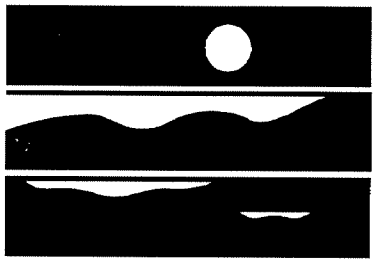

Watershed Briefing Paper for the Wenatchee Basin Water Resource Inventory Area

September 1995

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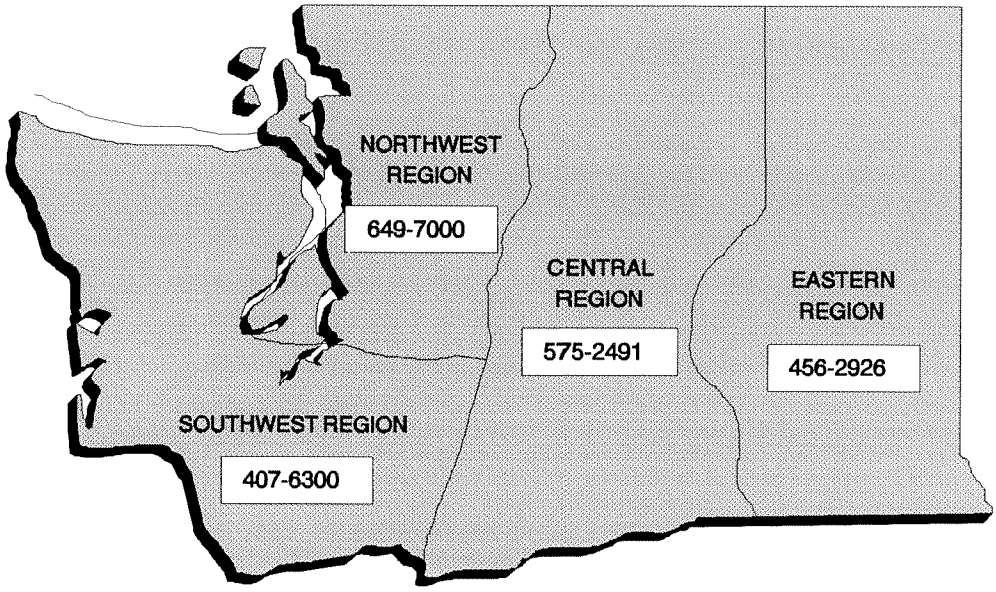

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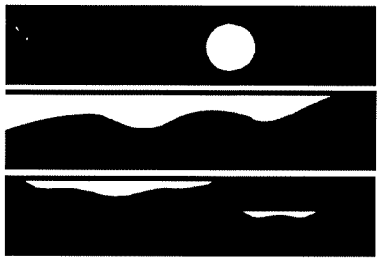

Watershed Briefing Paper for the Wenatchee Basin Water Resource Inventory Area

by
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Executive Summary

Below are summaries of the major points and recommendations made in the attached briefing papers.

Conclusions

Surface Waters

Wenatchee River Basin - Overall, most of the monitored surface waters in the Wenatchee River basin (WRIA 45) are not seriously degraded. Mission Creek and Chumstick Creek, identified as degraded in a Wenatchee watershed ranking study, are being studied by the Chelan County Conservation District through a grant provided by Ecology. This work, running through June 1996, is designed to identify the causes of the poor water quality.

Entiat River Basin - Like the Wenatchee River basin, the Entiat River basin has had good water quality, except for some temperature and pH violations near the mouth. Inspired by the forest fires of last summer, the US Forest Service (USFS), Chelan County Conservation District (CCCD), Ecology Central Regional Office (CRO), and Ambient Monitoring have pooled resources to monitor the Entiat and eight tributaries which have been affected to various degrees by the fires.

Lake Chelan - Total phosphorus concentration in Lake Chelan is currently being monitored by the PUD to determine whether the lake is in compliance with a TMDL for the Wapato basin of an epilimnion concentration of 4.5 $\mu g\ P\ L^{-1}$.

WRIA 40 - Little or no recent water quality data exist from this WRIA.

Lake Monitoring (all basins) - Lake Wenatchee is the only lake that is currently part of the Lake Monitoring Program. Three lakes may be selected for sampling in Wateryear 1996.

Recommendations

- Support Chelan County Conservation District's Wenatchee River basin studies. Wait for results of the current study on Mission Creek and Chumstick Creek before committing to work in these basins.

- Support the PUD's monitoring of Lake Chelan with technical assistance where needed. No ambient monitoring of Lake Chelan is warranted at this time.

- Support the work being done in the Entiat River basin by the USFS, CCCD, and Ecology CRO. The results of this work would be greatly enhanced by continuing it for at least one more year.

- Better define minimum flow requirements and better manage water allocations.

- Ambient Monitoring (and any other water quality investigations in the basin) should begin using a low-level total phosphorus analytical method.

- Consider initiating a separate Columbia River monitoring plan.

Toxics

Total DDT concentrations in sport fish from Lake Chelan are the highest in the state. There may be some risk of increased cancer in certain human populations or individuals that regularly consume fish from the lake. In addition, problems with population declines and poor productivity in some sport fish species in Lake Chelan may be due to pesticide contamination, especially the high t-DDT concentrations.

The highest levels of t-DDT in whole sucker samples for the state were from the Entiat River. However, these values were from only two composite samples, which may not be representative. No sport fish samples have been collected, so the risk to human health is unknown.

Two highly toxic insecticides (azinphos-methyl and chlorpyrifos) have been consistently detected at concentrations above aquatic life criteria in streams within the Wenatchee watershed that are adjacent to orchards. Detected concentrations are not high enough to be acutely toxic to adult or juvenile fish, but may be high enough to kill some aquatic invertebrates. However, the number of samples collected has been small and peak concentrations could easily have been missed. Developing fish that are in the fry stages when these pesticides are present in the water may also be experiencing some increased mortality. In addition, sublethal effects to fish may reduce survivability.

Zinc concentrations in Railroad Creek consistently exceed chronic and acute state water quality standards for the protection of aquatic life. Levels are apparently toxic to algae and invertebrates in the creek. Landlocked salmon from Lake Chelan that spawn in the creek may be directly impacted, and fish would certainly be indirectly affected by a reduced food supply if instream invertebrates are not able to survive.

Recommendations

- Consult with the Washington State Department of Health on the need for an intensive survey in Lake Chelan to assess the risk of t-DDT contamination in sport fish to human health for populations or individuals that regularly consume fish from the lake. A wide variety of fish species and age classes should be investigated so that sport fishing in the area would be impacted as little as possible by any necessary restrictions.

- Investigate possible ongoing sources of DDT to Lake Chelan. A probable source that is controllable is the conversion of orchards to residential areas. Soil erosion and runoff during this period is likely to contain high concentrations of t-DDT.

- Assess the effects of pesticides on fish productivity in Lake Chelan. This study could be implemented in conjunction with the Department of Fish and Wildlife. As an example, kokanee eggs could be collected in the fall when they are spawning and placed in a fish hatchery to compare hatchability and survivability of fry to eggs collected from uncontaminated fish.

- Collect additional fish from the Entiat River to confirm t-DDT contamination. Include sport fish to assess potential human health risks.

- Perform an intensive survey of streams adjacent to orchards in the Wenatchee watershed to assess the effects of pesticide contamination on aquatic invertebrate and fish populations. Invertebrates could be assessed by comparing species composition, diversity, and abundance to unimpacted (upstream) populations. Fish mortality could be determined by using caged fish experiments. Sublethal effects could estimated by acetylcholinesterase inhibition assays of caged fish. Endosulfan will accumulate in fish tissue, so analysis of wild or caged fish tissue shortly after application of the pesticide would indicate how much endosulfan the fish are being exposed to.

