JOHN SPELLMAN
Governor

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM
November 5, 1982

To: John Hodgson, Central Regional Office

From: Lynn R. Singleton, Water Quality Investigations Section

Subject: Icicle Creek Water Quality Survey Results

Icicle Creek (Class A waters) is the outlet for Josephine Lake. It flows through a mountainous, undeveloped watershed in the Wenatchee National Forest for the majority of its 31.8-mile course. Development in the upper watershed is confined to seven campgrounds. Water diversions; a small, unplatted housing development; the Icicle Island Club; the Leavenworth National Fish Hatchery; a children's camp; scattered homes and pasture; and a golf course are located along the final six miles of the creek. Icicle Creek is used extensively for recreation and as a source of potable, irrigation, and fish hatchery water supply.

Because of the nature of the resource, the Washington Departments of Game (WDG) and Ecology, Central Regional Office (WDOE CRO), and the Chelan-Douglas Health District have all expressed concern about the impacts from development. It is believed that increased algal growth was occurring as a result of inadequate sewage disposal systems in most of the Icicle Island Club's residences. The Icicle Island Club consists of about 20 residences, 17 of which have intermittent usage.

In response to these concerns, the Water Quality Investigations Section conducted a survey of Icicle Creek and the septic systems used by the Icicle Island Club residents from September 14-16, 1982. The survey was conducted by myself; Harold Porath and John Hodgson, CRO; and Phyllis McNulty, Chelan-Douglas Health District.

Water Quality Survey

Water quality samples were taken at five stations (Figure 1) beginning and ending at river mile (R.M.) 9.8 and 4.5, respectively. Three stations were located above the Icicle Island Club and two below. Field measurements were made for dissolved oxygen using the Winkler method, pH, temperature, and specific conductance at all stations. Grab samples were taken at all sites for fecal coliform, specific conductance, nitrate-N, nitrite-N, ammonia-N, orthophosphate-P, total phosphate-P, and chloride. Composite samples were made at two stations using a Manning compositor set to collect 250 mls every 30 minutes. All samples were kept on ice and delivered to the WDOE Olympia Environmental Laboratory within 24 hours.

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Icicle Creek Water Quality Survey Results

Periphyton samples were collected at four of the five stations. Upstream periphyton samples were taken in duplicate, whereas triplicate collections were taken downstream. The method of sampling involved selecting a piece of rubble from a depth of 15 to 30 cm in an unshaded area. A hard, plastic cylinder 28.6 mm in diameter equipped with a neoprene gasket was placed on an upper flat surface of the rubble and held firmly in place. The cylinder was filled with distilled water and the surface within the cylinder scrubbed with a stiff brush. This liquid was then aspirated and placed in a Nalgene field filtering system equipped with a 0.45 micron filter. This occurred three times and then the area was rinsed and aspirated three times. The liquid was then filtered, the filter stored in a petri dish, and the petri dish kept in a dark dessicator. The dessicator was kept on ice until delivered to the lab for chlorophyll a and pheophytin a analyses. These pigments were used as a measure of the quantity of plant material present. Samples of the visible filamentous algae were collected above and below the Icicle Island Club for identification.

Results of the water quality survey are presented in Table 1. As is evident from the data, water quality in the creek is very good. No differences existed between the stations above and below the Icicle Island Club during the survey. Observations made during the field work verified the presence of filamentous periphyton below the community. *Ulothrix zonata* was first noted near the upper boundary of the community, growing on the submerged rocks immediately in front of the uppermost residence having a drainfield permit. It occurred in sporadic clumps downstream from the initial location. The same alga was observed upstream at one site only. It was growing on the boards of the paddle wheel/fish barrier located in the irrigation diversion canal (about R.M. 5.5).

Periphyton's response to nutrient availability has been well documented. It appears very likely that the periphytic growth on the boards is possible because of the nutrients available from the wooden surface and/or its associated micro-community. The periphyton at the Icicle Island Club probably exists because of nutrient availability. Substrate, velocity, and light all appear to be uniform throughout most of the study area. The chlorophyll data do not indicate an increase below the community because their variability is quite high.

