JOHN SPELLMAN
Governor

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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MEMORANDUM
May 22, 1981

To: John Bernhardt

From: Lynn Singleton and Joseph Joy

Subject: Water Quality Index (WQI) Analysis of State Waterway Segments for the 1981 SEA

Introduction

The 1981 Water Quality Index (WQI) analysis is very similar to the analysis performed in 1980. The WQI software developed by Ray Peterson, EPA, Region X, was again used to evaluate the water quality data of the state. Waterway segments were evaluated in the following ten categories:

1. Temperature
2. Dissolved Oxygen
3. pH
4. Bacteria (fecal coliform)
5. Trophic (nutrients)
6. Aesthetics (primarily turbidity)
7. Suspended Solids
8. Radioactivity
9. Organic Toxicity
10. Ammonia Toxicity

Water Quality Index (WQI) Analysis

A WQI value is an abstract number without units, relative to itself. Criteria for WQI determination are based upon existing state standards, where possible, and EPA criteria where state standards are non-specific. A WQI score falling between 0-20 meets the goals of the Federal Water Pollution Control Act. Scores between 20 and 60 are considered marginal with respect to meeting the Act and values greater than 60 are unacceptable.

WQI values may be generated from data gathered during one year; however, data from multiple years may also be used. The multiple-year option, which gives the strongest data base, was chosen for this evaluation. As an initial step this option calculates WQI values from all data, then aggregates scores by month and parameter. The mean of the three highest consecutive months is taken as the individual "category" WQI. Another separate evaluation is made which first averages all WQI categories for a given month. Then, a penalty factor is added for any category exceeding acceptable standards (20.0). This causes the resulting WQI to be larger than the arithmatic mean would have been for that month. The weighted WQIs of the highest three consecutive months are then meaned. The resulting "Overall Index Rating" is considered a reflection of the

consecutive three-month period having the majority of the water violations. Due to the averaging process, the Overall Index Rating may fall below 20.0 and still contain violations in one or more category WQIs. Inspection of all category WQIs will provide detailed information for specific areas of interest.

The WQIs were developed from two sources of routine monitoring data collected within the state. First, WQI values were calculated for those stations routinely monitored during the last five years, October 1, 1975 to September 30, 1980. Second, the data base for historical stations, those stations not currently in the surface water quality monitoring network, was evaluated for the ten-year period extending from October 1, 1970 to September 30, 1980. Inclusion of the historical stations broadened the scope of the data base. Each station, regardless of record period had to meet the following criteria before it could be considered: Marine stations were required to have a data base containing information gathered from three or more months per year. This was due to the seasonality of sample procurement. All other stations were required to contain a minimum of one monthly sampling per quarter with the exception of a few stations which were established in 1980.

The WQI values for a segment were determined from the stations located within it. If only one station was present in the segment, the WQIs generated for that station became the values for the segment. If more than one station occurred in the segment, the average WQI values were calculated (a method used primarily for the marine stations) or the WQIs of the stations were weighted by the drainage they represented. Drainage area was chosen as the weighting factor because it is constant from year to year and it can roughly be related to flows in similar geographic areas. This method allows lesser tributaries a smaller impact upon the WQIs for a segment and the larger streams a greater impact. Areal drainage values were obtained for the individual stations from the River Mile Indices (Hydraulics and Hydrology Committee) and the USGS Water Data Reports, when possible. If no drainage information was available for a given location, values were estimated by linear interpolation from the closest upstream and downstream points having information.

The use of the Overall Index Rating may mask individual areas of concern. Extreme situations are removed by the averaging process. A mean could fall below 20.0 even though violations occurred. A data base of five or ten years will also lessen any recent improvements or degradations as the entire data base is all averaged by month and treated as one year.

Station location is also an important factor in the detection of problem areas. Therefore, the use of this index should not be substituted for good judgement and knowledge about specific areas where problems are known to exist.

Table 1 contains the ranking of all segments having an overall index rating of 13.0 or more. This is perhaps the most important information given in this report short of a detailed analysis. Recent Departmental interest promoted the inclusion of separate rankings for each WQI category. These rankings may be found in Tables 2 through 10.

A detailed listing of the water segment analysis including all segments and stations utilized is presented in Table 11. This table should be referred to for any detailed information on data used to develop the segment ranking given in Tables 1 through 10. The $\bar{x}$ indicates the mean WQIs for multiple-station segments. Parentheses indicate omission of that category's WQI from the calculation of the "Overall Index Rating". For example, the marine water stations are naturally high in nutrients; therefore, if included, the trophic category would have erroneously elevated the scores of all saltwater stations.

The suspended solids criteria have been adjusted from the criteria used to generate the 1980 values. They may now be used in the calculations of the overall index rating. An option also was added which allows the user to designate waters influenced by glaciation. This option sets the aesthetics (turbidity) and suspended solids WQI values greater than 25.0 to 25.0. A score of 25 still shows that water quality violations are occurring, but it does not excessively weight glacial-fed waters. Segments designated as glacial-fed are noted in the tables.

Tables 12 and 13 provide descriptions of the current and historical monitoring stations presented in Table 11.

Comments

As with most analyses of this nature, further refinement efforts are ongoing and will be incorporated into subsequent analyses. Inclusion of metal toxicity data in the calculation of the Overall Index Rating may be attained in future analyses if refinements in the metals criteria are made. The metals toxicity WQIs were included in this analysis for intradepartmental use only. The realness of water quality violations (scores of 20.0 or more) is subjective and the standards are probably inappropriate for the Pacific Northwest. Violation tends to be where data exist as evidenced by Table 10 where 85% of the stations have metal toxicity WQI values greater than 20.0. The problem is typified in your memo to John Arnquist (April 13, 1981) regarding mercury levels at Bridgeport (61A070) (see attachments). The attached memo shows that the development of appropriate criteria has greater implications than use in the WQI analysis alone and therefore, input from others is needed.

A word of caution needs to be expressed to those who wish to compare WQI values of previous analyses to the current values. Small changes due to natural variability are to be expected from year to year. Large changes,

if present, may be attributable to changing conditions or to the deletion of a year's data and/or the addition of one more year's data. It is impossible to determine the probable cause of such a change without inspecting the data base. Because of this, inferrences about trends using WQIs in this way should be avoided. Trends based upon WQIs using more sophisticated statistical procedures are possible and will be included in future WQI analyses.

For informational reasons, we have prepared a repetition of the 1980 WQI analysis in another memo. The repetition uses the 1981 criteria and modifications on the data base used in the 1980 analysis so that the two will be comparable. If differences between years are of interest, in light of the above caution, the modified 1980 version should be consulted and not the version contained in the original memo from Lynn Singleton to John Bernhardt, June 6, 1980.

These ongoing efforts are aimed at providing a consistent and accurate method of waterway segment assessment in Washington State.

LRS:JJ:cp

Attachments

cc: Dick Cunningham
Bill Yake
Bob Monn
Rod Sakrison
Allen Moore
Joan Thomas
Glen Fiedler
Bruce Cameron
Dick Burkhalter
Norm Glenn
Chuck Clark
John Stetson
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Claude Sappington
Gene Asselstine
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Bob McCormick
Stew Messmann
Russ Taylor
Clar Pratt

MEMORANDUM

CHECK
INFORMATON ____
FOR ACTION ____
PERMIT ____
OTHER ____

TO: John Bernhardt

FROM: Lynn Singleton and Joe Joy

SUBJECT: Modification of 1980 WQI Analysis Using 1981 Criteria

DATE: May 22, 1981

State of Washington Department of Ecology

The following tables are a modification of portions of the 1980 WQI analysis presented in the June 6, 1980 memo to you from Lynn Singleton. The primary reason for repeating the analysis was to give individuals using the WQI comparable analyses between 1980 and 1981. Slight changes were made in the WQI criteria, data base, and categories, which collectively make comparisions between the 1980 and 1981 analyses difficult. The data base source, basic assumptions, and criteria should remain virtually unchanged for future analyses thereby making similar repetitions unnecessary.