- Perform an intensive survey of Railroad Creek to assess the effects of zinc contamination on algal, aquatic invertebrate, and fish populations. Algae and invertebrates could be assessed by comparing species composition, diversity, and abundance to unimpacted (upstream) populations. Bioassays may also be useful. The impact to fish could be determined by comparing the abundance and size distribution of resident fish populations in Railroad Creek to other creeks that feed Lake Chelan.

Ground Water

Although ground-water quality is generally good where data exist, there is a concern over elevated nitrate-nitrite concentrations found in several wells. However, the hydrogeologic characterization of the entire watershed is inadequate and ground-water quality data are scarce.

Recommendations

- All available ground-water data should be compiled and evaluated to determine what data we have and what our data needs are.

- There is a serious need for baseline data everywhere in the watershed. To meet this need, the individual regions (river basins) of the watershed should be priority ranked relative to the necessity for data. Priorities should be based on such things as demand for water, potential sources of ground-water contamination, growth projections, land use patterns and projections, and historic ground-water quality data. Upon identification of priority areas, a schedule of characterization studies should be established and implemented wherein the highest priority basins are characterized first and lower priority basins follow in later years. Each basin should then be resampled at regularly occurring intervals, such as every three to five years, to establish data for trend analyses.

- An immediate need is to identify and characterize a "typical" basin in the watershed. A typical basin would be one in which the glacial/alluvial aquifers are most typical of the area -- a basin in which the findings of a characterization study could logically be applied to other basins in the watershed. For instance: if (1) the Wenatchee River basin between Leavenworth and Cashmere (as a possible example) contained aquifers that are "typical" or similar to the aquifers in the Entiat and other river basins; and if (2) the ground-water/surface-water relationships seemed similar; and if (3) there was a reasonable set of historic data for the area; then we could conduct a characterization study of that particular area and hopefully apply what we learn to other basins in the watershed.

  An important aspect of such a characterization is to evaluate the relationship between ground-water and surface-water quality. This could be accomplished by comparing surface-water quality data in certain stream reaches with ground-water quality data in adjacent aquifers.

Compliance Monitoring

There are currently 27 dischargers in the Wenatchee watershed that have permits under the National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge Permit Program (WAC 173-216). These include:

1) NPDES Major Permits - 1 Industrial, 2 Municipal
2) NPDES Minor Permits - 9 Industrial, 10 Municipal
3) State Discharge to Publicly Owned Treatment Works (POTW) Permits - 2 Industrial
4) State Discharge to Ground Permits - 3 Industrial

Recommendations

Past inspections point to problems which may warrant further investigation. These include:

- The need for a review of ALCOA (Wenatchee) STP influent sampling; TSS, fluoride, and aluminum analysis; and mercury and nickel sampling and analysis.

- High fecal coliform counts at the Chelan STP and Cashmere STP.

- Chelan STP effluent flow exceeding permit limits and percent removal below the 85% required by permit.

- Toxicity of the Wenatchee WWTP effluent to two species of organisms.

- Poor plant performance of the Vantage WWTP.

Class II inspections are needed for the following facilities:

- Industrial: ALCOA, Wenatchee
- Municipal: Wenatchee WWTP, Richland STP, Chelan STP, and Vantage WWTP

Class II inspections of industrial and municipal minor dischargers of concern are recommended.

Introduction

The Wenatchee Basin is comprised of WRIAs 40 (Alkali-Squilchuck), 44 (Moses Coulee), 45 (Wenatchee), 46 (Entiat), and 47 (Chelan). Neither WRIA 40 or 44 have major rivers (other than the Columbia River which forms the border between them and is addressed separately below). The major river basins within WRIAs 45-47 are the Wenatchee River, the Entiat River, and the Chelan River (Lake Chelan). Each of the river basins is extensively forested with very low proportions of land in either agriculture or urban landuse. However, because irrigated agriculture is the norm and because of the outstanding quality of water coming from the mountainous headwaters, water quality impacts from agriculture are obvious in specific tributaries and are becoming more evident in the major rivers.

The Wenatchee and Entiat River both originate in federally owned forest land in the Cascades where forestry and outdoor recreation are the main activities. There are extensive orchards downstream, many of which draw their irrigation water either directly from the rivers or from surficial aquifers. The Chelan River is very short, originating at the south end of Lake Chelan and flow is regulated by a dam. The upper Lake Chelan watershed includes portions of North Cascades National Park while residential and agricultural development is primarily located near the south end of the lake.

Little work has been done by EILS on surface water in either WRIA 40 or 44.

Ambient Monitoring Data Summary

by

William J. Ehinger
Ambient Monitoring Section

Nine stations have been monitored in this basin--five in the Wenatchee River watershed, one each on the Entiat River and the Chelan River, and two on the Columbia River (Table 1). Of these nine, three are currently long-term monitoring stations: the Wenatchee River at Wenatchee and above Leavenworth, and near the mouth of the Entiat River. The discussion below is based upon data collected by the Ambient Monitoring Section, two in-house reports done on the Wenatchee River (Ehinger, 1993a) and the Entiat River (1993b), and a TMDL study completed on Lake Chelan in 1989 (Patmont, *et al.*, 1989). The first two reports are available, on request, from the Ambient Monitoring Section.

Table 1. Ambient monitoring stations in the Wenatchee (management) basin. * = current long-term station.

Station #	Description	River Mile	Latitude	Longitude	WYs sampled
44A070	Columbia R. below Rock Island Dam	450.9	47° 18′ 40″	120° 05′ 02″	72, 75-6, 78-91
45A070*	Wenatchee R. at Wenatchee	1.1	47° 27′ 32″	120° 20′ 07″	60-7, 69-70, 72, 75-6,78-present
45A085	Wenatchee near Dryden	14.9	47° 32′ 07″	120° 32′ 53″	76
45A100*	Wenatchee at Leavenworth	26.4	47° 34′ 38″	120° 40′ 26″	76
45A110	Wenatchee above Leavenworth	35.6	47° 40′ 35″	120° 44′ 00″	78-present
45B070	Icicle Cr.	2.5	47° 33′ 45″	120° 40′ 00″	76, 93
46A070*	Entiat R.	1.5	47° 39′ 48″	120° 14′ 58″	59-67, 72, 75-6, 78-91, 94-present
47A070	Chelan R.	4.4	47° 50′ 23″	120° 01′ 11″	60-7, 69-70, 72, 75-6, 78-91, 94
47B070	Columbia R. at Chelan Station	504.1	47° 27′ 32″	120° 20′ 07″	91, 93

Results and Discussion

Wenatchee River at Wenatchee

A weak increasing trend in temperature was detected at this site along with increasing trends in both percent oxygen saturation and pH (Table 2) (Ehinger, 1993a). Further analysis showed that the increase in temperature had occurred during the 1970s and that, since 1981, temperature had shown a decreasing trend. Both percent saturation and pH can be driven upward by high primary productivity, so that, although the methodology for calculating percent saturation and the instruments used to measure pH have changed, the upward trend of both variables indicates that the trends are probably real. Decreasing trends in nitrate/nitrite-N concentration and fecal coliform values were also detected.

