Observed or Estimated Loading (#/d)												Yearly Average (#/d)
			July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
Beverly Beach (3)	0.003	1	No data available												
Boise Cascade (industrial) (4)	4.194	6500	2609	3033	2806	2790	3408	3200	5760	3312	3837	2933	2262	3268	
Boise Cascade (sanitary) (4)	0.008	3	9	1	12	16	.1**	.2	.2**	.1**	.1	1	2		4
Carlyon Beach (6)	0.002														.2
Chambers Creek (11)	12.00†	3002													
Etloh Beach (76)	0.04†														
Fort Lewis (75)	4.4	1902	14												
Hartstene Point (21)	0.068														
Ketron Island (24)	0.009†														
McNeil Island (Camp) (39)	0.029	80													
McNeil Island (Prison) (33)	0.07														
Olympia (LOTT) (38)	9.31	4078	1347	1248	795	994	1572	1326	1289	1338	1128	895	1211	1242	14
Rustlewood (52)	0.077	22	2*	6*	9*	13*	15	7	13	10	5	0.4	1	6*	7
Seashore Villa (53)	0.015†	4	No data available												
Shelton (57)	2.77	826	34	131	34	33	62	55	90	51	82	46	44	46*	59
Steilacoom (59)	1.07	1351	1582	1140	900	773	561	964*	625*	807	1159	1348*	1584	1089*	1044
Tamoshan (67)	0.018	9	3**	3**	3**	3**	4**	4**	3	3	4		5	3	4
Taylor Bay Beach Club (68)	0.029†	7	No data available												
Western Slopes (63)	1.66	4253	1600	1568	1555	1838	2011	2277	2045	1952	1781	2067	1924	2074	1891
Westside Sewer Dist. (72)	0.470	188	126	148	77			75	71*	94*	133*	102*	110*	86*	102
Wollochet Harbor (74)	0.015†	4	No data available												
Total loading (sum of data available)	36.237	22,324	8204	8092	6891	7011	8484	8917	10,888	8367	9304	8288	8085	5124	8429

\*No flow data available for this month - loading calculations based on the average of the observed flows for the July 1983 - July 1984 period.

\*\*No BOD data available for this month - loading calculations based on the average of the observed BOD concentrations for the July 1983 - July 1984 period.

†Design flow.

Table 25. Suspended solids loading into Southern Puget Sound.

Discharger Name (Location on Figure 2)	Average Flow (MGD)	Per- mitted loading (#/d)	Observed or Estimated Loading (#/d)												Yearly Average (#/d)
			July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
Beverly Beach (3)	0.003	1	No data available	.1**	.1	.2**	.2**	.2**	.3						
Boise Cascade (industrial) (4)	4.194	9900	8541	7295	6806	7489	6729	5122	4287	5437	11,259	10,018	8001		7362
Boise Cascade (sanitary) (4)	0.008	3	No data available												.2
Carlyon Beach (6)	0.002														
Chambers Creek (11)	12.0†	3002													
Elijah Beach (76)	0.04†														
Fort Lewis (75)	0.068	14	1902	954	911	781	569	792	841	787	823	1258	972	959	858
Hartstone Point (21)	0.009†			11**	9**	7*	5**	28**	25**	26**	5	4	4	6*	12
Ketron Island (24)	0.029	80													
McNeil Island (Camp) (39)	0.029	80	17	10	14	17	14	16	5*	3*	4*	4	3	17	7
McNeil Island (Prison) (33)	0.07	80	962	749	611	559	983	707	829	669	781	12	19*	9	13
Olympia (LOTT) (38)	9.31	4078		9*	8*	10*	8*	9	8	11	17	4	2	2	8
Rustlewood (52)	0.077	22													
Seashore Villa (53)	0.015†	4	No data available												
Shelton (57)	2.77	826	103	115	201	149	434	358	361	355	302	232	222	208*	253
Steilacoom (59)	1.07	844	856	642	500	531	365	232*	455*	558	627	616*	1000	491*	573
Tamoshan (67)	0.018	9	4**	4**	4**	4**	5**	5**	2	2	5	5	8	3	4
Taylor Bay Beach Club (68)	0.029†	7	No data available												
Western Slopes (63)	1.68	3128	937	963	1000	1234	1262	1513	1374	1381	1162	1270	1212	1107*	1201
Westside Sewer Dist. (72)	0.470	469	73	44	31			26	82*	78*	150*	137*	106*	71*	80
Willochet Harbor (74)	0.C15†	4	No data available												
Total loading (sum of data available)	36.237	24,373	12,474	10,750	9970	10,568	10,628	8870	8208	9354	15,569	13,640	12,101	3190	11,072

\*No flow data available for this month - loading calculations based on the average of the observed flows for the July 1983 - July 1984 period.

\*\*No suspended solids data available for this month - loading calculations based on the average of the observed SS concentrations for the July 1983 - July 1984 period.