The variability is somewhat inherent to chlorophyll sample collection and analysis. This was further aggravated by the variability in the spatial distribution of the downstream periphyton population. This caused sampling difficulties below Icicle Island and the collectors could have easily introduced bias. Great effort was taken to collect representative samples; however, underestimation could have occurred as areas of heavy growth were not sampled. The reason being that the non-visible periphyton would provide a better indication of real impact. More samples collected at random would be needed before the chlorophyll data would provide definitive results.

Septic System Survey

An on-site inspection of the septic systems at the Icicle Island Club residences was performed. Noted improprieties were addressed in letters prepared by Phyllis McNulty and sent to those individuals living in residences with substandard systems. The problems included illegal septic tanks and drainfields; drainfields

on the creek bank; privies in the floodplain; greywater disposal to the ground underneath the homes; and improper disposal of pet manure on the creek bank. Approximately 12 systems were dyed with 100 mls of Rhodamine WT dye. Three to four gallons of water were also added to each system. No dye was visible in the creek as a result of the tests. Analysis of composite samples with a Turner 111 fluorometer also indicated that no dye was present. These data appear to indicate that the tested systems are adequate; however, several factors make the tests inconclusive. The majority of the owners were not home and had not been for some time. Therefore, these systems were under little or no hydraulic loading. The addition of three to four gallons of water is not enough to hydraulically charge the systems. Flows in the creek were relatively high and would dilute any dye which might slowly seep out. Compositing the samples could also dilute a sample to the point where detection is not possible. Many times the dye was poured directly into sanitary holding tanks. This would not always indicate greywater disposal improprieties. Interesting plumbing arrangements at some dwellings indicated separate systems existed for greywater and sanitary sewage.

Summary

The collected data indicate water quality above and below the Icicle Island Club was the same. The only observed difference in the stream was the presence of periphyton downstream of the residences. On-site inspection showed the potential for nutrient and bacterial addition to the creek is very high. The systems in use at some residences are deplorable and should be replaced. The lack of concern shown by a few in such a pristine area is unfortunate.