Wenatchee River above Leavenworth

A decreasing trend in nitrate/nitrite-N concentration was noted here, although concentrations were much lower that at the site in Wenatchee. This site had significantly lower values than the Wenatchee station for temperature, percent saturation, pH, nitrate/nitrite-N, suspended solids, and fecal coliform (Table 3)

Recommendations

Water quality at these two sites is quite good with the major problem being the high pH values at the Wenatchee station in late summer and fall. A Hydrolab *in situ* monitor could be used to record temperature, pH, dissolved oxygen, and percent saturation at 30-60 minute intervals for two to three weeks in August or September and would shed some light on whether this is a photosynthetically driven phenomenon or due to some other cause. Unfortunately, phosphorus concentrations (both total and soluble reactive phosphorus) were usually below the laboratory reporting limits of 10 $\mu g\ L^{-1}$ which precludes any assessment of current conditions or trend analysis. We should also evaluate the recent Centennial Grant work done in the Wenatchee River basin and determine if and how we may fit into the source tracking studies being planned by the Chelan County Conservation District (CCCD).

Table 2. Results of linear trend analyses at the Wenatchee River sites at Wenatchee and above Leavenworth. I = increasing, d = decreasing, ns = not significant, id = insufficient data to do analysis.

Variable	at Wenatchee	above Leavenworth
Temperature	see text	ns
D.O. % saturation	i	ns
pH	i	i
NH_3	id	id
$NO_2 + NO_3$	ns	d
Total phosphorus	id	id
Total suspended solids	ns	ns
Turbidity	id	id
Fecal coliform	d	ns

Table 3. Results of Wilcoxon-Mann-Whitney rank sum test and difference between Wenatchee River sites at Wenatchee and at Tumwater Campground above Leavenworth in median value. For all significant differences, the Wenatchee site had the higher median value. id = insufficient data

Variable	Difference
Temperature (°C)	1.2
D O. % saturation	6%
pH	0.2
NH_3-N ($\mu g\ L^{-1}$)	id
NO_3+NO_2-N ($\mu g\ L^{-1}$)	57
Total phosphorus ($\mu g\ L^{-1}$)	id
Suspended solids (mg/L)	1.0
Turbidity (NTU)	id
Fecal coliform (# $100ml^{-1}$)	5

Entiat River

No significant trends were seen in flow, temperature, or dissolved oxygen concentration in this analysis (Table 4) (see Ehinger, 1993b). Apparent trends in temperature and dissolved oxygen concentration were artifacts of the change in the time of sampling from morning to the afternoon in WY 1984. Significant decreasing trends were detected in specific conductivity, total suspended solids and nitrate+nitrite-N concentration. These could all be related to a decrease in runoff related inputs to the stream. A decreasing trend was also seen in fecal coliform data. Ammonia, total phosphorus and soluble reactive phosphorus concentrations were quite low, usually below the laboratory reporting limit. Trend analysis was not feasible on these variables because of the large proportion of 'below reporting limit' values and the changes (decreases) in detection limits during the period of study. The turbidity data exhibited the same problems and were also excluded from analysis.

High temperatures in the afternoon during late-summer and fall were the major water quality standard violation seen in these data. Suspended solids concentrations were generally low, but this may be deceptive because large quantities of sediment may be transported during infrequent high flows and are often missed by monthly sampling. The pH excursions above 8.5 were relatively infrequent. In general, nutrient concentrations were low (ammonia-N, total phosphorus and soluble reactive phosphorus) while nitrate/nitrite-N concentration was well within the range expected of natural conditions and was decreasing. Fecal coliform counts were usually low.

Recommendations

The CCCD, US Forest Service (USFS), Central Regional Office (CRO), and the Ambient Monitoring Section are currently jointly monitoring nine stations in the Entiat River basin, in order to study the effects of last summer's fires and the subsequent efforts to revegetate (seeding and some fertilizer application) the area on water quality. Perhaps Ecology could extend the

study period and take advantage of this opportunity to evaluate the impacts of the fire. *In situ* temperature and pH monitoring to document diel fluctuations during August and September is recommended.

Table 4. Results of seasonal Kendall tests on Entiat River data, WY 1978-91. i = increasing trend, d = decreasing trend, n.s. = non significant result, i.d. = insufficient data to do analysis. $P<0.05$ was considered significant.

Variable	Uncorrected	Flow-corrected	Time-corrected*
Temperature	i		n.s.
Dissolved Oxygen	d		n.s.
% O_2 saturation	n.s.		
pH	**		
Specific conductivity	n.s.	d	
Total suspended solids	n.s.	d	
Turbidity	i.d.		
Nitrate+nitrite-N	d	d	
Ammonia-N	i.d.		
Total phosphorus	i.d.		
Soluble reactive phosphorus	i.d.		
Fecal coliform bacteria	d	***	

* = corrected for correlation with the time of day when the sample was collected.
** = no analysis was done because of probable changes in measurement technique.
*** = there was no significant correlation with flow

Chelan River

The sampling station is located above the dam in the lower lake and so it represents a lacustrine environment. Total phosphorus concentration (and loading) are of prime importance when lake eutrophication is a concern. Unfortunately, nearly all total phosphorus data collected by Ecology at this station are below the 10 $\mu g\ L^{-1}$ reporting limit of the Manchester Lab. A TMDL study (Patmont, 1989) determined that epilimnial total phosphorus concentration was 3.9 $\mu g\ L^{-1}$ and established a 4.5 $\mu g\ L^{-1}$ criterion which would protect the oligotrophic character of Lake Chelan. Environmental Investigations and Laboratory Services (EILS) staff have assisted the Chelan County PUD in designing a study plan (to be implemented by the PUD) to monitor total phosphorus concentration.

Recommendations

Given that Lake Chelan is currently being monitored (1995), ambient monitoring is not recommended at this time.

Columbia River

Sampling stations were located at the Highway 97 bridge (Chelan Station, 1991 and 1993 only) and below Rock Island Dam. When comparing data from above and below the above Columbia River stations, increasing concentration of total suspended sediment, turbidity, and specific conductivity are evident as one moves downstream (and the river receives irrigation return flows and inputs from the Yakima, Snake, and Walla Walla Rivers. If total dissolved gas concentration is of interest, then data collected by various agencies in conjunction with the monitoring of migratory fish passage are available.

Data collected from individual stations on the Columbia River are difficult to interpret without taking a larger section of the river into account. I recommend that Columbia River water quality issues be addressed separately from 'basin' watershed issues. Perhaps by subdividing the Columbia River into more manageable sections, based on hydrology, we could gain a better perspective on the water quality in the river without being overwhelmed by the enormity of the entire system. The river could be divided into four sections: above Grand Coulee Dam, between Grand Coulee Dam and McNary Pool, McNary Pool to Bonneville Dam, and below Bonneville Dam. Currently, the river above Grand Coulee Dam is being studied by several agencies with funding from both Ecology and EPA and the lower Columbia has been the subject of much work as part of the Bi-State Program. Similar initiatives on the middle reaches of the Columbia River would provide insight currently lacking due to a lack of a coordinated monitoring plan for this river.

Recommendations

Consider initiating a separate mid-Columbia River monitoring plan (as described above) which would focus on large, hydrologically similar, river reaches.

Conclusions and Recommendations

The Wenatchee River Watershed Ranking Project report and the data from the current source tracking study need to be evaluated before specifying sampling stations in the Wenatchee River basin. The same applies to the Entiat River basin. We are in communication with USFS and CCCD personnel who are conducting this study and we/they should be able to evaluate the data by next summer. Both the Wenatchee River at Wenatchee and the Entiat River near the mouth are good candidates for *in situ* monitoring of temperature, pH, and dissolved oxygen concentration during the late-summer to early-fall to discern the diel pattern of high pH and high temperature values recorded there. Total phosphorus in Lake Chelan is currently being collected by the PUD, for comparison with the maximum concentration set by the TMDL (Patmont, *et al.*,

1989), so no further monitoring should be necessary at this time. We should consider initiating a separate mid-Columbia River monitoring plan (as described above) which would focus on large, hydrologically similar, river reaches.