†Design flow.

Table 26. Classifications and their criteria for south Puget Sound waterbodies.

Waterbody	Criteria			
	Water Classification	Dissolved Oxygen (mg/L)	pH (S.U.)	Fecal Coliform (orgs/100 mL)
Pickering Passage	A	6	7.0 - 8.5	14
Hammersley Inlet/ Oakland Bay	A	6	7.0 - 8.5	14
Totten Inlet/ Skookum Inlet	A	6	7.0 - 8.5	14
Eld Inlet	A	6	7.0 - 8.5	14
Budd Inlet (Upper)	A	6	7.0 - 8.5	14
Budd Inlet (Lower)	B	5	7.0 - 8.5	100
Henderson Inlet	AA	7	7.0 - 8.5	14
Case Inlet	AA	7	7.0 - 8.5	14
Carr Inlet	AA	7	7.0 - 8.5	14

Table 1. South Puget Sound drainage basins, including all first-order streams or rivers discharging directly into Southern Puget Sound, their size, and the presence of current or historical gaging stations.

Drainage Basin	Area (mi <sup>2</sup> )	Gaging Station	Drainage Basin	Area (mi <sup>2</sup> )	Gaging Station
BUDD INLET (total)	313	--	CASE INLET (total)	76**	--
Deschutes River	270	Yes r.m. 2.4	Sherwood Creek (upper)	11.0 at r.m. 13.2	Yes r.m. 13.2
Percival Creek	9.8	No	Coulter Creek	14.1	No
Ellis Creek	2.2	No	Rocky Creek	18.3	No
Indian Creek	3.2 at r.m. 1.0	No	Dutcher Creek	5.8**	No
Unnamed Creeks (6)	27.8	No	Unnamed Creeks (19)	27	No
ELD INLET (total)	40**	--	CARR INLET/HENRIKSEN BAY (total)	86.4**	--
McLane Creek	11.5	No	Lackey Creek	3.5**	No
Simmons Creek	1.2	No	Winter Creek	16.5**	No (gaged on Huge Cr.)
Perry Creek	6.1	No	Burley Creek	16.1** at r.m. 0.0	Yes r.m. 0.3
Unnamed Creeks (4)	21.2	No	Purdy Creek	3.4 at r.m. 0.02	Yes r.m. 0.2
TOTTEN INLET (total)	41**	--	McCormick Creek	2.1**	No
Kennedy Creek	20.3	Yes r.m. 0.5	Warren Creek	3.7**	No
Schneider Creek	10.0	No	Artondale Creek	2.6**	No
Unnamed Creeks (2)	10.7	No	Sullivan Gulch	1.8**	No
SKOKUM INLET (total)	57.8*	--	Unnamed Creeks (15)	36.7	No
Skookum Creek	16.1	Yes r.m. 2.0	HENDERSON INLET (total)	53.5	--
Unnamed Creeks (3)	41.7	No	Woodard Creek	24.6 at r.m. 1.5	Yes r.m. 1.5
HAMMERSLEY INLET (total)	36.5**	--	Woodard Creek	3.8 at r.m. 3.6	Yes r.m. 3.6
M11 Creek + Isabe 1a Lake	31.7*	Yes r.m. 6.7	Unnamed Creeks (6)	25.0	No
Unnamed Creeks (4)	4.8	No	NISQUALLY REACH (total)	692**	--
OAKLAND BAY (total)	203.7*	--	McAllister River	648	Yes r.m. 21.8
Go Idsborough Creek	51.4 at r.m. 0.85	Yes r.m. 0.85, 5.9	McAllister Creek	25.5	No
She Iton Creek	1.2**	No	Unnated Creeks (4)	18.5	No
Johns Creek	18.6 at r.m. 3.0	Yes r.m. 3.0	TACOMA BASIN (total)	210**	--
Crabberry Creek	16.6 at r.m. 0.5	Yes r.m. 0.5	Chambers Creek	108.0	Yes r.m. 2.2
Deer Creek	13.3 at r.m. 0.6	Yes r.m. 0.6	Sequalitchew Creek	38.4	No
Malaney Creek	1.5**	No	Unnated Creeks (2)	63.6	No
Uncle John Creek	1.7**	No	Anderson Island	8.2*	No
Campbell Creek	4.6	No	McNeil Island	6.9*	No
Unnamed Creeks (2)	100.2	No	Hartstene Island	18.5*	No
SOUTH SOUND (total)	1892**		Squaxin Island	2.3*	No
Gauged area (total)	655	(35%)			
Ungauged area (total)	1269	(67%)			

\*SCS, 1969

\*\*Planner  
\*\*\*NOF (1981)

All other data from WDF (1981) except unnamed creeks

Table 24. Biochemical oxygen demand loading into Southern Puget Sound.

