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MEMORANDUM
May 22, 1985

To: Dick Cunningham

From: Tim Determan TGD

Subject: The Effects of the Purdy Landfill on Fecal Coliform Levels in Nearby Streams: A Minter/Burley/Purdy Watersheds Supplementary Study

INTRODUCTION

There has been considerable public comment concerning the planning effort to control non-point pollution sources in the watersheds draining into Burley Lagoon and Minter Bay. In response to public concerns, the draft water quality study conducted by the Water Quality Investigations Section (Determan, et al., 1985) was placed in local libraries for public review. Several reviewers indicated that the study detailed many problems associated with residential and agricultural land use, but did not address the Purdy Landfill. Some residents were particularly concerned about the disposal of wasted sludge from the Gig Harbor STP in the landfill and the effects of landfill operations on ground- and surface-waters in the area. At a public meeting held on January 23, 1985, I stated that I would carry out a short-term study of the landfill and nearby surface drainages. Because of limits on resources and time, the study would be limited in scope and confined to surface effects only.

A rain-event survey was conducted on March 26, 1985. The purpose of the study was to: (1) measure fecal coliform levels in surface runoff from the landfill, (2) trace the route of landfill runoff into nearby ditches and streams, and, if this occurred, (3) rank fecal coliform loads due to the landfill to watershed loads as a whole.

SETTING

The entrance to the Purdy Landfill lies on 144th Street Northwest (Purdy-Crescent Road) 0.8 mile east of Purdy, Washington (Figure 1). The landfill is located on top of a ridge running NNE to SSW.

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The landfill covers about 15 acres. Solid waste is dumped into a disposal pit two acres in area. Access to the pit is on the northwest side. The remaining sides are vertical walls 15 to 30 feet high. The bottom of the pit lies about 15 feet below the level of the pit access point. The southern half of the remaining area is an elevated "final cover" terrace. Steep banks mark the landfill perimeter to the south and west. Water tends to pond on the terrace during rainfall. The water is drained into the adjacent forest through several plastic flexible pipes. Water also runs westward over the ground from the pit access point.

There is no evidence that runoff travels farther than 50 to 100 feet before sinking into the ground. A field reconnaissance revealed no channels, ditches, or streams that could carry surface flow beyond the forest which surrounds the landfill on all sides. Soils in the area are either indianola loamy sand (6 to 15 percent slopes) with good percolation or harstene gravelly sandy loam (6 to 15 percent slope) with a relatively impermeable hardpan (A-7 and B-3, respectively; Plate 4, Determan, et al., 1985).

The Purdy Landfill lies on the boundary between two drainage basins because of its ridge-top location (Figure 1). To the east and south, an unnamed tributary system ultimately discharges into Henderson Bay.

The small stream located east of the landfill flows southward past two residences, a pond, and pasturage. The stream is joined at 144th Street NW by an intermittant flow which originates near the landfill access road, and flows east along the north side of 144th Street NW. The combined flow passes under the road and through a housing development. It joins a small tributary flowing from the east at a point about 0.5 mile south of 144th Street NW. From here, the creek flows west to Henderson Bay about a mile away.

Purdy Basin lies downslope to the west and north. The ditch on the north side of 144th Street NW carries intermittant drainage from near the landfill entrance westward toward State Route (SR) 16. The flow drops down onto the shoulder of SR 16 and enters the storm drain system. Storm water is carried northward under the median strip, and is discharged into Purdy Creek on the northeast side of the highway. Purdy Creek eventually flows into Burley Lagoon.

METHODS

Fecal coliform samples were taken at 14 sites (Figure 1). Single samples of landfill runoff were analyzed using the multiple-tube, most-probable-number (MPN) method because of high turbidity. Membrane filter (MF) analyses were done on replicate samples from the other sites (APHA, 1980). At selected sites, flow measurements were made with a Marsh McBirney Model 201 flow meter

and a top-setting wading rod. Fecal coliform loads were calculated based on the method of Kittrell (1969):

Load (No. per sec) = fc x Q x 284.7

where:

fc = fecal coliform (number per 100 mL)
Q = stream flow (cubic feet per sec. or cfs)

At streamflow gauging sites, temperature was taken with a thermometer (range: 0 to 32°C). Conductivity (umhos/cm) was measured with a Beckman Solu Bridge field conductivity meter adjusted for temperature.

