



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

M E M O R A N D U M

August 24, 1982

To: Dick Cunningham
From: Timothy A. Determan *TAD*
Subject: Reconnaissance of Henderson Inlet

INTRODUCTION

On Monday, August 16, 1982, I performed a short reconnaissance of Henderson Inlet and associated drainage basins at your request. The reconnaissance was carried out after Jack Lilja of Department of Social and Health Services (DSHS) Shellfish Sanitation Program reported high bacteria levels in a sample of oyster tissue collected from the inlet.

I was accompanied by Darrel Anderson of Washington Department of Ecology (WDOE) Southwest Regional Office who is familiar with the area. The purpose of the reconnaissance was to note general land-use patterns within the Henderson Inlet basin, obtain sets of bacteriological samples from input streams, and make recommendations for further work as needed.

OBSERVATIONS

The head of Henderson Inlet is located 3 km north of Lacey, Washington. The inlet is about 8.5 km along the north-south axis (Figure 1). It can be divided into two compartments. The outer, north compartment is 5.5 km in length and averages about 1 km in width. The depth ranges from a maximum of 60 feet at the mouth to 2 feet at the southern limit at mean lower low water (MLLW). The inner compartment is considerably smaller and is the site of the oyster beds (Figure 1). The length is 3 km and the width is 0.3 km. The bottom is an exposed mudflat at MLLW.

Two small streams discharge into Henderson Inlet. Woodward Creek flows north from East Olympia, an urban-residential area, then passes through mixed suburban and rural countryside composed mainly of one- to five-acre tracts with light agriculture and residential use. Housing and buildings are confined to roadsides which provide some open space between houses and the creek. The housing is a mixture of old and new, indicating a growing community. There is evidence of large livestock such as cows and horses. Further downstream, land-use grades into mainly agricultural type with several large dairy farms and horse ranches. The creek then flows into Woodward Bay, an extensive mudflat which enters

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the west side of Henderson Inlet. The Weyerhaeuser Company operates a large log storage area between Woodward Bay and Chapman Bay. The second stream, Woodland Creek, flows north from Lacey through rural lands of large dairy and horse ranches (15 to 40 acres) with low-intensity, suburban-rural use near the point of discharge into the southern part of Henderson Inlet.

Several other small creeks discharge into Henderson Inlet mainly in the southern end. There is also evidence of surface seepage from the clayish soils surrounding the inlet. The outer, northern compartment appears to have fewer streams, springs, or seeps feeding into it. There is evidence of low areas, channels, and drainage patterns that undoubtedly carry runoff during periods of extended rainfall. The area that is drained is primarily wooded or pastureland for large animals.

Much of the Henderson Inlet shoreline has been subdivided into one- to three-acre tracts that are used for residences and light agricultural practices, including keeping of livestock. We observed ducks, chickens, cows, horses, sheep, and a mule. Two fairly large cattle herds (10 to 20 animals) were observed at or near the shoreline within 0.5 km of the oyster beds located near the outer boundary of the southern compartment.

Replicate samples were taken from five streams for analysis of fecal coliform densities. Analysis was commenced within six hours of sampling using the membrane filter method (APHA, 1975). Stream flows ranged from highest at Woodward and Woodland creeks to a trickle at Snug Cove. Flows were not measured so loads cannot be calculated. No marine water samples were taken since there was no water in innermost Henderson Inlet at the time of the reconnaissance.

Table 1 summarizes the data. The highest fecal coliform values were detected at Woodward Creek (STN. 1), Woodland Creek (STN. 3), and an unnamed creek (STN. 4) on the Johnson Point Road. Results from several Burley Lagoon streams sampled in August, 1980 are shown for comparison (Clark and Determan, 1981).

According to the Washington State Water Quality Standards (WDOE, 1980), Puget Sound through Admiralty Inlet and South Puget Sound, south and west to Brisco Point on Hartstene Island is classified as Class AA. Henderson Bay falls into this classification. Undesignated surface waters that are "tributaries" to Class AA waters are designated as Class AA also. Thus, the Class AA freshwater standard is the appropriate standard for Henderson Inlet streams. The standard is shown on Table 1. There are too few data at present to compare to the Standards.