Discharger Name (Location on Figure 2)	Average Flow (MGD)	Permitted Loading (#/c)	Observed or Estimated Loading (#/d)			Yearly Average (#/d)
			July	Aug.	Sept.	
Beverly Beach (3)	0.003	1	No data available			
Boise Cascade (Industrial) (4)	4.194	6500	2603	303 <sup>3</sup>	2806	2790
Boise Cascade (sanitary) (4)	0.008	3	9	1	12	16
Carlton Beach (6)	0.002				.1**	.2
Chambers Creek (11)	12.0 <sup>t</sup>	300 <sup>t</sup>	Not presently discharging			
Erlon Beach (76)	0.04 <sup>t</sup>		Not presently discharging			
Fort Lewis (75)	4.4	1902	881	80 <sup>7</sup>	691	543
Hartstone Point (21)	0.068	14	4**	5**	3**	824
Ketron Island (24)	0.009 <sup>t</sup>		Not presently discharging			
McNeil Island (Camp) (39)	0.029	8C	3	3	1	2*
McNeil Island (Prison) (33)	0.07	8C	4	3	5	9
Olympia (LOTT) (38)	9.31	407 <sup>t</sup>	1347	124 <sup>t</sup>	795	994
Rustlewood (52)	0.077	2 <sup>t</sup>	2*	6*	9*	13*
Seashore Villa (53)	0.015 <sup>t</sup>	4	No data available			
Shelton (57)	2.77	826	34	131	34	33
Steilacoom (59)	1.07	1351	1582	114 <sup>t</sup>	900	773
Tamoshan (67)	0.018	5	3**	3**	3**	561
Taylor Bay Beach Club (68)	0.029 <sup>t</sup>	7	No data available			
Western Slopes (63)	1.68	4253	1600	156 <sup>t</sup>	1555	1838
Westside Sewer Dist. (72)	0.470	18 <sup>t</sup>	126	14 <sup>t</sup>	77	2011
Wollochet Harbor (74)	0.015 <sup>t</sup>	4	No data available			
Total loading (sum of data available)	36.237	22,324	8204	8092	6891	7011
						8484
						8917
						10,888
						8367
						9304
						8288
						8085
						5124
						8429

\*No flow data available for this month - loading calculations based on the average of the observed flows for the July 1983 - July 1984 period.

\*\*No BOD data available for this month - loading calculations based on the average of the observed BOD concentrations for the July 1983 - July 1984 period.

<sup>t</sup>Design flow.

Table 25. Suspended solids loading into Southern Puget Sound.

Discharger Name (Location on Figure 2)	Average Flow (MGD)	Per- mitted Loading (#/d)	Observed or Estimated Loading (#/d)						May	June	Yearly Average (#/d)
			July	Aug.	Sept.	Oct.	Nov.	Dec.			
Beverly Beach (3)	0.003	1	No data available						10,018	8001	7362
Boise Cascade (industrial) (4)	4.194	9900	8541	7295	6806	7489	6729	5122	4287	5437	11,259
Boise Cascade (sanitary) (4)	0.008	3	No data available								
Carlyon Beach (6)	0.002										
Chambers Creek (11)	12.0†	3002	No presently discharging	1**	.1	.2**	.2**	.2**			
Elwha Beach (76)	0.04†		No presently discharging								
Fort Lewis (75)	4.4	1902	954	911	781	792	841	787	823	1258	972
Hartstene Point (21)	0.068	14	9**	7*	5**	28**	25**	26**	5	4	4
Ketron Island (24)	0.009†		No presently discharging								
McNeil Island (Camp) (Prison) (33)	0.029	80	7	10	14	3	7	16	5*	3*	4
Olympia (LOTT) (38)	9.31	4078	962	749	611	559	983	707	829	669	781
Rustlewood (52)	0.077	22	9*	8*	10*	8*	9	8	11	17	4
Seashore Villa (53)	0.015†	4	No data available								
Shelton (57)	2.77	826	103	115	201	149	434	358	355	302	232
Steilacoom (59)	1.07	844	856	642	500	531	365	232*	455*	558	627
Tanoshan (67)	0.018	9	4**	4**	4**	4**	5**	5**	2	2	2
Taylor Bay Beach Club (68)	0.029†	7	No data available								
Western Slopes (63)	1.68	3128	937	963	1000	1234	1262	1513	1374	1381	1162
Westside Sewer Dist. (72)	0.470	469	73	44	31	26	82*	78*	150*	137*	1270
Wollochet Harbor (74)	0.015†	4	No data available								
Total loading (sum of data available)	36.237	24,373	12,474	10,750	9970	10,568	10,628	8870	8208	9354	15,569

\*No flow data available for this month - loading calculations based on the average of the observed flows for the July 1983 - July 1984 period.

\*\*No suspended solids data available for this month - loading calculations based on the average of the observed SS concentrations for the July 1983 - July 1984 period.

†Design flow.