In general, water quality at all sites appears to be good, with a few exceptions noted above. However, our lack of meaningful phosphorus concentration data greatly hinders our ability to interpret the data analysis results. Because the majority of these data are censored (reported as "less than"), we are unable to estimate current concentration or to determine if changes have occurred. In the fall of 1994, Manchester was able to lower the reporting limit for soluble reactive phosphorus to 5 $\mu g\ L^{-1}$, and in the spring of 1995 developed a low-level total phosphorus method (reporting limit ~3 $\mu g\ L^{-1}$ but at an additional cost). This issue is important because, given the relatively high concentrations of nitrate/nitrite-N, phosphorus is likely to be a limiting factor for primary productivity in these waters. If phosphorus loading is increasing, this could account for the high pH values (increased photosynthetic activity) and the decreasing nitrate/nitrite-N concentration (nitrogen is utilized roughly in proportion to phosphorus, so that, increased phosphorus concentration allows increased phosphorus uptake by algae which requires a proportionate uptake of nitrogen). We should look into employing the low-level total phosphorus analysis on a routine basis in each of these river basins.

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Watershed Briefing Paper Wenatchee Water Quality Management Area

by

Robert F. Cusimano
Watershed Assessments Section

Lake Chelan (WA-47-9020)

Lake Chelan is listed on the 303(d) list as exceeding fish tissue standards for 4,4'-DDE and PCB-1254 (based on Ecology toxics section report), and the water quality pH criterion (based on Ecology ambient monitoring station data).

A project funded by Ecology (1989) is the most comprehensive study of Lake Chelan completed in the last 10 years. Unless otherwise noted, the following summary is based on the Ecology results.

Lake Chelan is the largest and deepest natural lake in Washington and is composed of two distinct basins separated by a sill: Lucerne and Wapato basins. The Wapato basin represents only 7.6 % of the volume, but its nearshore area is the most developed part of the entire lake's watershed. Consequently the water quality of the Wapato basin is of primary concern.

Overall, the water quality of Lake Chelan is excellent, however, there is concern about the potential for nearshore degradation, because of possible human impacts and because local residents obtain their drinking water from the nearshore area. The highest levels of bacterial indicators measured in the lake have been found during the stratified period (April to September) with some of the highest concentrations found at the lake outlet. Since the City of Chelan's water supply withdrawals occur within the outlet area, bacterial contamination is of concern. Although reported fecal coliform levels have been in compliance with state standards for water contact recreation (geometric mean of fecal coliform < 50/100 mL), total coliform data collected at the lake outlet did not meet drinking water standards (total coliform < 1/100 mL). Stormwater runoff from the Wapato basin area showed the highest concentrations and represented about 40% of the estimated bacterial inputs.

In addition to nearshore concerns about bacteria, the potential for nearshore impacts from human-induced increased nutrient loading to the Wapato basin is also of concern. Stormwater runoff (from urban and agricultural areas) and septic system inputs have been identified as significant contributors of nutrients to the lake. A total maximum daily load (TMDL) for total phosphorus (P) has been developed by Ecology and incorporated in the Lake Chelan Water Quality Plan (Pelletier 1991, Lake Chelan Water Quality Committee 1991). The TMDL was developed in response to the recommended management action in Ecology (1989) that "additional development

within the Lake Chelan basin is considered acceptable only if there is a less than 5% chance that such development will cause in-lake nutrient (P) concentrations to exceed the established ultraligotrophic threshold" (*i.e.*, 4.5 µg P/L).

The TMDL identified sources and estimated P loads due to various land uses, and set limits on each of those loads relative to the 1986-87 levels (*i.e.*, average epilimnetic concentration of 3.45 µg/L), so that epilimnetic P values in the Wapato basin would not exceed 4.5 µg/L. In order to determine if the water quality and TMDL goal is being met in the Wapato basin, Ecology has funded a water quality monitoring study which began in May 1995 (Lake Chelan Water Quality Committee 1995)

In-lake concentrations of arsenic (As), iron (Fe), and zinc (Zn) have been found to be well below aquatic life water quality criteria and drinking water standards. Temporal and spacial variation of these metals have also been reported to be low. However, there is some concern about inputs of As to the lake from some of its major tributaries: Mitchell and Railroad Creeks and the Stehekin River are listed on the 303(d) list for exceedences of the As human health criteria. Measured concentrations of As in agricultural drains were found to be 40 times greater than estimated background levels in the basin. The source of this As may be related to use of arsenicals containing pesticides in orchards.

Concerns about the lake receiving DDT residues and PCBs have also been raised, because these toxic substances have been found in fish tissue and sediment (Ecology 1989; Ecology 1994).

A Water Quality Plan was completed in December 1991 that recommends strategies to maintain the excellent water quality in the lake. The plan also recommends water quality monitoring of the lake and major agricultural drains. In addition to the lake water quality study that started in May 1995 mentioned above, the Lake Chelan Reclamation District has been funded by Ecology to assess the water quality of the major agricultural drains to Lake Chelan (Lake Chelan Reclamation District 1994). Sampling by the Reclamation District began in September 1994 and will continue through December 1996.

First Creek (WA-47-1012), Mitchell Creek (WA-47-1014), Railroad Creek (WA-47-1020), Stehekin River (WA-47-1030)

First Creek is listed on the 303(d) list as exceeding the Class AA water quality dissolved oxygen standard, based on data collected by Ecology (1989). Mitchell and Railroad Creeks, and the Stehekin River are listed for exceedences of the human health arsenic standard, also based on data collected by Ecology (1989). Steve Butkus is now revising the listing of Mitchell Creek based on new human health criteria for arsenic (pers. comm.) Other than these variables, these water bodies appear to have good water quality.

Wenatchee River (WA-45-1010; -1020)

The Wenatchee River is listed on the 303(d) list as exceeding the Class A standard for temperature and pH in waterbody segment number WA-45-1010, and exceeding the Class AA standard for temperature and dissolved oxygen in waterbody segment number WA-45-1020 (exceedences are based on Ecology ambient monitoring station data).

Water Quality in the Wenatchee River basin was evaluated for general chemical parameters from October 1992 to September 1993 by the CCCD as part of the Wenatchee River Watershed Ranking Project (CCCD, 1994). The following is a summary of the findings of the project:

The watershed ranking committee ranked the subwatersheds of the Wenatchee basin based on their current or potential impact on water quality in the basin as follows: (1) Mission Creek, (2) Chumstick Creek, (3) White River, (4) mainstem Wenatchee River, (5) Nason Creek, (6) Peshastin Creek, (7) Icicle Creek, (8) Chiwawa River, and (9) Little Wenatchee River.

The major water quality concerns for Mission Creek are low dissolved oxygen, high turbidity, and high fecal coliform. The levels of nutrients are also higher than anywhere else in the watershed. Causes of water quality problems in Mission Creek are logging, overgrazing, other land disturbances, and animal keeping. Although Mission Creek contributes less than 1% of the flow it is one of two major sources of sediments to the Wenatchee River (the other is Chumstick Creek). Concerns have also been raised about Mission Creek not meeting minimum flow requirements.

The Chumstick Creek drainage is about the same size as Mission Creek. Water quality concerns are also similar to those of Mission Creek (*i.e.*, low dissolved oxygen, high fecal coliform, and nutrient concentrations). Also, no flow has been observed in sections of the creek during late summer and fall. Chumstick Creek is of little value to salmonids because of irrigation diversions.

The major water quality concern for the remaining sub-basins, and the mainstem of the Wenatchee River is dissolved oxygen levels below the appropriate standard (either Class AA or A). Temperatures were not found to exceed standards during the Conservation District's study, possibly because the summer weather pattern during the study period was cooler than normal. Low minimum flows are also of concern.