Table 1 corresponds to Table 1 of the June memo where the segments are ranked by their overall index rating. The second attached table, labeled Table 3, is the detailed WQI analysis and corresponds to Table 3 in the previous memorandum.

LRS:JJ:cp

Attachments

cc: Dick Cunningham
Bill Yake
Bob Monn
Rod Sakrison

Table 1. Reranking of segments having overall index values of 10.0 -- 1980 WQI data base using 1981 WQI curves and methodologies.

Rank	Segment	WQI	Basin
1	16-34-02	100.0	S.F. Palouse and Tribs.
2	18-39-06	61.1*	Wilson Creek and Tribs.
3	15-32-02	56.5	Walla Walla River and Tribs.
4	19-41-01	54.3	Crab Creek and Tribs.
5	06-13-03	54.0	Budd Inlet
6	15-32-03	53.6	Touchet River and Tribs.
7	16-34-01	51.7	Palouse River and Tribs.
8	24-56-03	47.2	Hangman Creek and Tribs.
9	15-32-04	45.9*	Mill Creek and Tribs.
10	03-07-09	45.5	Port Gardner and Inner Everett Harbor
11	04-09-09	41.0**	Duwamish Waterway and River to limit of Tidal Infl.
12	10-22-04	39.2	Inner Grays Harbor east of long. 123°59'W to Cosmopolis and Including Tidal Waters of the Wishkah and Hoquiam Rs.
13	17-35-03	37.0*	Grande Ronde River and Tribs.
14	25-00-04	36.8	South Hood Canal
15	18-37-01	36.1	Yakima R. and Tribs. from Mouth to Sunnyside Dam Bridge
16	04-08-02	33.4	Lake Washington and Sammamish Lk. Feeder Streams
17	01-01-06	32.7	Sumas River and Tribs. from Canadian Border to Hdwtrs.
18	05-10-01	32.4	Inner Commencement Bay to Puyallup R.M. 1
19	10-23-13	30.2	Chehalis River from Scammon Cr. to Newaukum River
20	24-54-01	26.7	Spokane River from Mouth to Hangman Creek
21	17-35-02	26.6	Tucannon River and Tribs.
22	13-28-03	26.3*	Salmon Creek and Tribs.
23	01-01-04	25.1	Nooksack River and Tribs. from Mouth to Confl. with Maple Creek
24	18-37-03	24.6*	Wide Hollow Creek and Tribs.
25	04-09-99	24.2*	Undesignated Tribs. to Puget Sound; Des Moines Cr.; Miller Cr.
26	01-01-99	23.5*	Undesignated Tribs. to Marine Waters: Whatcom Creek
27	10-22-12	22.4	Chehalis River from Cosmopolis to Porter Creek
28	05-10-02	22.3	Commencement Bay
29	03-07-19	22.1	Pilchuck River and Tribs.
30	11-24-02	22.0	Willapa River and Tribs. from Mouth to Limit of Tidal Infl.
31	10-22-10	21.2*	Wildcat Creek and Tribs.

Table 1. - Continued

Rank	Segment	WQI	Basin
32	05-10-03	21.0	Puyallup River from R.M. 1 to Kings Creek
33	23-59-02	21.0	Colville River and Tribs
34	13-28-04	20.9*	Burnt Bridge Cr. and Tribs.
35	05-10-05	20.7	White River and Tribs. from Mud Mt. Dam to Headwaters
36	11-24-03	20.0	Willapa River and Tribs. from Limit of Tidal Infl. to Headwaters
37	05-12-07	19.7*	Chambers Creek and Clover Creek and Tribs.
38	22-49-02	19.6	Okanogan River Mouth to Lake Osoyoos
39	23-60-04	18.4	Kettle River and Tribs.
40	26-00-05	17.8	Snake River and Tribs. from Confl. w/Columbia River to the WA/OR Border
41	03-05-05	17.7	S.F. Stillaguamish to Mouth of Canyon Creek
42	24-57-04	17.3	Spokane River from Hangman Cr. to WA/ID Border
43	01-01-03	17.2	Inner Bellingham Bay and Whatcom Waterway
44	04-08-01	16.3*	Ship Canal and Lake Union
45	23-62-05	15.3	Pend Oreille River and Tribs.
46	03-05-02	15.1	Stillaguamish River and Tribs. from Mouth to Confl. of N and S Forks
47	04-09-05	14.9*	Elliott Bay
48	09-17-04	14.7*	Chimacum Creek and Tribs.
49	12-26-05	14.7*	Coweman River and Tribs.
50	03-07-10	14.6	Snohomish River and Tribs. to Confl. of Skykomish and Snoqualmie Rivers
51	26-00-01	14.4	Columbia River from Mouth to Lower Bradford Island
52	10-23-15	13.5	Chehalis River from Newaukum River to Headwaters
53	18-37-02	13.4	Yakima River and Tribs. from Sunnyside Dam Br. to Wilson Cr.
54	24-55-02	13.3	Little Spokane River and Tribs.
55	14-30-01	13.2	Klickitat River and Tribs.
56	04-09-06	13.1*	Green River and Tribs. from Limit of Tidal Infl. to Flaming Geyser Park
57	02-03-10	13.0	Samish River and Tribs.
58	02-03-06	12.1	Skagit River and Tribs. from Mouth to WRIA #4 Boundary
59	10-22-08	11.8*	Wynoochee River and Tribs.
60	10-23-14	11.8*	Newaukum River and Tribs.

Table 1. - Continued

Rank	Segment	WQI	Basin
61	23-52-03	11.8	Sanpoil River and Tribs.
62	03-06-07	11.7	Saratoga Passage and Adjacent Waters
63	11-24-04	11.7	Willapa Bay Tribs.
64	06-11-01	11.6	Nisqually River and Tribs.
65	10-21-01	11.2	Queets River and Tribs.
66	05-10-08	11.1*	South Prairie Creek and Tribs.
67	21-47-101	10.9	Lake Chelan
68	03-07-08	10.6*	Possession Sound
69	13-28-05	10.3*	Washougal River and Tribs.
70	25-00-03	10.3	North Hood Canal

*WQI based upon historical data

**WQI based upon intensive survey data

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

Table 3. Water segment analysis using the Water Quality Index of the Environmental Protection Agency, Region X. If one station per segment is present, the WQI values for that station are the values for the segment. If there are multiple stations in a segment, the $\bar{X}$ equals the mean of all stations within the segment.

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX 5/	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER 1/	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX.	AMMO TOX.	RATING	
NOOKSACK CONSOLIDATED PLANNING AREA														
01-01-01	Drayton Harbor													
	DRA 001		9.7	9.5	10.4	16.7	(22.5) 2/	2.2	* 3/	*	*	2.3	5.6	
01-01-02	Bellingham Bay													
	$\bar{X}$ =		5.5	8.5	10.2	7.3	(20.6)	2.3	*	*	*	1.2	5.0	
	BLL 008		4.8	11.5	8.0	9.1	(21.5)	2.4	*	*	*	1.3	5.7	
	BLL 009		6.2	5.5	12.2	5.5	(19.6)	2.1	*	*	*	1.0	4.4	
01-01-03	Inner Bellingham Bay and Whatcom Waterway													
	BLL 006		7.4	19.7	22.4	21.9	(20.1)	2.8	*	*	*	1.9	17.2	Some recent improvements have occurred which are not reflected in the WQI for this segment. Bact - Georgia Pacific Corp. Pulp Mill, Urban Runoff D.O. - Georgia Pacific Corp. Sediment Oxygen Demand
01-01-04	Nooksack R. and tribs. from mouth to confluence with Maple Cr.													
	$\bar{X}$ =		8.4	6.0	7.0	35.3	14.0	16.3	14.8	*	*	2.7	25.1	
	01A050		8.8	7.7	4.8	49.7	11.9	15.2	12.8	*	*	0.0	31.7	
	01A120		7.9	3.8	9.9	15.9	16.9	17.8	17.4	*	*	4.9	16.2	
01-01-05	Nooksack R., and tribs. above confluence with Maple Cr.													
01-01-06	Sumas R. and tribs. from Canadian Border to headwaters													
	01D070		17.0	16.9	4.1	47.0	24.4	16.3	13.3	*	*	8.2	32.7	Temp - Low flows, lack of sufficient vegetative cover. Bact - Trophic: Agricultural Runoff.