I have discussed the Henderson Bay situation with Jack Lilja several times since the reconnaissance. He has provided a copy of a detailed sanitary survey conducted in August, 1978. No samples were taken at

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that time. An additional study in 1981 included bacteriological data from shucked oysters which suggested a contamination source in the basin. Samples taken at Station 3 showed a median value of 62 fc/100 mls (n = 6) over a four-month, wintertime period, somewhat lower than our summer results. No samples of marine waters over the shellfish beds were taken. Samples taken from chlorinator-type individual disposal systems suggested those to be the major source rather than loads from the Woodland River. The role of livestock pasturing was not specifically addressed. Data from their most recent sampling are also attached, in addition to a map showing sampling stations. These data are for water samples collected during the recent period of high fecal coliform tissue densities. (Background data are available on file for Stations 21 and 22, according to Mr. Lilja.) During this period, the median fecal coliform density at Station 20 (Woodland Creek) was 350 fc/100 mls, which was considerably higher than our own value at the same site (STN. 3) sampled several days later. The data generally suggest a pattern of decreasing fecal coliform density following a major rainfall event. Supplemental sampling during the following week continued this trend, according to Mr. Lilja. Therefore, DSHS has decided to delay any closure action until a more definitive wet-weather study is conducted.

RECOMMENDATIONS

DSHS seems to be collecting substantial data at this time from shellfish and marine waters in Henderson Inlet. I have suggested to Mr. Lilja that we could assist his team during the wet-weather study by sampling input streams and measuring flow since DSHS does not have this ability. We then can estimate loads and establish the importance of each probable source of contamination.

We should remember that the drainage system for Henderson Inlet has been or is undergoing large-scale urban development in the upper reaches. The two major inputs (Woodward and Woodland creeks) undoubtedly receive massive inputs of stormwater during rain events. The agricultural use farther downstream, coupled with the urbanization of upland areas may have serious implications for the continued use of Henderson Inlet for shellfish mariculture. Although the present issue of concern seems to be fecal coliform contamination, the level of toxic materials, metals, oils and grease, etc. in the shellfish should be considered.

TAD:cp

Attachments

REFERENCES

- American Public Health Association, 1975. *Standard Methods for the Examination of Water and Wastewater*. 14th Ed., Washington DC, 1193 pp.
- Clark, D.K. and T.A. Determan, 1980. Burley Lagoon water quality survey, August 1980. Intra-office memorandum. Wash. Dept. Ecology, Olympia WA.
- Washington Department of Ecology, 1980. Water quality standards for waters of the State of Washington *in* Laws and Regulations; Water Pollution. Olympia, WA. 11 pp.

Table 1. Fecal coliform levels in streams discharging into two Puget Sound shellfish growing areas.

Station Number	Description	Relative Flow	fc/100 mls (median)	n*
<u>Henderson Inlet</u> (August 16, 1982)				
1	Woodward Creek at Woodward Bay Road	high	90	2
2	Small stream at Snug Harbor	very low	24	2
3	Woodland Creek at South Bay Road	high	120	2
4	Unnamed creek, east shore inner Henderson Inlet	medium	120	2
5	Unnamed creek near Swayne Road	low	34	2
<u>Burley Lagoon</u> (August, 1980)				
	Burley Creek	--	430	3
	Purdy Creek	--	170	3

Water Quality Standard for fc (Class AA) freshwaters: Median value not to exceed 50 fc/100 mls; not more than 10% to exceed 100 fc/100 mls.

*n = number of samples.



STATE OF
WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

Olympia, Washington 98501

Mail Stop LD-11

September 20, 1978

J. V. Deshayé, M.D., D.P.H.
Thurston-Mason Health District
529 S.W. Fourth
Olympia, Washington 98501

Attn: Patrick Vosse
Director of Environmental Health

Dear Doctor Deshayé:

Enclosed is a copy of a sanitary survey of Henderson Inlet (South Bay) which was recently completed by this agency.

We are happy to report that there were no failing fecal on-site sewage disposal systems found in the 214 places of human habitation surveyed. Only one out of twelve chlorinated effluent type systems was found to be non-operable. There were 32 recreational cabins surveyed and ten of them were found to be discharging sink and/or laundry waste upon the surface of the ground.