Daily rainfall data were obtained from workers at the Minter Creek Department of Fisheries salmon hatchery who maintain a rain gauge for the National Weather Service.

RESULTS

Rainfall totaled 0.6 inch on March 26, 1985. From March 20 through March 26, daily rainfall averaged 0.39 inch. Maximum 24-hour totals occurred on March 22 (0.82 inch) and March 23 (0.69 inch). Soils in the region appeared to be saturated. Standing water was visible in pastures and open spaces.

Fecal coliform densities, stream flows, FC loads, and field observations are shown in Table 1, together with a description of each sampling site. Relative loads are shown as a percentage of the load leaving Purdy Watershed (site P 0.1).

Landfill Site

Samples taken near the landfill disposal pit (sites C and D; Figure 1, inset A) were an order of magnitude higher than samples from the "final cover" terrace (samples A and B, inset A). The reason may be due in part to the presence of thousands of gulls and crows that stay close to the margins of the disposal pit. Few birds were seen on the remaining "final cover" area. The birds likely feed on the solid waste. There is little evidence that the waste is routinely covered with earth, which is the usual practice in landfill management.

Henderson Bay Drainage

The small creek (sites E, F, and G) was not seriously contaminated from either the landfill or the two small farms alongside the creek. The roadside drainage (site SD) entering the creek near site G had somewhat higher fecal coliform levels, but not higher than expected in roadside runoff. The residential

development farther downstream did not contribute significant levels of fecal bacteria to the creek, either (site H). Indeed, the highest level of fecal coliforms encountered along this creek came from the small east tributary draining a boggy, undeveloped area (site I).

Purdy Creek Drainage

The drainage from the roadside ditch at site K carried the highest concentrations of fecal coliforms (FC) encountered during the survey excluding the landfill itself. The FC load at Site K was nearly 14 times greater than the load carried into the eastern creek from the same ditch (Site SD). The conductivity at Site K was over twice as high as that at Site SD (34 and 13 umhos/cm, respectively). According to the contours on Figure 1, Site K lies about 100 feet lower in elevation than the landfill disposal pit. Site SD lies at the same or slightly higher elevation than the pit. There were no grazing animals, buildings, or other potential FC sources visible along 144th Street NW between Sites K and SD. We located no ditches, ravines, or creeks carrying runoff from the landfill to the roadside ditch over the ground. These facts suggest that ground-water movement from the landfill may be finding its way into the drainage ditch. The presence of a subsurface hardpan may facilitate this movement. The ultimate fate of this drainage is Purdy Creek and Burley Lagoon through the SR 16 storm drain.

Fecal coliform levels in Purdy Creek violated the Class AA freshwater quality standard ("Fecal coliform organisms shall not exceed a geometric mean value of 50 organisms/100 mL," etc.) at both Sites L and P0.1. FC concentrations were similar at both sites. However the streamflow at P0.1 was substantially higher. Thus, nearly 25 percent additional FC load was added between the two sites.

This outcome was different than that noted for this stretch of Purdy Creek during a previous rain-event survey in December 1983 (Determan, et al., 1985). At that time, there was no downstream increase in load. However, 24-hour rainfall was slight (0.1 inch) and runoff minimal.

DISCUSSION

During wet-weather conditions of the survey, the fecal coliform load from the roadside drain at 144th Street NW (Site K) accounted for one percent of the total load in the Purdy Creek basin (P0.1). This represents three percent of the total load added between Site L and P0.1 on Purdy Creek (Table 1). This is a small but measurable component of the load generated within the Purdy Watershed. Determan, et al. (1985) estimated that Purdy Watershed accounted for 12 percent of the load entering Burley Lagoon from the three main creeks in the Burley/Purdy Watershed. If the quality of the drainage in the ditch is due to contaminated ground water from the landfill, then an estimate of the effect of Purdy Landfill on Burley Lagoon would be one percent of 12 percent or 0.12 percent.