1/ See Table 4 for description of current monitoring stations and Table 5 for descriptions of the (H) historical stations.
2/ Parenthesis indicate that parameter was not used in the generation of the Overall Index Rating.
3/ *Indicates insufficient data.
4/ (H) indicates stations are historical and not part of the current DOE Water Quality Monitoring Network.
5/ A weighted rating determined from the highest three consecutive monthly WQI scores. See text for detailed explanation.

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORC TOX	AMMO TOX		
01-01-07	Marine water, undesignated													
	BLL 010		4.2	8.3	7.3	3.8	(21.1)	1.5	*	*	*	0.7	3.5	
01-01-99	Undesignated tribs. to marine waters: Whatcom Cr.													
	$\bar{X}$ =		17.8	10.7	5.0	59.0	14.5	6.6	*	*	*	2.7	23.5	
	01E050(H) a/		18.4	7.2	5.3	59.0	15.5	10.2	*	*	*	3.4	34.8	
	01E070(H)		17.2	14.5	4.7	*	13.1	2.7	*	*	*	2.0	8.1	
SKAGIT CONSOLIDATED PLANNING AREA														
02-03-01	Samish Bay													
	$\bar{X}$ =		7.6	10.0	10.5	3.9	(14.9)	3.8	*	*	*	1.4	6.2	
	SAM 001 (H)		7.2	9.3	9.8	3.9	(14.9)	3.5	*	*	*	1.4	5.4	
	SAM 002 (H)		8.0	10.7	11.2	*	*	4.0	*	*	*	*	7.0	
02-03-02	Padilla Bay													
	PAD 001 (H)		5.1	12.2	5.7	16.0	(23.8)	4.3	*	*	*	1.1	5.3	
02-03-03	Fidalgo Bay													
	PAD 002 (H)		4.6	11.8	5.9	10.2	(25.0)	2.9	*	*	*	0.6	5.2	
02-03-04	Guemes Channel													
	PAD 003 (H)		1.3	10.7	5.8	21.2	(25.7)	3.6	*	*	*	0.0	9.6	
02-03-05	Skagit Bay and Similk Bay													
	SKG 001		3.3	15.0	3.9	6.6	(19.3)	3.3	*	*	*	0.1	5.5	
02-03-06	Skagit R. & tribs. from mouth to WRIA #4 boundary													
	03A060		8.9	5.6	7.0	14.8	7.1	9.5	25.0	*	*	0.4	12.1	
02-03-08	Marine water, undesignated													
02-03-09	Swinomish Channel													
02-03-10	Samish R. and tribs.													
	03B050		12.5	4.3	6.0	28.0	11.7	10.4	7.3	*	*	1.2	13.0	
02-03-99	Undesignated tribs. marine waters													
02-04-07	Skagit R. tribs. from WRIA #4 boundary to Canadian Border													
	$\bar{X}$ =		3.7	2.8	6.5	6.8	5.3	9.0	5.5	*	*	0.6	5.5	
	04A060		4.9	3.0	4.0	6.3	6.0	10.8	5.8	*	*	0.1	4.8	
	04A100		1.4	1.6	12.4	9.0	2.7	3.5	2.3	*	*	1.7	6.1	
	04B070		5.3	5.7	6.9	3.3	4.1	5.3	1.7	*	*	0.0	3.6	
	04C070		3.1	3.0	3.9	5.8	8.7	15.0	13.3	*	*	0.4	7.8	

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES									OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG. TOX	AMMO TOX		
SNOHOMISH ISLAND-STILLAGUAMISH CONSOLIDATED PLAN													
03-05-01	Port Susan												
	SUZ 001		7.0	11.7	8.1	4.2	(20.1)	1.7	*	*	*	1.0	4.4	
03-05-02	Stillaguamish R. and tribs. from mouth to confluence of N.F. and S.F.												
	05A070		13.3	9.4	5.7	19.9	10.1	17.2	24.9	*	*	0.0	15.1	
03-05-03	N.F. Stillaguamish R. from mouth to Squire Cr.												
	05B070		7.8	5.5	4.8	13.0	9.2	14.9	14.3	*	*	0.8	7.1	
03-05-04	N.F. Stillaguamish R. from Squire Cr. to headwaters												
03-05-05	S.F. Stillaguamish R. to mouth of Canyon Cr.												
	05A090		11.2	6.9	6.7	26.1	9.6	27.0	23.4	*	*	0.0	17.7	
03-05-06	S.F. Stillaguamish R. from Canyon Cr. to headwaters												
	05A110 (H)		5.7	4.1	4.4	*	13.2	30.2	*	*	*	0.6	7.8	
03-06-07	Saratoga Passage and adjacent harbors												
	$\bar{X}$ =		4.6	22.8	7.7	11.7	(18.0)	2.2	*	*	*	0.5	11.7	D.O. - Natural upwelling (?).
	PNN 001		5.3	29.5	8.5	7.7	(13.9)	3.3	*	*	*	0.9	14.4	
	SAR 003		4.7	15.2	8.1	24.8	(19.2)	1.4	*	*	*	0.3	10.4	
	HLM 001		3.9	23.8	6.5	2.5	(21.0)	1.9	*	*	*	0.4	10.3	
03-06-18	Marine waters undesignated												
03-06-99	Undesignated tribs. to marine waters												
03-07-08	Possession Sound												
	$\bar{X}$ =		6.2	22.4	5.6	8.3	(19.8)	2.9	*	*	*	0.0	10.6	
	PSS 001 (H)		7.5	22.1	6.0	*	*	4.1	*	*	*	*	10.7	
	PSS 002 (H)		6.0	17.5	5.2	16.6	(19.8)	2.3	*	*	*	0.0	8.4	
	PSS 003 (H)		6.3	26.6	5.8	0.0	*	2.3	*	*	*	*	12.0	
	PSS 004 (H)		4.9	23.4	5.3	*	*	3.0	*	*	*	*	11.5	
03-07-09	Port Gardner & Inner Everett Harbor												
	$\bar{X}$ =		15.3	8.0	22.2	57.2	(18.0)	4.1	*	*	*	0.9	45.5	Bact. - Combined sewer overflows, Weyerhaeuser Co. and Scott Paper Co. pulp mills, urban runoff.
	PSS 015		14.4	7.4	23.3	53.9	(17.1)	3.5	*	*	*	1.0	53.9	
	PSS 020		16.1	8.5	21.2	60.6	(18.8)	4.6	*	*	*	0.8	37.1	