We would appreciate your department affecting repairs of the places of human habitation discharging waste to the surface of the ground. To assist you in locating these survey sites, we are forwarding to you a color coded map of the survey area.

Since this survey was conducted during a dry time of the year, there could be some drainfields breaking out when the rainy weather sets in. If in your routine surveillance of this area you should come across conditions which could be hazardous for humans to consume the shellfish from this estuary, we would appreciate being advised.

Thank you for your kind consideration.

Very truly yours,

FOOD AND HOUSING SECTION

Max G. Hays

Max G. Hays, R.S.
Advisory Sanitarian
Shellfish Program Supervisor

MGH:jh

Enclosures

SANITARY SURVEY OF HENDERSON INLET

Thurston County

A sanitary survey of Henderson Inlet was conducted for the purpose of locating and evaluating potential and actual sources of pollution affecting the sanitary quality of the shellfish growing waters. The survey was conducted during August, 1978 by Leo Wainhouse.

Items investigated included: the location and operating conditions of individual sewage disposal systems; the means of disposition of waste water if other than subsurface disposal; the condition of the soil with regard to drainage; the number of inhabitants at each site; and the number of large animals pastured at each site.

A site was considered to have a failing disposal system when sewage effluent was not confined underground in the case of subsurface disposal systems. Also when sewage effluent was discharged directly to the bay as in the case of failing chlorinated effluent systems.

Water from a kitchen, laundry or bath not confined underground but instead discharged to the ground, watercourse of bay was noted as nonfecal contamination. The area surveyed included 4 to 7 miles of Woodwark Creek, 5.5 miles of Woodland Creek and 16.5 miles of Henderson Inlet shoreline. Of the 234 sites in the survey area, 214 or 88% were surveyed.

There were no places of human habitation found with a failing fecal on-site sewage disposal system. This absence of failing systems maybe attributed to the time of year the survey was undertaken. Twelve chlorinated effluent sewage disposal systems were surveyed. Only one confirmed system was found to be non-operable. Since chlorinated systems depends greatly upon the maintenance of the equipment, their effectiveness is always questionable.

A total of 32 recreational cabins were surveyed. Of this number, ten were found to be discharging nonfecal contamination to the ground. One permanent residence and one recreation cabin were found with drainfields subject to flooding during high winter tides.

Please see attached table and maps.

WASHINGTON STATE DEPARTMENT OF SOCIAL AND HEALTH SERVICES
DIVISION OF HEALTH
SANITARY UPLAND SURVEY OF SHELLFISH GROWING AREAS

Location: Henderson Inlet

	NUMBER	%	# SURVEYED	% SURVEYED
A. Total Sites on Watershed:	<u>243</u>	<u>100%</u>	<u>214</u>	<u>88%</u>
Total Permanent Residences.....	<u>190</u>	<u>1/</u>	<u>175</u>	<u>94%</u> <u>2/</u>
Total Recreational Cabins.....	<u>32</u>	<u>1/</u>	<u>26</u>	<u>85%</u> <u>2/</u>
Total Commercial Sites.....	<u>4</u>	<u>1/</u>	<u>4</u>	<u>100%</u> <u>2/</u>
Total Vacant Sites.....	<u>17</u>	<u>1/</u>	<u>14</u>	<u>82%</u> <u>2/</u>
Total Pasture Sites.....	<u>29</u>	<u>1/</u>	<u>28</u>	<u>96%</u> <u>2/</u>
	NUMBER	%	POPULATION	# NOT SURVEYED
B. Permanent Residences Surveyed:	<u>175</u>	<u>100%</u> <u>2/</u>	<u>467</u>	<u>43</u>
Premises discharging raw sewage.		<u>3/</u>		
Premises discharging effluent directly to bay or stream.	<u>1</u>	<u>.5%</u> <u>3/</u>	<u>2</u>	
Premises discharging effluent to surface of ground.		<u>3/</u>		
Premises with non-fecal discharge to bay, stream or ground.		<u>3/</u>		
Premises with disposal systems in an adverse location or soil.	<u>1</u>	<u>.5%</u> <u>3/</u>	<u>2</u>	
C. Recreational Cabins Surveyed:	<u>32</u>	<u>2/</u>	<u>60</u>	
Premises discharging raw sewage.		<u>3/</u>		
Premises discharging effluent directly to bay or stream.		<u>3/</u>		
Premises discharging effluent to surface of ground.		<u>3/</u>		
Premises with non-fecal discharge to bay, stream or ground.	<u>10</u>	<u>31%</u> <u>3/</u>	<u>15</u>	
Premises with disposal systems in an adverse location or soil.	<u>1</u>	<u>3%</u> <u>3/</u>	<u>3</u>	
D. Commercial Sites Surveyed:	<u>4</u>	<u>2/</u>	<u>33</u>	
Premises discharging raw sewage.		<u>3/</u>		
Premises discharging effluent directly to bay or stream.		<u>3/</u>		
Premises discharging effluent to surface of ground.		<u>3/</u>		
Premises with non-fecal discharge to bay, stream or ground.		<u>3/</u>		
Premises with disposal systems in an adverse location or soil.		<u>3/</u>		