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CONCLUSIONS

1. The Purdy Landfill lies mostly in Purdy Watershed which drains into Burley Lagoon. A remaining part lies in a watershed draining into Henderson Bay.

2. The landfill is surrounded by forest on all sides. There is no evidence of surface runoff from the landfill reaching drains.

3. Runoff from Purdy Landfill contains very high concentrations of fecal coliform. This runoff ultimately sinks into the earth within 50 to 100 feet of the edge of the forest buffer. The highest concentrations were observed from areas surrounding the disposal pit. This may be due to the large populations of gulls and crows that feed on material dumped into the landfill. Routine covering of the waste in the pit may substantially reduce the numbers of foraging birds and the level of fecal coliform in runoff.

4. The drainage from the ditch on the north side of 144th Street NW entering Purdy Creek via the SR 16 storm drain system is equivalent to one percent of the Purdy Watershed load and 0.12 percent of the total load from both Burley and Purdy Creeks. If we assume that the source of fecal coliform contamination in this ditch is groundwater from the Purdy Landfill, the influence on local streams and Burley Lagoon is still relatively slight.

TAD:cp

Attachments

cc: Jane Hedges
Brett Betts
Bob Elliott
Starr Dehn

REFRENCES

American Public Health Assn., 1980. Standard Methods for the Examination of Water and Wastewater. 15th Ed. Washington D.C. 1193 pp.

Determan, T.A., B.M. Carey, W.E. Chamberlain, and D.E. Norton 1985. Sources affecting sanitary conditions of water and shellfish in Minter Bay and Burley Lagoon. WDOE Report No. 84-10 (draft). Wash. Dept. Ecology, Olympia, WA. 147 pp.

Kittrell, F.W., 1969. A Practical Guide to Water Quality Studies of Streams. U.S. Dept. Int./FWPCA. CWR-5. Washington D.C. 135 pp.

Table 1. Results from a survey of the Purdy Landfill and nearby drainages and streams.

Site No.	Site Description	Fecal Coliform (FC/100 mL)[a]	Flow (cfs)	FC load (FC/sec)	Relative Contribution (percent)[b]	Temp. (°C)	Conductivity (umhos/cm)
A	Pipe draining upper surface of "final cover" in southeast corner of landfill	9000(1)	--	--	--	--	--
B	As above; farther west along south wall	11,000(1)	--	--	--	--	--
C	Over-the-ground drainage from off-loading zone on west side of landfill	>240,000(1)	--	--	--	--	--
D	As in A, B, above; from upper surface immediately soth of D, above	>240,000(1)	--	--	--	--	--
E	Creek upstream of landfill and several small pastures	8 ± 0(2)	--	--	--	--	--
F	Creek east of landfill and downstream of pond and pastures	10 ± 3(2)	--	--	--	--	--
G	Creek southest of landfill at 144th Street NW	8 ± 1(2)	0.23	520	0.2	6.3	38
SD	Culvert draining roadside runoff along north side of 144th Street NW	33(1)	0.02*	190	0.1	5.2	13
H	Creek above confluence with tributary from east; downstream of residential area	12 ± 1(2)	0.45	1,540	0.5	4.8	38
I	East tributary; above confluence with North Creek; limited development observed; boggy	50 ± 2(2)	0.10	1,420	0.4	6.0	46
J	Creek mouth, Henderson Bay	29 ± 0(2)	0.33	2,720	0.8	6.2	83[c]
K	Drainage ditch along north side of 144th Street NW	915 ± 35(2)	0.01	2,600	0.8	6.4	34
L	Purdy Creek east of SR 16	84 ± 23(2)	10.46	250,000	74.7	5.6	65
PO.1	Purdy Creek; routine sampling site during Minter/Burley/Purdy study	88 ± 16(2)	13.36	335,000	100	5.8	71

[a]Results shown as x ± s(n).

[b]Loads relative to that observed at PO.1.

