Publication No. 75-e45

MEMORANDUM

TO: Ron Pine

FROM: Tom McCann

Department of Ecology

SUBJECT: CEDAR HILLS LANDFILL SURVEY

DATE: February 11, 1975

This memo puts into writing our discussion this morning regarding the subject.

It has been requested that a follow-up to last years survey be conducted this year.

Last years survey is discussed in Ron Devitt's memo of January 10, 1974 and it is requested that this survey be conducted as before for reasons of comparisons.

You indicated that Tuesday, February 18th would be a good time for you, this is also fine with us. Please advise us on further assistance you may require from this office.

Attached is Ron Devitt's January 10th memo.

TM:ll

Attachment

January 10, 1974

State of Washington Department of Ecology

Memo To: John Glynn

From: Ron C. Devitt

Subject: Cedar Hills Survey

INTRODUCTION: King County operates Cedar Hills sanitary landfill near Issaquah, Washington. Leachate, runoff and contaminated ground and spring water merge with a small unnamed creek and flow to Mason Creek. In the spring of 1972, a heavy slime growth developed in Mason Creek and downstream in Issaquah Creek at the Washington State Department of Fisheries hatchery at Issaquah.

Several studies were initiated to examine the problem.* The Washington State Department of Ecology undertook an independent survey to characterize the leachate and to determine the effect of the leachate on the water quality of Mason Creek.

SUMMARY: The flow originating from the disposal site is grossly polluted. As the distance from the fill increases, chemical, physical, and biological changes generally improve the quality of the leachate. In addition, the unnamed creek has a dilutional effect on the leachate before reaching Mason Creek.

During dry weather, the combined flow is so small that these is no direct above ground flow to Mason Creek. However, during wet weather flow, the aestethic and chemical nature of Mason Creek is significantly affected.

A similar discharge would not be permitted to such a small waterway by a Washington State industrial waste discharge permit.

The adverse effect of slime growth at the fish hatchery will be eliminated when the use of water from Issaquah Creek is discontinued and well water is employed.

*AN INVESTIGATION OF LANDFILL LEACHATE PROBLEMS AT KING COUNTY'S CEDAR HILLS SITE, John W. Mellor, University of Washington Masters thesis 1972.

CEDAR HILLS LANDFILL STUDY MUNICIPALITY OF METROPOLITAN SEATTLE, Feb. 1 thru June 21, 1972, J. T. Clark, R. J. Morrice, R. I. Matsuda, and R. S. Domenowske.

STATION LOCATIONS

Primary stations were established at the following locations and are pinpointed on the attached map.

STATION #1: Combined leachate and spring water in ravine as it emerges from ground.

STATION #1A: 10 yards downstream - comprised of flow from Station #1 and surface runoff.

STATION #1B: Flow from 1A after passing downstream.

STATION #2: Control to be compared to 1A, spring water and runoff from an uncontaminated area.

STATION #3: Three combined flows from 1B and 2 in field at gun club.

STATION #3A: Flow from station #3 ten yards above confluence with Mason Creek.

STATION #4: Control for Mason Creek; Mason Creek at bridge about ten yards above confluence with flow from 3A.

STATION #5: Mason Creek at bridge about 100 yards below confluence with flow from #a.

In addition, two secondary stations were sampled sporatically.