E. Pasture. Total Animals 185. Animals with Access to Water 125.

1/ Percent of sites of that category.

2/ Percent of sites surveyed of that category.

3/ Percent based on number of sites of that category surveyed.

Effluent discharged directly to bay:

Bowden

Route 7 Box 498 - Site #153

Kitchen and or laundry wastes drained to bay, stream or ground:

Day, Knause, D. Daviscourt, R. Daviscourt

Summer cabins off shore across road - Site #37

O'Hare summer place

Off 61st Avenue - Site #143

Bowden.

Unknown summer cabin

Between Box 507 and 506A on 72nd Avenue - Site #159

Zydek summer cabin

Between Box 507 and 506A on 72nd Avenue - Site #160

Unknown summer cabin

Off 72nd Avenue - Site #166

Kitchen and laundry wastes drained to bay, stream or ground:

Jorgenson summer cabin

Off 72nd Avenue - Site #167

Burton summer cabin

Off 72nd Avenue - Site #169

Ericson summer cabin

Off 86th Avenue - Site #194

Drainfield subject to flooding by high tide:

Angel

Route 9 box 498

Drainfield in log bulkhead on beach

Galbraith summer cabin

Off 72nd Avenue

Drainfield in beach



STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
Olympia, Washington 98504

March 11, 1981

Mr. Don Leaf 753-8073 (inform him if sampling effort is picked up.)
Environmental Health Division
Thurston County Health Dept.
2000 Lakeridge Drive S.W.
Olympia, Washington 98502

Dear Don:

In response to your request I am forwarding the data concerning our findings in Henderson Inlet. As you know, our increased concern regarding the water quality of Henderson Inlet was stimulated by recent shell-stock samples which exceeded the fecal coliform standard of 230/100 grams of shellfish meat. The list of shell-stock samples below span the last 12 months of sampling at the oyster plant in Henderson Inlet.

<u>Date Collected</u>	<u>Bed #</u>	<u>Total Coliform</u>	<u>Fecal Coliform</u>
2-20-80	6	4,600 MPN/100 grams	3,300 MPN/100 grams
10-13-80	8	130 MPN/100 grams	20 MPN/100 grams
1-12-81	6	35,000 MPN/100 grams	460 MPN/100 grams
1-26-81	6	1,300 MPN/100 grams	790 MPN/100 grams
2-16-81	2	3,100 MPN/100 grams	490 MPN/100 grams

To isolate the source of pollution, other historical records were examined and additional water samples were taken. In August of 1978 a shoreline sanitary survey was conducted and no septic systems were found to be failing. However, during the water samplings conducted on February 9, 1981, a failing mound system was identified at the George Krash residence, 5402 South Bay Terrace Drive. This system is reported to have a french drain which could pipe the overflow from the mound directly to the bay. Water samples were taken at the end of the pipe and from standing water on the surface of the ground in the vacant lot next to the mound system. The effluent from four of the chlorinated systems identified in the 1978 survey were also sampled. The results are as follows:

<u>Name & Address</u>	<u>Type System</u>	<u>Sampling Loc.</u>	<u>Results</u>
Arthur Getchman 4427 Johnson Pt. Rd.	Chlorinator	End of pipe at stream bed	Total coliform 4,600,000/100 ml. Fecal coliform 4,600,000/100 ml.
George Krash 5402 So. Bay Ter. Dr.	Mound	End of pipe at french drain	Total coliform 11,500/100 ml. Fecal coliform 3.0/100 ml.