[c]High value may be due to presence of sea salts in sediments.

*Estimate.

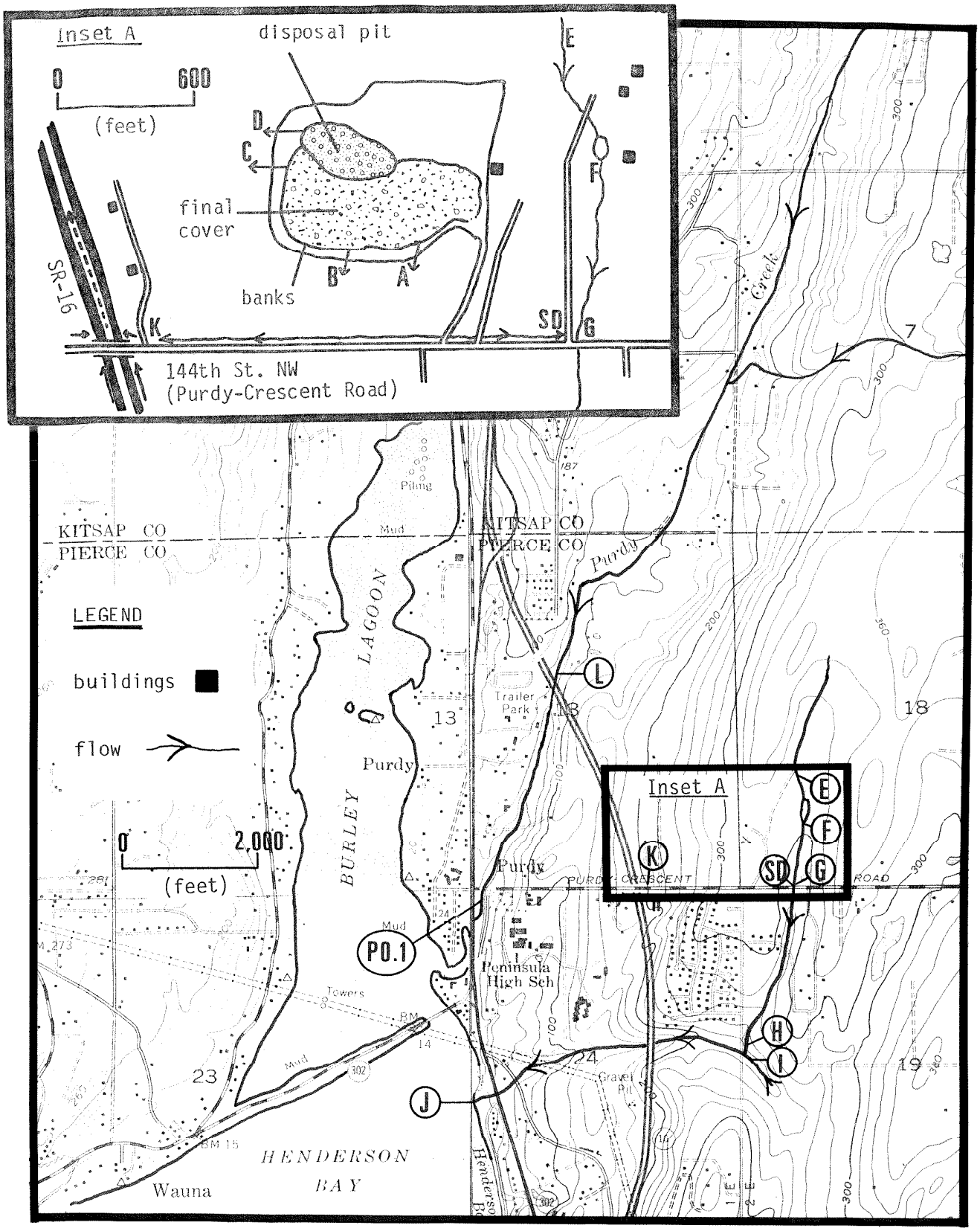

Figure 1. Purdy Landfill and Burley Lagoon showing water sampling sites on March 26, 1985.