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
03-07-10	Snohomish R. and tribs. to confluence of Skykomish & Snoqualmie R.													
	07A090		16.9	7.9	9.2	23.8	5.0	7.2	8.6	*	*	1.2	14.6	Temp. - Lack of sufficient vegetative cover. Bact. - Agricultural runoff (dairy wastes, etc.).
03-07-11	Skykomish R. to mouth of May Cr.													
	07C070		10.8	6.1	6.4	10.9	3.1	5.5	5.9	*	*	0.0	5.4	
03-07-12	Skykomish R. from May Cr. to headwaters													
	07C120		6.3	3.9	14.1	6.4	2.3	6.3	4.1	*	*	0.0	4.8	
03-07-13	Snoqualmie R. & tribs. from mouth to Twin Falls State Park on S.F.													
	$\bar{X}$ =		10.4	7.4	7.4	16.1	3.7	6.5	7.3	*	*	0.0	6.1	
	07D070		12.5	7.2	7.7	15.4	4.1	7.0	8.7	*	*	0.0	6.7	
	07D130		7.0	7.7	7.0	17.2	3.0	5.6	5.1	*	*	0.1	5.1	
03-07-14	M.F. Snoqualmie R. from mouth to R.M. 6.1													
03-07-15	N.F. Snoqualmie R.													
03-07-16	M.F. Snoqualmie R. R.M. 6.1 to headwaters													
03-07-17	S.F. Snoqualmie R. from Twin Falls State Park to headwaters													
03-07-19	Pilchuck R. & tribs.													
	07B055		24.5	6.2	6.3	31.2	7.2	13.1	16.8	*	*	2.3	22.1	Temp. - Summer low flows. Bact. - Agricultural runoff.
CEDAR-GREEN CONSOLIDATED PLANNING AREA														
04-08-01	Ship Canal & Lake Union													
	$\bar{X}$ =		22.2	18.3	8.5	27.0	7.0	2.3	7.4	*	*	1.9	16.3	Temp. - High residence time of water.
	PSB 006 (H)		23.2	18.0	8.3	39.3	6.1	3.1	*	*	*	2.5	22.8	D.O. & Bact. - Combined sewer overflows, urban runoff.
	PSB 007 (H)		21.6	17.8	10.1	16.1	6.3	1.7	*	*	*	1.9	12.5	
	PSB 008 (H)		21.8	19.1	7.0	25.8	8.6	2.1	7.4	*	*	1.4	13.5	
04-08-02	Lake Washington and Sammamish Lake Feeder Streams													
	08B070		18.8	11.0	5.2	50.0	23.9	6.9	3.7	*	*	0.7	33.4	Bact. - Agricultural runoff, septic tank seepage. Temp. - Stream originates from shallow lake.

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
04-08-03	Cedar R. and tribs.													
	$\bar{X}$ =		6.7	3.8	3.8	13.5	-8.1	10.5	4.4	*	*	0.9	4.9	
	08C070		9.5	3.8	3.9	17.3	10.0	15.8	5.6	*	*	1.3	6.3	
	08C110		2.2	3.7	3.7	7.6	5.0	2.3	2.5	*	*	0.2	2.6	
04-08-101	Lake Washington													
	$\bar{X}$ =		16.7	9.2	4.6	11.3	6.3	1.6	*	*	*	0.1	7.1	
	LWA 001 (H)		19.1	8.4	5.1	4.1	4.1	2.1	*	*	*	0.4	7.1	
	LWA 002 (H)		14.5	9.6	3.8	7.5	5.6	1.6	*	*	*	0.0	4.6	
	LWA 003 (H)		16.5	9.6	5.0	22.4	9.2	1.1	*	*	*	0.0	9.6	
04-08-102	Sammamish Lake													
04-09-05	Elliott Bay													
	$\bar{X}$ =		4.3	14.9	2.8	28.8	(23.7)	3.6	*	*	*	0.1	14.9	Bact. - Urban runoff, combined sewer overflows.
	ELB 001 (H)		4.7	11.3	2.4	16.4	(24.1)	2.5	*	*	*	0.0	4.8	
	ELB 002 (H)		4.2	15.6	2.6	36.2	(23.2)	2.7	*	*	*	0.2	19.9	Organic toxics - Not included in data base; however, other work indicates a problem is present.
	ELB 003 (H)		4.0	17.8	3.4	33.8	(23.7)	5.6	*	*	*	0.2	20.1	
04-09-06	Green R. & tribs. from limit of tidal influence to Flaming Geyser Park													
	$\bar{X}$ =		12.9	8.6	5.2	19.7	19.2	12.4	*	*	*	1.0	13.1	Bact. Trophic - Cattle and other animal wastes, urban runoff, combined sewer overflows.
	09A090 (H)		17.1	12.3	5.8	27.1	20.0	17.4	*	*	*	2.2	16.9	
	09A110 (H)		12.3	4.9	5.3	22.4	19.5	9.3	*	*	*	0.0	13.6	
	09A130 (H)		9.6	9.2	4.8	*	*	*	*	*	*	*	6.4	
	09B070 (H)		7.0	7.1	3.9	26.0	15.0	5.1	*	*	*	2.5	14.4	
	09B090 (H)		7.1	5.7	4.0	20.0	16.1	6.0	*	*	*	0.2	8.6	
04-09-07	Green R. & tribs. from Flaming Geyser Park to headwaters													
	09A190		8.1	5.3	4.1	7.3	9.8	27.2	4.1	*	*	0.6	6.4	
04-09-09	Duwamish Waterway and River to limit of tidal influence													
	$\bar{X}$ =		18.4	26.5	3.0	43.8	64.2	2.0	(3.5)	*	*	8.0	41.0	D.O. - Saltwater density gradient.
	Intensive survey stations													Trophic; Bact. - Renton STP, combined sewer overflows.
	Salt water		12.3	23.0	3.0	67.5	(48.5)	2.0	*	*	*	0.9	12.0	Organic toxics - not in data base; however, other work indicates a problem is present.
	Fresh water		24.6	30.0	3.0	20.0	80.0	2.0	(3.5)	*	*	4.0	43.0	
04-09-99	Undesignated tribs. to Puget Sound: Des Moines Cr., Miller Cr.													
	$\bar{X}$ =		8.5	9.7	4.5	*	40.3	18.2	17.8	*	*	1.3	24.2	Trophic - Urban runoff.
	09C090 (H)		9.0	10.7	4.6	*	37.5	26.0	*	*	*	0.9	22.8	
	09D070 (H)		7.3	9.1	4.9	*	41.8	15.6	17.8	*	*	1.8	26.6	
	09D090 (H)		9.3	9.3	3.9	*	41.6	13.0	*	*	*	1.2	23.1	