While the watershed project ranked nine subwatersheds of the Wenatchee River basin, it did not identify specific sources of nonpoint pollution in each sub-basin. As a follow-up to the initial ranking project, Ecology has funded the CCCD to provide more information collection and water quality sampling within Mission and Chumstick subwatersheds, and continue the overall monitoring at the established sampling stations. Sampling for this project was scheduled to begin in July 1995 and continue through June 1996 (CCCD, 1995).

Entiat River (WA-46-1010)

This segment of the Entiat River is listed on the 303(d) list as exceeding standards for pH and temperature based on Ecology ambient monitoring station data. Plotnikoff (1992) sampled one

site on the Entiat River from November 1990 through May 1991 as part of the Timber/Fish/Wildlife Ecoregion Bioassessment Pilot Project. The data he collected display excellent water quality.

Conclusions and Recommendations

Overall, the Wenatchee Water Quality Management area meets water quality standards. However, there are two general areas of concern: (1) Lake Chelan's Wapato basin's drainage, and (2) Mission and Chumstick Creeks drainages to the Wenatchee River. As mentioned above, projects have been funded in these areas to monitor water quality. There is a need to coordinate management of these drainages between the different groups and agencies interested in improving water quality, and there is also a need to fund projects designed to mitigate known problems.

The phosphorus TMDL and major recommendations in the Lake Chelan Water Quality Plan should be fully implemented.

One of the major concerns in the Wenatchee River's drainage is low minimum flows. Decreased summer flows impact fish and other beneficial uses of the water body. It will be important for Ecology to better define minimum flow requirements and better manage allocations of water use in the drainage..

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Surface Water Toxics

by

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Four issues were identified regarding toxics contamination in surface waters of the Wenatchee watershed:

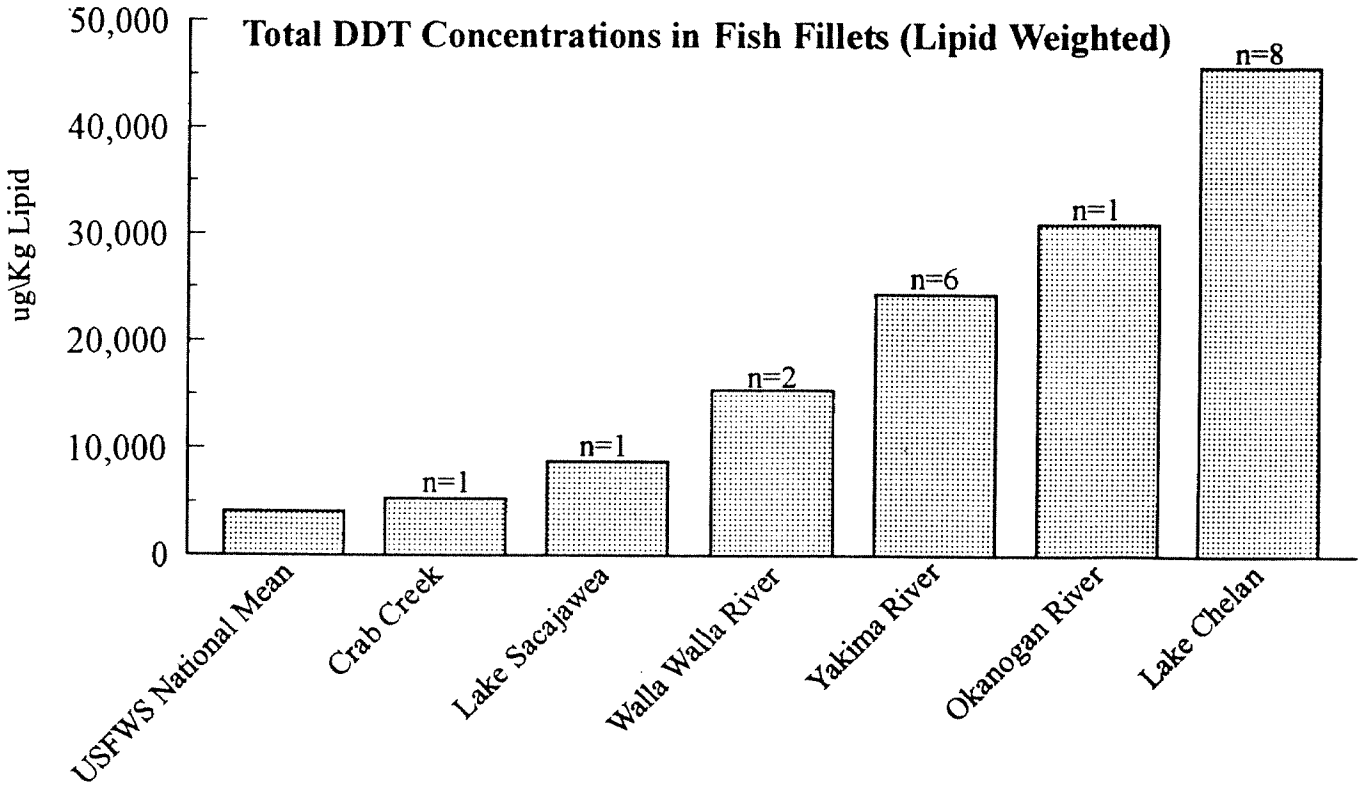
- Pesticide contamination of sport fish in Lake Chelan
- DDT contamination of fish in the Entiat River
- Insecticide contamination of streams adjacent to orchards
- High zinc concentrations in Railroad Creek

Lake Chelan

High concentrations of total DDT (t-DDT=DDT+DDE+DDD) in fish and/or sediments have been found by five studies performed by Ecology in the Lake Chelan basin (Hopkins *et al.*, 1985; Patmont *et al.*, 1989; Serdar *et al.*, 1994; Davis and Johnson, 1994a; Davis *et al.*, 1995a). In Figure 1, a mean value was calculated for t-DDT in sport fish fillets from these studies and compared to results from other water bodies in the state with high levels of t-DDT (Schmitt *et al.*, 1990; Davis and Johnson, 1994a; Davis *et al.*, 1995a, 1995b). These data indicate that edible tissue in sport fish from Lake Chelan contain the highest concentrations of t-DDT on a lipid weight basis in the state. Concentrations are one to two orders of magnitude higher than National Toxics Rule criteria (40CFR part 131), and exceed EPA human health screening levels as a carcinogen (EPA, 1993).

Data for fillets were from several species of fish, which often have substantially different lipid contents. DDT concentrations in fish are primarily a function of lipid content, so values were lipid normalized to improve comparability.

In Figure 1, a mean value was also calculated for t-DDT concentrations in whole suckers from Lake Chelan and compared to other sucker data collected in the state (Davis and Johnson, 1994a; Davis *et al.*, 1995a, 1995b; Schmitt *et al.*, 1985, 1990; Rinella *et al.*, 1990; Johnson *et al.*, 1986). Total DDT levels in whole suckers from Lake Chelan are the fourth highest in the state. The lower ranking for whole fish may be due to the size of fish collected. Suckers collected from Lake Chelan were substantially smaller than fish from other water bodies in the state. Fish size is an indication of age and the small suckers from Lake Chelan would not have been exposed to contaminants as long as larger, older fish.