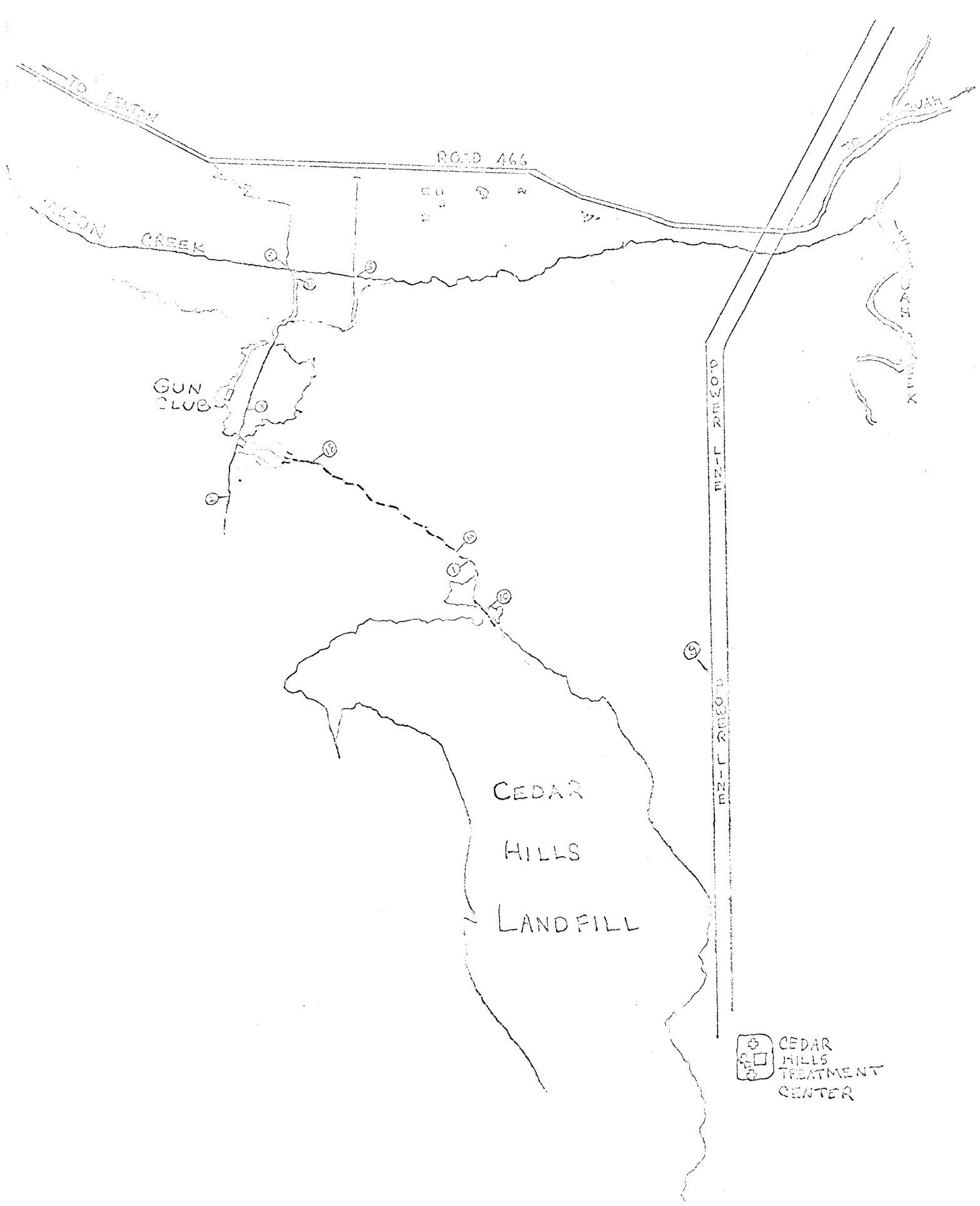
STATION #9: Leachate and runoff originating in the south and east area of the fill at the powerline road.

STATION #10: Runoff in leachate ditch (about 30 yards above Station 1A).

GENERAL DRAINAGE: Contaminated ground water emerges in a spring and combines with surface runoff and leachate at station #1. It proceeds down the ravine and merges with the uncontaminated water from Station #2. This combined flow enters Mason Creek at Station #3A.

SAMPLING PROCEDURES: From 10-31-72 to 5-29-73, six sets of grab samples were taken from the drainage from the landfill site from the control drainage and Mason Creek.

The samples were iced and analyzed by DOE water quality lab in Tumwater. Appropriate preservation was added to COD, nutrients, and iron samples. Dissolved oxygen samples were fixed in the field and determination was made by the azide modification of the Winkler method.


TO FENTON
ROAD 466
MASON CREEK
GUN CLUB
POWER LINE
RECORD LINE
CEDAR HILLS LANDFILL
CEDAR HILLS TREATMENT CENTER

UNITS OF MEASUREMENT:

pH: pH units
Turbidity: Jackson Turbidity Units
Conductivity: µmhos/cm @ 25°C.
NO_3-N: ppm filtered
NO_2-N: ppm filtered
O-PO_4-P: ppm filtered
Total alkalinity: ppm as $CaCO_3$
Hardness: ppm as $MgCo_3$ + $CaCO_3$
Temperature: degrees Centigrade

All remaining results are report as parts per million.

DISCUSSION OF DATA:

Values obtained at the leachate-effected stations vary significantly. The amount of snowmelt and precipitation were the main factors in determining the amount of runoff. The more runoff, the more adversely the water quality was affected. Specifically on 10-31-72, the flow was so low that there was no above ground discharge to Mason Creek. Between Station #3 and #3A, about 10 yards below the gun club road, the flow (<1 cfs) was entering a pool and joining either ground water and/or underground creek. It would have been desirous to dye this subsurface flow in an attempt to determine if it did reach Mason Creek, but flow levels were not observed to be as low again. On subsequent dates, there was always a surface flow preventing the effective use of dye.