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
PUYALLUP CONSOLIDATED PLANNING AREA														
05-10-01	Inner Commencement Bay to Puyallup R.M. 1													
	$\bar{X}$ =		4.7	12.2	6.4	54.2	(23.2)	8.5	*	*	*	1.2	32.4	Bact., D.O. - Urban runoff, combined sewer overflows, agricultural runoff, Tacoma STP by way of the Puyallup R. Organic toxics - not in data base; however, other work indicates problem is present.
	CMB 006		4.5	13.0	4.8	40.6	(23.2)	4.1	*	*	*	1.5	22.0	
	CMB 010		4.9	11.3	7.9	67.7	(23.1)	12.8	*	*	*	0.8	42.7	
05-10-02	Commencement Bay													
	CMB 003		4.0	11.8	5.0	40.3	(22.9)	2.8	*	*	*	5.4	22.3	Bact., D.O. - Urban runoff, combined sewer overflows, agricultural runoff, Tacoma STP by way of the Puyallup R. Organic toxics - not in data base; however, other work indicates problem is present.
05-10-03	Puyallup R. from R.M. 1 to Kings Cr.													
	$\bar{X}$ =		7.3	5.6	5.7	24.5	16.3	24.2	23.9	*	*	1.2	21.0	Monitoring station location does not reflect the severity of the problem. Bact., Trophic - Puyallup and Tacoma STPs. Aesthetic - turbidity from White R.
	10A050		7.8	5.7	6.3	24.8	17.2	23.9	25.0	*	*	1.1	23.9	
	10A070		6.9	5.8	5.5	26.4	15.9	24.3	23.5	*	*	1.1	19.6	
	10A110		3.9	3.9	4.1	12.4	13.6	25.0	19.7	*	*	0.8	13.4	
05-10-04	Puyallup R. & tribs. from Kings Cr. to headwaters & tribs.													
05-10-05	White R. & tribs. from mouth to Mud Mountain Dam & tribs.													
	10C070		8.5	8.4	5.6	26.4	13.0	22.5	25.0	*	*	0.1	20.7	Aesthetic - Glacial fed.
05-10-06	White R. & tribs. from Mud Mountain Dam to headwaters.													
	10C150 (H)		6.5	4.4	3.4	*	11.6	25.0	*	*	*	2.0	8.6	
05-10-08	South Prairie Cr. & tribs.													
	10F070 (H)		8.0	4.7	4.6	21.5	11.4	16.7	*	*	*	2.1	11.1	
05-10-09	Carbon R. & tribs.													
	$\bar{X}$ =		2.9	3.1	5.4	11.1	14.9	25.0	*	*	*	0.1	8.4	
	10B070 (H)		2.6	2.3	5.1	11.6	12.7	25.0	*	*	*	0.0	8.3	
	10B090 (H)		3.2	4.2	5.8	10.5	17.8	25.0	*	*	*	0.3	8.5	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
05-12-07	Chambers Creek-Clover Creek & tribs.													
	$\bar{X}$ =		13.8	9.4	10.9	26.7	13.4	5.2	*	*	*	7.1	19.7	Bact., Trophic - Septic tank seepage.
	12A070 (H)		8.1	12.6	3.4	27.6	13.9	5.1	*	*	*	1.9	14.3	Temp., Trophic - Originates from Lake Steilacoom.
	12A100 (H)		25.2	5.3	19.6	10.0	12.0	4.9	*	*	*	6.5	20.8	
	12A110 (H)		8.5	9.8	11.2	44.9	14.3	5.6	*	*	*	3.6	26.0	
NISQUALLY-DESCHUTES CONSOLIDATED PLANNING AREA														
06-11-01	Nisqually R. & tribs.													
	$\bar{X}$ =		5.2	6.8	7.7	17.2	15.5	25.2	8.1	*	*	0.0	11.6	
	11A070		5.6	7.1	8.0	16.2	14.3	20.5	2.8	*	*	0.0	10.3	
	11A090		4.3	3.8	5.6	15.6	10.9	20.7	3.8	*	*	0.0	6.5	
	11A140		1.1	3.3	3.8	7.9	13.6	25.0	25.0	*	*	0.6	14.9	
06-11-02	Nisqually R. estuary													
	NSQ 001		0.0	8.1	5.0	7.0	(21.5)	1.7	*	*	*	0.6	3.3	
06-13-03	Budd Inlet													
	BUD 002		10.3	45.5	4.3	54.8	(21.2)	3.9	*	*	*	4.0	54.0	D.O. - Natural. Bact. - Urban runoff, Deschutes River, Moxlie Creek, Olympia STP, 2/3 point and 1/3 non-point.
06-13-04	Deschutes R. & tribs.													
	$\bar{X}$ =		11.2	5.5	5.5	10.9	11.0	12.9	2.9	*	*	2.7	6.3	
	13A060		13.1	4.6	6.0	16.5	10.3	9.7	3.0	*	*	4.3	6.4	
	13A150		8.3	6.5	4.8	15.9	12.1	13.3	2.7	*	*	0.2	6.1	
WEST SOUND-HOOD CANAL CONSOLIDATED PLANNING AREA														
07-14-01	Oakland Bay west of Longitude 123°05' & tribs. to Oakland Bay													
07-15-03	Kitsap Peninsula Inlets													
	$\bar{X}$ =		8.4	10.2	10.5	15.5	(22.5)	3.5	*	*	*	1.7	7.9	
	DYE 003		7.8	7.9	8.4	19.0	(24.9)	1.5	*	*	*	1.5	7.2	
	POD 006		9.8	9.7	8.2	7.5	(17.5)	6.8	*	*	*	1.3	4.6	
	SIN 001		7.6	12.9	14.9	20.0	(25.1)	2.1	*	*	*	2.2	11.8	
SAN JUAN CONSOLIDATED PLANNING AREA														
08-02-01	Marine waters, San Juan Islands													
	$\bar{X}$ =		1.8	15.7	4.2	2.6	(22.7)	1.7	*	*	*	0.6	3.9	
	SJI 001		1.9	15.6	4.2	2.5	(22.2)	1.8	*	*	*	0.6	4.1	
	HRO 001		1.7	15.8	4.3	2.6	(23.2)	1.5	*	*	*	0.5	3.7	
08-02-99	Undesignated tribs. to marine waters													

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
NORTH OLYMPIC CONSOLIDATED PLANNING AREA														
09-17-01	Port Townsend Harbor													
	PTH 005		5.5	10.5	8.4	2.6	(22.7)	2.8	*	*	*	0.2	3.6	
09-17-02	Sequim Bay													
	JDF 005		6.0	11.4	8.9	3.9	(23.7)	1.8	*	*	*	2.1	4.3	
09-17-03	Big Quilcene R. & tribs.													
	17A070 (H)		8.2	4.4	3.5	*	6.1	2.9	*	*	*	0.0	3.1	
09-17-04	Chimacum Cr. & tribs.													
	$\bar{X}$ =		18.7	12.3	4.4	*	23.8	3.4	*	*	*	6.7	14.7	Bact. - Dairy wastes, septic tank seepage.
	17B090 (H)		15.6	16.3	4.0	*	26.1	3.7	*	*	*	8.2	17.4	
	17B110 (H)		21.7	8.3	4.7	*	21.4	3.0	*	*	*	5.1	12.0	
09-17-05	Port Discovery													
	JDF 006 (H)		4.7	13.5	13.7	*	*	2.4	*	*	*	*	9.0	
09-17-99	Undesignated tribs. to marine waters.													
09-18-05	Dungeness R. & tribs.													
	18A070 (H)		8.8	5.0	4.7	*	6.7	9.5	*	*	*	1.5	4.0	
09-18-06	Elwha R. & tribs.													
	18B080		3.8	5.2	4.5	4.3	3.9	10.6	5.0	*	.0	0.0	3.0	
09-18-07	Port Angeles Harbor													
	PAH 003		1.7	17.7	5.3	4.3	(22.6)	1.8	*	*	*	0.4	5.6	
09-18-08	Port Angeles Harbor tribs.													
09-18-99	Undesignated tribs. to marine waters													
09-19-09	Hoko R. & tribs.													
	$\bar{X}$ =		10.8	12.3	5.3	*	9.9	19.7	*	*	*	0.0	7.7	
	19B070 (H)		15.6	17.7	5.6	*	8.3	13.4	*	*	*	0.0	8.5	
	19B090 (H)		6.0	6.8	5.0	*	11.4	25.9	*	*	*	0.0	6.9	
09-19-10	Pysht R. & tribs.													
	19A070 (H)		10.1	15.4	4.2	*	10.6	14.8	*	*	*	0.0	8.0	
09-19-99	Undesignated tribs. to marine waters													
09-20-11	Hoh R. & tribs.													
	20B070		1.6	3.9	3.0	12.5	8.2	11.5	*	*	*	0.0	4.7	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
09-20-12	Quillayute R. & tribs.													
	20A090 (H)		7.1	5.1	3.3	*	6.3	9.5	*	*	*	0.0	3.1	
09-20-13	Quillayute R. estuary waters													
09-20-17	Pacific Ocean													
09-20-99	Undesignated tribs. to marine waters													
CHEHALIS-GRAYS HARBOR CONSOLIDATED PLANNING AREA														
10-21-01	Queets R. & tribs.													
	21A080		9.5	5.8	4.8	20.5	6.0	9.2	13.5	*	*	0.0	11.2	
10-21-02	Quinault R. & tribs.													
	$\bar{X}$ =		11.5	7.3	5.4	5.0	6.0	4.9	7.4	*	*	0.0	4.4	
	21B090		14.5	8.4	5.4	5.2	7.0	4.9	*	*	*	0.0	4.8	
	21D070		0.9	3.3	5.5	4.2	2.4	*	7.4	*	*	0.0	2.8	
10-21-17	Pacific Ocean													
10-21-19	Joe Creek & tribs. (tributary to Pacific Ocean													
10-21-99	Undesignated tribs. to marine waters (Pacific Ocean)													
10-22-03	Grays Harbor (Outer)													
	GYS 014 (H)		7.1	13.0	5.5	12.5	(14.3)	5.0	*	*	*	1.1	5.8	
10-22-04	Inner Grays Harbor east of longitude 123°59'W to Cosmopolis and including the tide waters of the Wishkah & Hoquiam rivers													
	$\bar{X}$ =		15.5	16.3	11.6	56.1	(16.7)	12.7	*	*	*	0.5	39.2	
	GYS 004		16.0	17.4	18.7	50.6	(20.1)	18.1	*	*	*	0.3	36.7	
	GYS 006		17.2	17.0	10.9	59.3	(15.0)	12.4	*	*	*	0.1	43.3	
	GYS 007		16.1	16.7	9.1	63.2	(15.4)	11.1	*	*	*	0.5	43.2	
	GYS 009		12.6	14.2	7.8	51.2	(16.2)	9.0	*	*	*	1.0	44.8	
10-22-05	Humptulips R. & tribs.													
	22A070		14.1	4.9	8.3	12.6	4.4	3.5	*	*	*	0.0	4.8	
10-22-06	Hoquiam R. & tribs.													
	22B070 (H)		4.6	6.3	6.6	*	9.6	14.5	*	*	*	0.0	6.2	
10-22-07	Wishkah R. & tribs.													
	22D070 (H)		10.1	8.0	6.5	17.4	6.2	8.1	*	*	*	0.0	6.7	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
10-22-08	Wynoochee R. & tribs.													
	22F090 (H)		22.9	8.0	3.8	12.0	6.2	14.0	*	*	*	0.9	11.8	
10-22-09	Satsop R. & tribs.													
	22G070		6.4	7.2	8.4	13.8	7.6	12.7	2.7	*	*	0.9	5.4	
10-22-10	Wildcat Cr. & tribs.													
	22J070 (H)		6.1	13.3	8.4	*	35.9	2.8	*	*	*	0.0	21.2	
10-22-11	Cloquallum Cr. & tribs.													
	22H070 (H)		6.0	7.8	7.1	15.1	8.9	6.4	*	*	*	0.0	6.1	
10-22-12	Chehalis R. from Cosmopolis to Porter Cr.													
	22C050		19.1	11.9	9.7	26.5	25.1	14.5	3.5	*	*	0.0	22.4	Bact., Trophic - Chehalis-Centralia STP's, agricultural runoff, small municipal STP's, septic tank seepage. Aesthetic - Silviculture.
10-22-16	Pacific Ocean													
10-22-99	Undesignated tribs. to marine waters (Pacific Ocean and Grays Harbor)													
10-23-13	Chehalis R. from Scammon Cr. to the Newaukum R.													
	23A120		32.0	19.8	12.1	35.2	23.3	12.6	6.8	*	*	0.8	30.2	Bact., Trophic - Chehalis-Centralia STP's. D.O. - Non-Point sources. Temp. - Low flows.
10-23-14	Newaukum R. & tribs.													
	$\overline{X}$ =		16.3	7.2	6.4	23.5	12.4	11.6	*	*	*	2.6	11.8	
	23B070 (H)		16.6	8.8	5.1	21.0	11.5	11.6	*	*	*	2.1	9.4	
	23B090 (H)		16.0	4.7	8.6	21.6	13.3	10.0	*	*	*	4.8	11.3	
	23C070 (H)		16.1	5.9	7.3	30.9	13.6	13.2	*	*	*	1.7	17.6	
10-23-15	Chehalis R. from Newaukum R. to headwaters and tribs.													
	23A160		15.3	8.4	6.3	24.8	12.1	10.4	1.4	*	*	1.0	13.5	Bact. - Septic tank seepage, agricultural runoff.
10-23-18	Chehalis R. from Porter Cr. to Scammon Cr.													
	23A070		17.7	12.8	8.0	18.2	12.3	6.4	5.3	*	*	0.3	9.7	Temp. - Low flows.
WILLAPA CONSOLIDATED PLANNING AREA														
11-24-01	Willapa Bay													
	WPA 004		10.6	9.5	8.4	20.2	(10.7)	4.7	*	*	*	2.0	8.0	