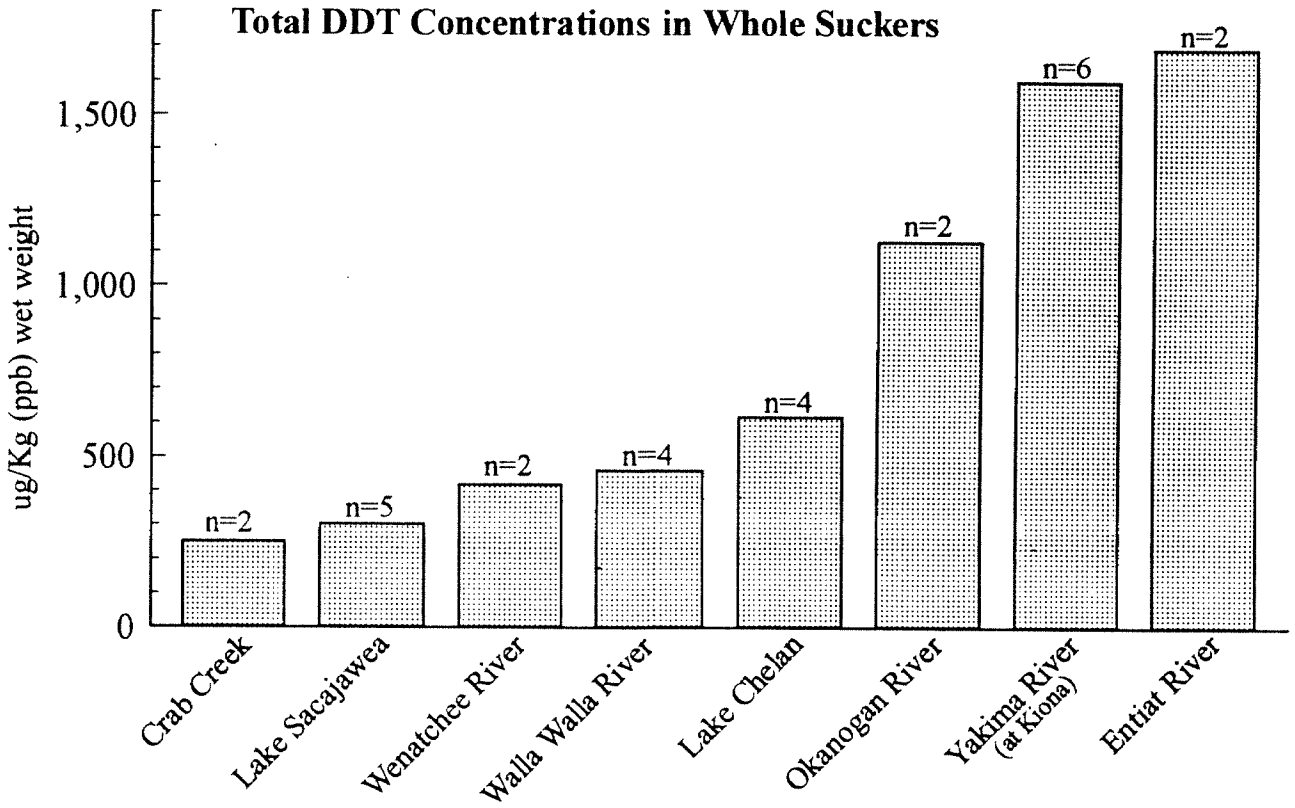


Figure 1. Comparison of Average DDT Concentrations in Fish Tissue

In 1992, kokanee eggs were collected from Lake Chelan for the Washington State Pesticide Monitoring Program (WSPMP) (Davis and Johnson, 1994a). These eggs contained 23 pesticidal compounds and PCBs, and the t-DDT concentration was well above the level likely to significantly increase egg or fry mortality. Kokanee populations are currently not self sustaining and the Department of Fish and Wildlife plants as many as 600,000 fry into the lake each year. Rainbow trout, Chinook salmon, and lake trout are also planted each year, suggesting that the fish are not reproducing well enough to sustain their populations. Pesticide contamination may be, in part, responsible for their poor productivity.

Entiat River

Figure 1 shows that whole suckers from the Entiat River have the highest concentrations of t-DDT in the state A study is currently being performed by Ecology's Environmental Investigations and Laboratory Services Program to assess t-DDT contamination in fish from Lake Osoyoos, which is a part of the Okanogan River system. From the data used in Figure 1, it appears that the DDT problem in the Entiat River may be more substantial than it is in the Okanogan River.

Data from the Entiat River are from only two composite whole sucker samples collected in 1994 for the WSPMP, and no sport fish were collected. Access to the lower river appears to be limited; popularity for sport fishing is unknown.

Insecticide Contamination

Water and fish samples have been collected from a number of sites within the Wenatchee watershed from 1992 to 1994 as a part of the WSPMP (Davis, 1993; Davis and Johnson, 1994a, 1994b; Davis *et al.*, 1995a, 1995b). In samples from Mission Creek, near Cashmere, three toxic insecticides have been consistently detected above water quality criteria to protect aquatic life and wildlife (EPA, 1986; WAC 173-201A). The insecticides are azinphos-methyl (Guthion), chlorpyrifos (Dursban), and t-DDT. Azinphos-methyl and chlorpyrifos are highly toxic organophosphorus insecticides. Stemilt Creek near Wenatchee and Stink Creek near Manson were sampled in 1994. The above three insecticides were also found in Stink Creek at levels above criteria, and azinphos-methyl exceeded the criterion in a sample from Stemilt Creek. One sample from Mission Creek also exceeded recommended water quality criteria (NAS, 1973) for total endosulfan (Thiodan), a chlorinated insecticide that is highly toxic to fish.

Azinphos-methyl, chlorpyrifos, and endosulfan are typically applied to control orchard pests in the spring. Although these insecticides generally break down fairly quickly, their presence in streams for even a short time at concentrations above criteria may adversely affect resident fauna. Invertebrates, such as insect larvae and crustaceans, are probably the most vulnerable aquatic life. Aquatic invertebrates are an important food source for many fish, so reduction of the invertebrate population could easily adversely affect fish. Although pesticide concentrations may not reach levels that are lethal to fish, sublethal effects may lead to reduced survivability.

Streams within the Wenatchee Valley are important salmon rearing habitat. Fry stages of many fish are the most sensitive to pesticides. The insecticides identified in Mission Creek are used in the spring, from April through June, when some salmon may be going through the susceptible fry stages of development.

Railroad Creek

Water samples collected from Railroad Creek, a tributary of Lake Chelan, in 1987-88 contained zinc at concentrations well above state water quality standards (Patmont *et al.*, 1989). Although no hardness values were found specifically for Railroad Creek, water quality standards were calculated using hardness values from Lake Chelan, the Stehekin River, and Company Creek. The mean zinc concentration from Railroad Creek was 70.2 µg/L and the chronic standard ranged from 20.4 to 60.8 µg/L, using a hardness range of 16.4 to 59.5 mg/L. Acute standards ranged from 22.5 to 67.2 µg/L.

The zinc enters Railroad Creek in leachate from an extensive mine tailing area about 10 miles upstream from Lake Chelan. The high concentrations of zinc are reported to be toxic to algae and invertebrates in the creek downstream of the mine (Patmont *et al.*, 1989). Impact to Lake Chelan is apparently minimal; levels of zinc in areas offshore from the creek mouth ranged from 1.3 to 2.9 µg/L.

Conclusions

Total DDT concentrations in sport fish from Lake Chelan are the highest in the state. There may be some risk of increased cancer in certain human populations or individuals that regularly consume fish from the lake. In addition, problems with population declines and poor productivity in some sport fish species in Lake Chelan may be due to pesticide contamination, especially the high t-DDT concentrations.

The highest levels of t-DDT in whole sucker samples for the state were from the Entiat River. However, these values were from only two composite samples, which may not be representative. No sport fish samples have been collected, so the risk to human health is unknown.