Mr. Don Leaf
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March 11, 1981

<u>Name & Address</u>	<u>Type System</u>	<u>Sampling Loc.</u>	<u>Results</u>
		Standing water in vacant lot	Total coliform 15,000/100 ml. Fecal coliform 9.1/100 ml.
Eldon Flahaut 5529 Johnson Pt. Rd.	Chlorinator	In pipe after CI contact chamber	Total coliform 4,600,000/100 ml. Fecal coliform 2,400,000/100 ml.
Harvey Robinson 4328 - 68th Ave. (Rental)	Chlorinator	In contact chamber	Total coliform 3.0 Fecal coliform 3.0
Harvey Robinson 4310 - 68th Ave.	Chlorinator	In contact chamber	Total coliform 23,000 Fecal coliform 9,300

In addition to the samples above, data from Woodland Creek water samples at the Johnson Point Road bridge were examined.

<u>Date</u>	<u>Fecal coliform</u>
10-20-80	170/100 ml.
10-21-80	220/100 ml.
11-19-80	79/100 ml.
1-12-81	46/100 ml.
1-14-81	33/100 ml.
2-9-81	43/100 ml.

There were no water samples taken over the shellfish beds during 1980, so we could not make a direct comparison of growing water quality to shellfish meat quality. However, it is known that the oysters are harvested by hand at the low tide, at which time the stream flows over bed #6. Bed #8 which produced the only satisfactory shell-stock sample is not in the path of the stream at low tide. Considering the high test results of the chlorinators and the lower levels of fecal coliforms detected at the bridge above the chlorinators, it seems likely the Gatchman and Flahaut chlorinators must be having a substantial influence on the sanitary quality of the stream at low tide. Therefore, the water quality of the stream must have an adverse impact on the sanitary quality of the shellfish. Corrective action is needed to prevent further deterioration to the water quality of Henderson Inlet and the potential loss of the inlet to commercial shellfish production.

Sincerely,

FOOD AND HOUSING SECTION

Jack Lilja

Jack Lilja, Acting Supervisor
Shellfish Program

JL:jh

HENDERSON INLET
FECAL COLIFORMS
August 9-12, 1982

Station \ Date	August 9		August 10		August 11		August 12	
1	79	79	79	17	17	23	4.5	13
2	11	79	49	33	23	33	7.8	11
3	7.8	170	49	33	9.3	13	13	7.8
4	17	170	79	23	14	4.5	2.0	7.8
5	130	130	33	33	13	6.8	2.0	7.8
6	23	49	23	49	13	13	7.8	7.8
7	79	13	9.3	17	33	2.0	4.5	4.5
8	23	17	6.8	11	22	11	4.5	13
9	17	13	23	11	6.8	4.5	9.2	6.8
10	13	6.8	4.5	7.8	13	<1.8	4.5	4.0
11	4.5	4.5	13	6.8	4.5	2.0	4.5	13
12	23	6.8	23	<1.8	2.0	4.5	2.0	2.0
13	22	79	6.8	79	6.8	11	6.8	2.0
21	6.8	17	7.8	11	7.8	4.5	13	4.5
22	17	33	4.5	11	4.5	<1.8	2.0	4.5
20	920		350		350		70	

HENDERSON INLET

FECAL COLIFORMS

August 9-12, 1982

<u>Station</u>	<u>Median</u>	<u>Range</u>	<u>% > 43</u>
1	20	4.5-79	37.5
2	28	7.8-79	25
3	13	7.8-170	25
4	15	2.0-170	25
5	23	2.0-130	25
6	18	7.8-49	25
7	11	2.0-79	12.5
8	12	4.5-23	0
9	10 12	4.5-23	0
10	6	<1.8-13	0
11	4.5	2.0-13	0
12	3	<1.8-23	0
13	9	2.0-79	25
21	7.8	4.5-17	0
22	4.5	<1.8-33	0

Water quality Standard for fc (Class AA) marine waters: fecal coliform organisms shall not exceed a median value of 14 organisms per 100 ml, with not more than 10% of samples exceeding 43 organisms/100 ml.

Henderson Inlet
Sampling Station Locations