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
11-24-02	Willapa R. & tribs. from mouth to limit of tidal influence													
	$\bar{X}$ =		19.0	14.9	7.2	33.6	(19.5)	7.6	*	*	*	1.2	22.0	Bact. - Raymond and South Bend STP's.
	WPA 001		21.5	16.3	9.0	45.1	(22.2)	8.4	*	*	*	1.1	33.1	
	WPA 003		16.4	11.5	5.5	22.2	(16.8)	6.8	*	*	*	1.4	11.0	Temp. - Low flows.
11-24-03	Willapa R. & tribs. from limit of tidal influence to headwaters													
	$\bar{X}$ =		13.1	11.2	10.3	35.6	10.1	8.1	5.8	*	*	0.0	20.0	Bact. - Septic tank seepage, raw sewage, agricultural runoff.
	24B090		14.3	11.0	9.1	31.1	8.6	6.2	7.0	*	*	0.0	16.9	
	24B130		9.4	11.7	14.1	49.9	14.7	8.0	1.9	*	*	0.0	29.7	
11-24-04	Willapa Bay tribs.													
	24F070		12.2	5.8	3.7	23.5	4.8	3.5	*	*	*	0.0	11.7	Bact. - Non-point sources.
11-24-05	Pacific Ocean													
11-24-99	Undesignated tribs. to marine waters (Pacific Ocean)													
COWLITZ-COLUMBIA ESTUARY CONSOLIDATED PLANNING AREA														
12-25-01	Grays Bay													
12-25-02	Grays R. & tribs.													
	25B070 (H)		11.5	7.2	4.2	13.5	8.8	10.0	*	*	*	0.0	7.2	
12-25-03	Elochoman R. & tribs.													
	25C070 (H)		11.6	6.8	4.1	19.3	12.0	6.5	*	*	*	0.8	9.9	
12-25-06	Skamokawa Cr. & tribs.													
12-25-07	Coal Cr. & tribs.													
12-26-04	Cowlitz R. & tribs.													
	$\bar{X}$ =		7.1	5.2	5.9	11.4	9.4	11.2	20.8	*	*	0.3	7.9	
	26B070		7.7	5.8	6.3	13.7	10.6	11.8	23.3	*	*	0.2	12.2	
	26B100		7.2	5.3	5.1	10.9	8.6	10.7	*	*	*	0.5	5.1	
	26B150		3.7	3.8	6.5	10.8	7.3	9.2	*	*	*	0.0	4.8	
	26D070		13.5	6.3	6.0	11.5	13.6	16.1	10.4	*	*	0.4	9.1	
12-26-05	Coweman R. & tribs.													
	$\bar{X}$ =		18.8	14.9	5.4	20.6	13.1	10.4	*	*	*	1.0	14.7	Bact. - Septic tank seepage.
	26C070 (H)		22.0	19.1	5.0	23.0	14.5	11.6	*	*	*	1.4	18.6	Temp. - Water pumping practices.
	26C090 (H)		12.7	7.1	6.1	16.2	10.5	8.1	*	*	*	0.0	7.5	
LEWIS CONSOLIDATED PLANNING AREA														
13-27-01	Lewis R. & tribs.													
	$\bar{X}$ =		9.9	8.1	12.3	11.6	3.6	2.9	0.9	*	*	0.0	6.0	
	27C110		5.2	9.5	17.1	2.4	4.2	3.3	0.7	*	*	0.0	4.5	
	27D090		13.7	7.0	8.4	19.2	3.2	2.6	1.0	*	*	0.0	7.3	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
13-27-02	Kalama R. & tribs.													
	$\bar{X}$ =		5.0	5.1	4.1	16.2	8.4	10.7	*	*	*	0.2	6.4	
	27B070 (H)		7.4	5.9	3.4	16.2	6.2	8.1	*	*	*	0.1	7.6	
	27B090 (H)		3.6	4.6	4.6	*	12.7	16.7	*	*	*	0.1	7.6	
	27B110 (H)		3.4	4.5	4.5	*	5.9	6.4	*	*	*	0.4	2.8	
13-28-03	Salmon Cr. & tribs.													
	$\bar{X}$ =		22.9	11.3	7.7	*	33.5	15.2	*	*	*	0.8	26.3	Temp. - Bank vegetation removal.
	28D070 (H)		23.2	10.3	8.7	*	36.6	18.0	*	*	*	2.4	26.7	D.O., Trophic - Battleground STP.
	28D110 (H)		23.5	10.3	5.6	*	16.2	9.6	*	*	*	6.8	17.0	Aesthetic - Agricultural runoff.
	28E070 (H)		15.2	29.8	6.2	*	86.9	9.1	*	*	*	1.2	67.2	
13-28-04	Burnt Bridge Cr. & tribs.													
	$\bar{X}$ =		20.2	13.5	5.0	*	27.4	14.2		*	*	6.7	20.9	
	28C070 (H)		11.9	10.7	5.3	*	28.9	15.9	*	*	*	5.9	16.9	Trophic - Suburban and urban runoff.
	28C110 (H)		40.4	20.3	4.2	*	23.8	10.2	*	*	*	8.6	30.8	
13-28-05	Washougal R. & tribs.													
	28B070 (H)		16.7	4.5	7.5	16.9	4.1	3.6	1.4	*	*	2.9	10.3	
MIDDLE COLUMBIA CONSOLIDATED PLANNING AREA														
14-29-02	Wind R. & tribs.													
	29C070		8.8	4.4	4.3	4.0	5.5	6.3	*	*	*	0.6	3.7	
14-29-03	White Salmon R. & tribs.													
	29B070		0.8	4.6	6.9	13.8	7.4	3.8	*	*	*	1.3	3.9	
14-29-04	Rock Cr.													
14-30-01	Klickitat R. & tribs.													
	30B070		16.9	8.8	6.9	9.8	13.0	11.8	23.6	*	*	2.7	13.2	
WALLA WALLA CONSOLIDATED PLANNING AREA														
15-32-02	Walla Walla R. & tribs.													
	32A070		50.8	17.7	11.3	33.5	40.4	45.5	44.9	*	*	13.8	56.5	Trophic, Bact. - Additive effect from small municipal STP's. Trophic, Aesthet. - Agricultural runoff. Temp. - Lack of bank vegetation, low flows.
15-32-03	Touchet R. & tribs.													
	32B070		45.4	14.0	8.4	34.2	38.7	56.6	41.6	*	*	9.3	53.6	Aesthet., Trophic - Agricultural runoff. Trophic, Bact. - Waitsburg STP. Temp. - Lack of sufficient bank vegetation, low flows.