Two highly toxic insecticides (azinphos-methyl and chlorpyrifos) have been consistently detected at concentrations above aquatic life criteria in streams within the Wenatchee watershed that are adjacent to orchards. Detected concentrations are not high enough to be acutely toxic to adult or juvenile fish, but may be high enough to kill some aquatic invertebrates. However, the number of samples collected has been small and peak concentrations could easily have been missed. Developing fish that are in the fry stages when these pesticides are present in the water may also be experiencing some increased mortality. In addition, sublethal effects to fish may reduce survivability.

Zinc concentrations in Railroad Creek consistently exceed chronic and acute state water quality standards for the protection of aquatic life. Levels are apparently toxic to algae and invertebrates

in the creek. Landlocked salmon from Lake Chelan that spawn in the creek may be directly impacted, and fish would certainly be indirectly affected by a reduced food supply if instream invertebrates are not able to survive.

Recommendations

- Consult with the Washington State Department of Health on the need for an intensive survey in Lake Chelan to assess the risk of t-DDT contamination in sport fish to human health for populations or individuals that regularly consume fish from the lake. A wide variety of fish species and age classes should be investigated so that sport fishing in the area would be impacted as little as possible by any necessary restrictions.

- Investigate possible ongoing sources of DDT to Lake Chelan. A probable source that is controllable is the conversion of orchards to residential areas. Soil erosion and runoff during this period is likely to contain high concentrations of t-DDT.

- Assess the effects of pesticides on fish productivity in Lake Chelan. This study could be implemented in conjunction with the Department of Fish and Wildlife. As an example, kokanee eggs could be collected in the fall when they are spawning and placed in a fish hatchery to compare hatchability and survivability of fry to eggs collected from uncontaminated fish.

- Collect additional fish from the Entiat River to confirm t-DDT contamination. Include sport fish to assess potential human health risks.

- Perform an intensive survey of streams adjacent to orchards in the Wenatchee watershed to assess the effects of pesticide contamination on aquatic invertebrate and fish populations. Invertebrates could be assessed by comparing species composition, diversity, and abundance to unimpacted (upstream) populations. Fish mortality could be determined by using caged fish experiments. Sublethal effects could estimated by acetylcholinesterase inhibition assays of caged fish. Endosulfan will accumulate in fish tissue, so analysis of wild or caged fish tissue shortly after application of the pesticide would indicate how much endosulfan the fish are being exposed to.

- Perform an intensive survey of Railroad Creek to assess the effects of zinc contamination on algae, aquatic invertebrate, and fish populations. Algae and invertebrates could be assessed by comparing species composition, diversity, and abundance to unimpacted (upstream) populations. Bioassays may also be useful. The impact to fish could be determined by comparing the abundance and size distribution of resident fish populations in Railroad Creek to other creeks that feed Lake Chelan.

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Wenatchee Ground-Water Issue Paper

by

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Ground-Water Characteristics

This ground-water issue paper will concentrate only on the Stehekin River/Lake Chelan, Entiat River, and Wenatchee River basins, in Chelan County, plus the eastern portion of the area, in Douglas and Grant Counties. The southern extremes of the "watershed" has been eliminated because the Kittitas County portion is better considered, in a hydrogeologic sense, as part of the Upper Yakima basin, and the Department of Ecology's Hanford Site is a massive, ongoing project that would be inappropriate to include in this paper.

Alluvial and Glacial Aquifers

Chelan - Entiat - Wenatchee Regions

Glacial-drift deposits and alluvial deposits, ranging from a few feet to about one hundred feet thick, contain the main volume of ground water in the Chelan and Entiat/Wenatchee regions of the watershed (Molenaar *et al.*, 1980; Ebbert, 1984). These deposits occur mostly in and adjacent to the major valleys of the Columbia, Wenatchee, Entiat, and Stehekin Rivers. Well yields range from 10 to 100 gallons per minute (gpm) in the Chelan region and 250 to 500 gpm in the Entiat/Wenatchee region (Molenaar *et al.*, 1980). Some wells along the Wenatchee River have yielded as high as 1000 gpm, but these are not typical.

Lower Douglas County Region

There are no significant alluvial or glacial deposit aquifers in the Lower Douglas County region. If there are any aquifers of this type in the area, they are minor and would supply only isolated single domestic wells.

Bedrock Aquifers

Chelan - Entiat - Wenatchee Regions

Bedrock aquifers in this region occur in the mountainous terrain and consist of a complex mix of fractured igneous, metamorphic, and sedimentary rocks (Gresens, 1983). The fractured bedrock

locally yields water to springs and wells, but is a relatively unimportant source of water compared to the alluvial and glacial aquifers in the regions.

Lower Douglas County Region

The basalt flows of the Columbia River Basalt Group are the primary source of ground water in this region. Ground water is generally produced from the fractured zones at the tops and bottoms of individual basalt flows. The sedimentary units deposited between basalt flows also act as aquifers, depending upon the presence of porous materials at the local of interest. Well yields from the basalt aquifers range from 150 gpm near Waterville to 500 - 800 gpm in the vicinity of Moses Coulee (Molenaar *et al.*, 1980).

Surface Water/Ground Water Interaction

Ground water within the alluvial and glacial deposits is, for the most part, in direct hydraulic continuity with surface water. Some aquifers may appear to be confined locally, but local aquitards of interbedded clays, silts, and tills are relatively inconsequential, when compared to the regional aquifer system. It is best to assume, unless there is strong evidence to the contrary, that essentially all ground water contained in the alluvial/glacial aquifers, including that in tributary valleys, is in hydraulic continuity with surface water.

Surface water flows are dependent on ground-water occurrence and movement, particularly during the dry months of the year when stream discharge is made up almost entirely from baseflow.

The status of surface-water/ground-water interaction in the Lower Douglas County region is largely unknown. Extensive development of irrigation wells could have an adverse affect on surface water in the area. Specific evaluations would be needed to determine the effects of wells on surface water. Hydraulic continuity between aquifers, caused by wells completed across aquifer boundaries, is a problem in many areas of the Columbia basin and can enhance the effects of ground-water withdrawals on surface-water flows. This may be a problem in the Lower Douglas County region as well.

Ground-Water Quality

Ground-water quality in the Wenatchee watershed is generally good and suitable for most purposes (Ebbert, 1984; Turney, 1986).

Chelan - Entiat - Wenatchee Regions

The predominant ground-water type in the Entiat and Wenatchee regions is calcium bicarbonate (Ebbert, 1984). The Chelan region, however, shows a mixed ground water type where the principle anion is bicarbonate, but where there is no dominant cation type (Ebbert, 1984). Ebbert's (1984) data shows nitrate concentrations in ground water ranging from less than 1.0 to 7.9 mg/L. The data seems to show unusually high nitrate concentrations in the glacial and alluvial

deposits along the valleys. None of the reported concentrations exceed the maximum contaminant levels (MCL) specified by the U.S. Environmental Protection Agency (EPA), however.

Lower Douglas County Region

According to Turney (1986), ground-water types in the Lower Douglas County region are varied. Three wells have calcium bicarbonate type water, one has calcium-magnesium bicarbonate type, and one has a mixed type water. One well in the region, that is 515 feet deep, has nitrate levels of 13 and 22 mg/L, exceeding the MCL of 10 mg/L specified by EPA (1982 & 1983 values, respectively). Another, well at 205 feet deep, had nitrate concentrations of 4.6 and 4.2 mg/L in 1982 and 1983, respectively (Turney, 1986).

Ground-Water Issues

The presence of elevated nitrate concentrations in ground water is the main ground-water issue. Nitrate concentrations can be considered a regional problem since it seems to be a concern in all areas. However, the sources of contamination are of local origin such as unsewered development, failing septic systems, and agricultural practices. Areas of concern for nitrate contamination are: Rock Island area; Waterville in Douglas County (irrigation & fertilization); Wenatchee River Valley (agriculture practices and residential development); Upper reaches of Entiat River (residential development); Lake Chelan (residential development and agriculture); Mission Creek and Chumstick Creek (increasing development).