In contrast, it had been raining for three days preceeding the sampling on 4-18-73. Definite changes in water quality are due to the leachate.

Assuming that the differences between Station #2 and Station #1A are due to the leachate, a definite trend can be observed by comparing the mean values of selected parameters:

	Control (#2)	Contaminated (#1A)
pH (range)	7.0 - 7.8	6.8 - 6.5
turbidity	1	173
conductivity	88	1290
COD	10	790
Iron	<.1	79
Total Solids	67	1144
Total Non Vol. Solids	31	620
Total Suspended Solids	4	124
Total Suspended Non Vol. Solids	1	98
Alkalinity	22	494
Chlorides	14	89
Calcium	2.8	161
Magnesium	2.5	32
Hardness	17	532

The maximum values at Station #1A occurred during periods of high run-off.

Another significant observation is the general improvement in water quality due to natural purification of the combined leachate and runoff by travelling from Station #1A to 1B.

	Station #1A	Station #1B*
pH (range)	6.8 - 6.5	8.1 - 7.1
turbidity	173	85
conductivity	1290	865
COD	790	432
Iron	79	35
Total Solids	1144	676
Total Suspended Solids	620	371
Total Non Vol. Solids	124	50
Total Suspended Non Vol. Solids	98	38
Alkalinity	494	338
Chlorides	89	64
Calcium	161	122
Magnesium	32	24
Hardness	532	404

*Data from 4-18-73 not included in calculation because of increased flow before sampling.

The most drastic effect on the water quality of Mason Creek was reported on 4-18-73.

Washington State water quality criteria include Implementation and Enforcement Plan for Water Quality Regulations Department of Ecology 1970:

1. Turbidity shall not exceed 5 JTU over natural conditions. The natural conditions (Sta. #4) was 7 JTU; downstream (Sta. #5) the turbidity of Mason Creek was 30 JTU, or an increase of 23 JTU.

2. pH shall be within the range of 6.5 to 8.5 with an induced variation of less than 0.25 units. Station #4 was 6.9, Station #5 was 6.6 or an induced variation of 0.3.

3. Aesthetic values shall not be impaired . . . which offend the senses of sight, smell, touch, or taste. By this definition the aesthetics of Mason Creek were impaired.

4. Deleterious material concentrations shall be below those of public health significance, . . . or which may adversely affect any water use.

The characteristic uses of Class A water include domestic, industrial, and agricultural water supply.

Water quality criteria[1] say that concentrations of 0.3 mg/l and 0.1 mg/l should not be deleterious to the uses of water for domestic and industrial water supplies, respectively. It is also reported that all of the waters in the United States which support good fish populations have iron concentrations below 0.7 mg/l. The concentrations of iron at Station #5 was 6.8 ppm.

Metro's survey documented that Mason Creek was substandard for total coliform although this fact was not due to effects of the leachate.

BIOLOGICAL SAMPLING:

To evaluate the effect of the leachate on biological colonization, artificial substrates were placed at Station #4 and #5 on December 5, 1972.

The substrate was similar to that developed by Britt[2]; a 12"x12"x3" concrete anchor was poured inside a plywood frame. A redwood lattice was attached to the anchor. A modificiation was made in an attempt to quantilatively evaluate slime growth development. A 9-1/2"x4"x1/8" piece of transite was attached to a corner of the wooden lattice.

Although slime growth developed on some of the vegetation at Station #5, it failed to establish on either the wood or transite.

Invertebrates did colonize the substrates. On 5-29-73, the specimens were collected, preserved in ethanol, identified, and enumerated at the water quality laboratory in Tumwater.

The results are reported below:

	Station #4	Station #5
Tubifex	31	268
Chironomids	13	140
Leeches	8	1
Fingernail Clams	4	1
Tabanidae	1	0
Total	57	410

As indicators of water quality, neither population would typify a "clean water" situation. The increased numbers of tubifex ("sludge worms") and chironomids ("blood worms") and decreased diversity at Station #5 would

1. Water Quality Criteria, 2nd Edition State Water Quality Control Board, Sacramento, California, 1963.
2. New Methods of Collecting Bottom Fauna from Shoals or Rubble Bottoms of Lake and Streams, Ecology 38(3): 524-525 Britt, N.W. 1955.

tend to indicate an enrichment of the creek not demonstrated by chemical sampling. Conditions were present which promoted the growth of "polluted water" macroorganisms.

The difference between the populations at Station #4 and #5 are considered to be due to the leachate. The water velocity and depth were similar; the substrate was identical. The development of these populations over a period of six months is a significant method of evaluating biological conditions in situ.

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