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
15-32-04	Mill Cr. & tribs.													
	$\bar{X}$ =		33.0	16.2	15.6	29.0	41.7	15.6	*	*	*	11.0	45.9	Walla Walla STP has a substantial impact on all parameters.
	32C070 (H)		45.5	20.7	20.7	34.0	56.3	14.3	*	*	*	16.1	68.8	
	32C110 (H)		15.8	10.0	8.5	22.2	21.6	17.3	*	*	*	3.9	14.7	
PALOUSE CONSOLIDATED PLANNING AREA														
16-34-01	Palouse R. & tribs.													
	34A070		32.6	15.9	18.8	27.9	63.3	55.1	24.7	*	*	16.0	51.7	Temp. - Low flows - irrigation projects. Bact., Trophic, Aesth. - S.F. Palouse R., agricultural runoff - cattle and dryland.
16-34-02	S.F. Palouse R. & tribs.													
	34B110		11.0	12.0	16.2	77.4	100.0	63.3	73.3	*	*	9.4	100.0	Bact., Trophic, Aesth. - Moscow and Pullman STP's, agricultural runoff.
LOWER SNAKE CONSOLIDATED PLANNING AREA														
17-35-02	Tucannon R. & tribs.													
	35B060		31.4	17.4	10.6	22.2	24.5	28.0	16.1	*	*	5.7	26.6	Aesthet., Trophic - Agricultural runoff. Trophic, Bact. - Additive effect from small municipal STP's. Temp. - Low flows.
17-35-03	Grande Ronde R. & tribs.													
	35C070 (H)		56.0	5.2	*	*	10.7	6.7	*	*	*	*	37.0	Temp. - Low flows, little bank vegetation.
YAKIMA CONSOLIDATED PLANNING AREA														
18-37-01	Yakima R. & tribs. from mouth to Sunnyside Dam bridge													
	37A090		38.3	7.3	15.5	28.3	28.3	16.5	24.8	*	*	5.6	36.1	Trophic, Temp., Solids - Irrigation return flow system. Bact. - Agricultural runoff.
18-37-02	Yakima R. & tribs. from Sunnyside Dam bridge to Wilson Cr.													
	37A190		17.8	5.5	8.4	19.6	20.4	10.9	8.5	*	*	5.0	13.4	Trophic, Bact. - Agricultural runoff - feedlots - irrigated agriculture, Ellensburg and Yakima STP's.
18-37-03	Wide Hollow Cr. & tribs.													
	$\bar{X}$ =		10.6	7.3	7.5	*	41.8	11.1	*	*	*	4.9	24.6	Trophic - Agricultural runoff - cattle, urban runoff.
	37E070 (H)		11.3	5.8	8.2	*	43.3	11.3	*	*	*	6.1	25.4	
	37E090 (H)		9.8	9.1	6.8	*	40.1	10.9	*	*	*	3.6	23.7	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
18-38-07	Naches R. & tribs.													
	$\overline{X}$ =		13.8	6.4	8.1	11.1	6.9	9.7	*	*	*	3.6	8.2	
	38A050 (H)		13.0	7.7	4.4	*	*	*	*	*	*	*	7.2	
	38A070 (H)		15.3	4.9	14.1	14.1	7.9	8.7	*	*	*	5.7	10.9	
	38A110 (H)		13.1	6.7	5.5	7.7	5.9	10.9	*	*	*	1.2	6.1	
18-39-04	Yakima R. & tribs. from Wilson Cr. to Cle Elum R.													
	39A070 (H)		8.7	6.1	3.3	5.3	7.0	11.7	*	*	*	0.9	4.1	
18-39-05	Yakima R. & tribs. from Cle Elum R. to the headwaters including the Cle Elum R. & its tribs.													
	$\overline{X}$ =		7.6	6.7	4.2	5.2	4.0	3.8	*	*	*	0.2	4.5	
	39A080 (H)		8.3	6.1	4.1	*	*	*	*	*	*	*	4.7	
	39A090 (H)		6.4	7.5	5.3	8.7	4.4	5.1	*	*	*	0.2	4.5	
	39B070 (H)		7.6	7.1	3.4	5.8	3.6	2.3	*	*	*	0.3	4.2	
18-39-06	Wilson Cr. & tribs.													
	39C070 (H)		13.3	6.8	8.0	68.5	39.9	12.8	*	*	*	0.7	61.1	Bact., Trophic - Agricultural runoff - feedlots and dryland.
BIG BEND CONSOLIDATED PLANNING AREA														
19-36-05	Undesignated waters													
19-41-01	Crab Cr. & tribs.													
	41A070		45.1	13.6	20.2	22.7	35.1	27.4	27.8	*	*	6.6	54.3	Bact., Trophic, Temp., Aesthet. - Aesthet. - Agricultural runoff - irrigation return flow system - feedlots, food processing.
19-42-02	Crab Cr. & tribs.													
19-43-03	Crab Cr. & tribs.													
19-44-04	Douglas Cr. & tribs.													
19-50-06	Foster Cr. & tribs.													
WENATCHEE-CHELAN CONSOLIDATED PLANNING AREA														
21-45-01	Wenatchee R. & tribs.													
	$\overline{X}$ =		6.5	8.4	5.6	13.1	4.4	5.8	3.9	*	*	0.6	5.3	
	45A070		6.8	8.1	5.2	15.7	5.0	5.4	4.4	*	*	0.3	6.0	
	45A110		6.0	8.9	6.5	7.8	3.3	6.7	2.9	*	*	0.0	3.9	
21-46-02	Entiat R. & tribs.													
	46A070		4.5	4.6	5.7	11.8	5.5	6.4	12.1	*	*	1.2	7.6	
21-47-03	Tribs. to Lake Chelan													
21-47-101	Lake Chelan													
	47A070		24.9	9.8	3.4	6.3	3.7	3.0	2.1	*	*	0.2	10.9	Temp. - Natural - elevated summer temperatures in lake.