Other ground-water issues I've identified are:

- Water quantity is, by far, the most prominent ground-water issue in the watershed. Ground water withdrawals affect the already low flows in the rivers, and rising demand for water, as development increases, has caused increased conflicts between water users in the area.

- Possible pesticide contamination associated with the farming practices, particularly the orchards in the area, and with chemicals applied to lawns and gardens as populations increase.

Data Gaps and Recommendations

What We Know

- In general, there seems to be an adequate amount of published geologic information for the Wenatchee watershed.

- The USGS publications by Ebbert (1984) and Turney (1986) provide basic water-quality characterization information. The data in these reports is the only published ground-water

quality data found for the watershed. Although the work in these reports is excellent, the characterization is general due to the sparse data coverage of the area.

- Ground-water quality is generally good through out the watershed.

- There is wide-spread concern about nitrate concentrations in ground water. Historic data seems to support this concern.

- Ground-water availability and hydraulic connection between ground water and surface water is the most prominent ground-water issue in the Chelan-Entiat-Wenatchee regions.

- Growth pressures and water demands are increasing at a rapid pace.

What We Don't Know

- Hydrogeologic characterization for the entire watershed is very incomplete. All of the individual regions in the watershed need characterization studies.

- What unpublished data is available for the watershed? For instance: There may be consultant reports for specific sites; there may be small amounts of ground water data collected as parts of grant projects; there may be some graduate thesis work done in the area; there is certainly some Washington Department of Health data for public water systems; and there may be unpublished work by the USGS or even the Department of Ecology.

- There is very little ground-water quality data available for the watershed.

- There is little known about ground-water quality trends, particularly over the past 12 years.

- What is the relationship between ground-water and surface-water quality?

Recommendations

- All available ground-water data should be compiled and evaluated to determine what data we have and what our data needs are.

- There is a serious need for baseline data everywhere in the watershed. To meet this need, the individual regions (river basins) of the watershed should be priority ranked relative to the necessity for data. Priorities should be based on such things as demand for water, potential sources of ground-water contamination, growth projections, land use patterns and projections, and historic ground-water quality data. Upon identification of priority areas, a schedule of characterization studies should be established and implemented wherein the highest priority basins are characterized first and lower priority basins follow

in later years. Each basin should then be re-sampled at regularly occurring intervals, such as every three to five years. to establish data for trend analyses.

- An immediate need is to identify and characterize a "typical" basin in the watershed. A typical basin would be one in which the glacial/alluvial aquifers are most typical of the area -- a basin in which the findings of a characterization study could logically be applied to other basins in the watershed. For instance: if (1) the Wenatchee River basin between Leavenworth and Cashmere (as a possible example) contained aquifers that are "typical" or similar to the aquifers in the Entiat and other river basins; and if (2) the ground-water/surface-water relationships seemed similar; and if (3) there was a reasonable set of historic data for the area; then we could conduct a characterization study of that particular area and hopefully apply what we learn to other basins in the watershed.

- An important aspect of such a characterization is to evaluate the relationship between ground-water and surface-water quality. This could be accomplished by comparing surface-water quality data in certain stream reaches with ground-water quality data in adjacent aquifers.

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Wenatchee Watershed Compliance

by
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EILS Data and Reports

There are currently 27 dischargers in the Wenatchee watershed that have permits under the National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge Permit Program (WAC 173-216). These include:

- NPDES Major Permits - 1 Industrial, 2 Municipal
- NPDES Minor Permits - 9 Industrial, 10 Municipal
- State Discharge to Publicly Owned Treatment Works (POTW) Permits - 2 Industrial
- State Discharge to Ground Permits - 3 Industrial

The following summarizes information from the three industrial and four municipal discharge facilities that have had Class II inspections during the last ten years. It is important to note that Class II inspections more than five years old may not be representative of the facility today.

The following industrial discharge facility inspections during the last ten years indicate general compliance with permit requirements: Asamera-Cannon Mine; Tree Top (Wenatchee), and ALCOA (Wenatchee).

The December 1992 inspection of ALCOA (Wenatchee) found lead (in one of four samples) and cadmium exceeding EPA chronic freshwater water quality criteria and zinc exceeding acute and chronic criteria. These comparisons were based on effluent out-of-pipe and do not consider mixing zone dilution. Bioassays showed no adverse effects. The need for a review of ALCOA STP influent sampling; TSS, fluoride, and aluminum analysis; and mercury and nickel sampling and analysis were indicated (Golding, 1993).

Inspections of Wenatchee wastewater treatment plant (WWTP), Chelan sewage treatment plant (STP), Cashmere STP, and Vantage WWTP were conducted during the last ten years. The Chelan STP (Hoyle-Dodson, 1993) and the Cashmere STP (Heffner, 1987) inspections indicate general compliance with most permit requirements. Both inspections showed fecal coliform counts higher than permitted limits, greatly higher for Chelan. The Chelan facility did not meet the NPDES 85% removal of BOD_5. Plant influent flow exceeded 85% of the permit loading criteria and effluent flow exceeded permit limits. Copper and silver exceeded acute and chronic EPA water quality criteria for receiving waters. These comparisons were based on effluent out-of-pipe and do not consider mixing zone dilution. Bioassays found no acute toxicity, with slight chronic toxicity in fathead minnow.

The Wenatchee WWTP inspection in 1989 found permit limits being met for BOD_5 and TSS. Effluent concentrations of copper, lead, mercury, silver, zinc, cyanide, and 4,4'-DDT exceeded the Environmental Protection Agency (EPA) acute and/or chronic criteria for freshwater. These comparisons were based on effluent out-of-pipe and do not consider mixing zone dilution. Bioassays showed no effluent toxicity to Microtox®, some acute toxicity to rainbow trout, and moderate acute and chronic toxicity to *Ceriodaphnia dubia*. Preliminary results of the ongoing centrifuge study of effluent particulates were presented and discussed (Andreasson, 1990).

The inspection of the Vantage WWTP in 1989 found that the plant was not performing well during the inspection. The WWTP effluent was found to be outside of permit limits for BOD, TSS and fecal coliform. It was recommended that modifications to the plant be made to correct poor WWTP hydraulics. Sample splits compared very poorly. The flow meter was in need of calibration (Hallinan, 1990).

Summary of Issues

Industrial minor dischargers that have not at any time received EILS Class II inspections are: American Silicon Technologies, K B Alloys Inc., Chinet Company, Columbia Feeders Inc., Acme Concrete Company, and Glico Apple Corporation.

Both municipal major dischargers in the Wenatchee watershed (Wenatchee WWTP and Richland STP) have not received EILS Class II inspections during the last five years. East Wenatchee, Leavenworth, Stevens Pass, Rock Island PH1, Rocky Reach Dam, Entiat, and Lake Wenatchee are municipal minor facilities that have not received EILS Class II inspections during the last five years.

Past inspections point to problems which may warrant further investigation. These include:

- The need for a review of ALCOA (Wenatchee) STP influent sampling; TSS, fluoride, and aluminum analysis; and mercury and nickel sampling and analysis.
- High fecal coliform counts at the Chelan STP and Cashmere STP.
- Chelan STP effluent flow exceeding permit limits and percent removal below the 85% required by permit.
- Toxicity of the Wenatchee WWTP effluent to two species of organisms.
- Poor plant performance of the Vantage WWTP.

Needs and Recommendations

Class II inspections are needed for the following facilities:

- Industrial: ALCOA, Wenatchee

- Municipal: Wenatchee WWTP, Richland STP, Chelan STP, and Vantage WWTP

Class II inspections of industrial and municipal minor dischargers of concern are recommended.

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