LRS:cp

Attachment

cc: Harold Porath
Phyllis McNulty
John Bernhardt
Section Files

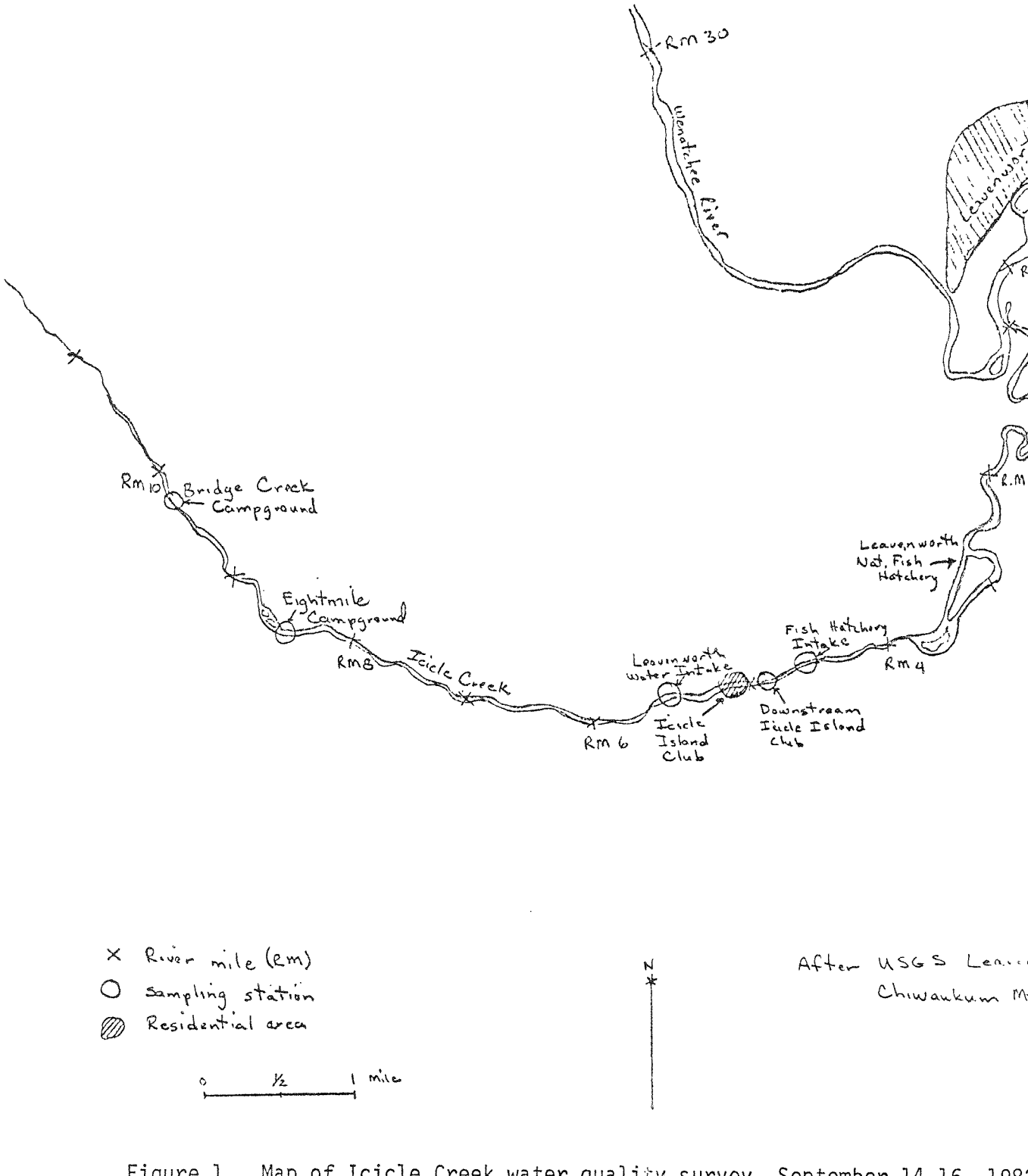

Figure 1. Map of Icicle Creek water quality survey, September 14-16, 198

Table 1. Results of Icicle Creek water quality survey, September 15-16, 1982.

	Bridge Cr. Campground		Eight Mile Campground		Leavenworth Water Intake		Downstream Icicle Is. Club		Fish Hatchery Intake	
River Mile	9.8		8.5		5.6		5.0		4.5	
Date	9/15	9/16	9/15	9/16	9/15	9/16	9/15	9/16	9/15	9/16
Time	1400	0900	1430	0915	1500	0943	1602		1530	1023
Temperature (°C)	11.1	7.5	10.4	7.7	11.3		11.8		11.6	
Dissolved Oxygen (mg/L)	10.6		10.7		11.1		10.9		10.9	
pH (S.U.)	6.1		6.2		6.1		6.2		6.3	
Conductivity (μmhos/cm)	48	48	45	46	45	46**	44		44	43**
Fecal Coliform (org/100 ml)	<1		<1		<1		1*		2*	
NO_3-N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01**	<0.01		<0.01	<0.01**
NO_2-N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01**	<0.01		<0.01	<0.01**
NH_3-N (mg/L)	<0.01	<0.01	0.01	0.01	<0.01	0.01**	0.03		0.01	<0.01**
O-PO_4-P (mg/L)	<0.01	<0.01	<0.01	<0.01	0.01	<0.01**	<0.01		<0.01	<0.01**
T-PO_4-P (mg/L)	0.01	0.01	0.01	0.01	0.01	0.02**	0.01		0.01	0.01**
Chloride-Cl (mg/L)	1.4	1.4	1.4	0.7	1.4	0.7**	1.4		1.4	1.4**
Chlorophyll a/Pheophytin a ($\mu g/642\ mm^2$)			1.4/0.8 1.3/0.4		0.2/2.3 1.4/0.2		0.6/1.6 0.2/0.6 2.5/2.8		1.1/0.9 2.6/0.9 0.3/0.7	

*Estimated count.
**24-hour composite sample.