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

Table 3 (Continued)

SURFACE WATER SEGMENT		DRAINAGE AREA (sq mi)	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER		TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
24-55-02	Little Spokane R. & tribs.													
	55B070		9.4	10.2	12.6	19.0	15.5	22.0	19.4	*	*	3.5	13.3	Aesthet. - Erosion during spring runoff. Trophic - Agricultural runoff.
24-56-03	Hangman Cr. and tribs.													
	56A070		25.4	14.3	10.3	32.8	45.5	45.9	23.7	*	*	4.4	47.2	Temp. - Low flows. Bact. - Septic tank seepage, agricultural runoff. Aesthet. - Agricultural runoff. Temp. - Low flows.
24-57-04	Spokane R. from Hangman Cr to Washington-Idaho border													
	12419000		33.4	16.7	12.0	6.7	3.6	3.2	2.7	*	*	0.0	17.3	Temp. - Summer low flows. Metal toxicity from Kellogg ID mining district has been a historical problem - recent trend analysis indicates metals are declining.
PUGET SOUND SPECIAL STUDY AREA														
25-00-01	North Puget Sound													
	$\bar{X}$ =		5.2	11.8	7.2	4.5	24.9	1.9	*	*	*	0.8	4.1	
	ADM 001		3.1	13.7	6.5	3.7	(24.9)	1.5	*	*	*	0.7	3.7	
	POD 005		7.8	10.0	8.6	6.0	(24.3)	2.8	*	*	*	1.3	4.9	
	PSB 003		4.6	11.6	6.6	3.9	(25.5)	1.4	*	*	*	0.5	3.8	
25-00-02	South Puget Sound - Specifically Outer Budd Inlet													
	$\bar{X}$ =		8.6	10.4	8.3	8.6	(18.5)	2.1	*	*	*	2.1	6.2	
	BUD 005		9.5	12.5	7.8	14.4	(16.5)	2.3	*	*	*	3.1	9.5	
	CRR 001		6.0	13.4	5.8	2.6	(21.2)	1.1	*	*	*	3.8	4.7	
	CSE 001		7.5	7.0	8.9	0.0	(19.2)	1.3	*	*	*	2.2	4.0	
	ELD 001		9.5	11.6	7.5	9.1	(11.8)	1.8	*	*	*	3.4	7.0	
	NRR 001		3.5	11.3	8.3	15.7	(22.6)	1.3	*	*	*	2.0	6.0	
	NSQ 001		5.5	8.5	8.5	7.0	(21.5)	1.5	*	*	*	0.6	4.3	
	PCK 001		8.0	9.0	6.7	4.1	(19.3)	1.8	*	*	*	2.0	4.3	
	TOT 001		13.7	7.7	12.7	1.9	(16.0)	1.6	*	*	*	1.7	6.8	
	OAK 004		14.0	12.6	7.4	21.2	(15.0)	6.4	*	*	*	0.5	9.3	
25-00-03	North Hood Canal													
	$\bar{X}$ =		6.3	23.1	7.1	5.3	(24.1)	1.7	*	*	*	0.6	10.3	D.O. - Natural
	HCB 002		7.1	19.0	6.5	6.8	(23.5)	2.5	*	*	*	0.3	9.0	
	HCB 003		6.5	31.6	7.9	3.3	(24.2)	1.4	*	*	*	0.6	15.7	
	HCB 006		5.4	18.8	7.0	5.8	(24.6)	1.3	*	*	*	0.9	6.1	
25-00-04	South Hood Canal													
	HCB 004		8.7	61.7	11.6	4.9	(21.7)	1.4	*	*	*	1.3	36.8	D.O. - Natural
25-15-99	Undesignated tribs. to Puget Sound													
	15A070 (H)		4.9	5.3	6.3	*	6.0	3.8	*	*	*	0.3	2.8	

Table 3 (Continued)

A REPETITION OF THE 1980 WQI ANALYSIS USING 1981 CRITERIA

SURFACE WATER SEGMENT		DRAINAGE AREA	WATER QUALITY INDEX CATEGORIES										OVERALL INDEX RATING	PROBABLE CAUSES OF HIGH WQI RATINGS
SEGMENT NUMBER	SEGMENT NAME STATION NUMBER	(sq mi)	TEMP	OXY	pH	BACT	TROPH	AEST	SUSP SOLIDS	RAD	ORG TOX	AMMO TOX		
OKANOGAN-METHOW CONSOLIDATED PLANNING AREA														
22-48-01	Methow R. & tribs.													
	$\bar{X}$ =		5.8	6.4	6.1	7.7	4.7	7.5	12.0	*	*	0.4	8.1	
	48A070		9.5	6.3	7.4	7.5	5.1	9.7	18.8	*	*	0.6	12.4	
	48A130		2.3	6.3	5.1	9.3	4.6	5.6	5.6	*	*	0.1	3.7	
	48A190		0.2	7.9	3.2	3.1	2.6	2.8	1.3	*	*	0.1	2.0	
	48C070		0.0	6.1	8.0	1.1	1.0	*	0.4	*	*	*	2.7	
22-49-02	Okanogan R., mouth to Lake Osoyoos													
	$\bar{X}$ =		26.7	10.8	11.3	13.5	6.9	12.4	13.4	*	*	5.0	19.6	Temp. - Mouth to Lake Osoyoos, return flow irrigation.
	49A070		29.0	13.4	9.8	18.5	6.2	13.3	15.2	*	*	2.5	21.8	Solids - Agricultural runoff.
	49A090		27.1	10.0	11.3	13.3	7.9	14.3	17.6	*	*	6.9	21.3	
	49A190		35.4	11.6	20.0	5.5	7.2	4.2	1.2	*	*	10.3	23.7	
	49B070		12.9	6.2	7.0	9.7	6.3	13.5	11.0	*	*	0.8	7.4	
22-51-03	Nespelem R. & tribs.													
NORTHEAST CONSOLIDATED PLANNING AREA														
23-52-03	Sanpoil R. & tribs.													
	52A070		16.8	11.5	10.2	14.8	8.1	8.0	*	*	*	3.7	11.8	Temp. - Natural.
23-59-02	Colville R. & tribs.													
	59A070		24.9	13.5	8.6	25.1	24.2	21.3	*	*	*	3.0	21.0	Aesthet. - Silviculture. Temp. - Low flows. Bact., Trophic, Aesthetics - Agricultural runoff, small municipal STP's.
23-60-04	Kettle R. and tribs.													
	60A070		22.1	9.1	18.0	14.4	5.9	13.7	*	*	*	8.9	18.4	Temp. - Low flows. pH - Unknown. Inorg. tox. - Unknown.
23-62-05	Pend Oreille R. & tribs.													
	$\bar{X}$ =		24.6	12.6	14.5	4.8	6.3	7.2	1.7	*	*	1.8	15.3	Temp. - Impounded water.
	62A080		26.4	16.4	10.4	2.4	4.3	2.4	1.7	*	*	3.2	15.1	
	62A150		22.8	8.7	18.8	7.3	8.4	12.1	*	*	*	0.3	15.5	
SPOKANE CONSOLIDATED PLANNING AREA														
24-54-01	Spokane R., mouth to Hangman Cr.													
	$\bar{X}$ =		20.2	22.3	6.6	15.2	26.0	8.2	17.6	*	*	3.2	26.7	Trophic - Recent declines in nutrient loading from Spokane STP prompted use of the current one year data base for nutrients. D.O. - Eutrophication in Long Lake. Temp. - Impounded water, summer low flows. Metal toxicity from Kellogg ID mining district has been a historical problem - recent trend analysis indicates metals are declining.
	54A070		23.1	29.6	4.9	13.6	22.2	6.2	2.9	*	*	1.3	21.3	
	54A120		16.2	12.1	9.0	17.4	31.3	11.0	38.2	*	*	5.8	34.4	