Peace Portal Dye Test

March through April, 2003

Report Submitted
to
Whatcom County Water Resources Division

Written by

Geoff Menzies

for

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Introduction

A six-month long community-based shoreline storm water sampling program was conducted during the late summer and fall of 2001. The focus area was 11 storm drains along the eastern shore of Drayton Harbor, including the mouths of Dakota and California Creeks. This project was managed by the Puget Sound Restoration Fund (PSRF) with support from the City of Blaine, Washington State Department of Health-Shellfish Division (DOH), Whatcom County Water Resources Division and citizen volunteers. Results were summarized in the February, 2002 report titled: Drayton Harbor Community Shoreline Water Quality Sampling Program, FINAL REPORT. This report was submitted to Whatcom County Water Resources Division and distributed to all of the project partners.

All of the partners as well as some interested citizens and local agency representatives were convened on February 20, 2002 to review and discuss the results of this project.
At the request of the PSRF, DOH reviewed the findings of the Shoreline Sampling report in detail in June, 2002. This review was done by Frank Meriwether. His comments were shared with Geoff Menzies (PSRF), Grant Stewart (Blaine Public Works Director) and Ami Stillings (Whatcom County). In summary, Mr. Meriwether felt that it was possible that the high fecal coliform concentrations detected at storm drains 2 and 3 (see figure 1) could be due to possible cross-connections between the sanitary sewer and storm water conveyance systems. He recommended that a simple dye test of sewer manholes in the drainages serviced by these two storm water drains could determine whether such a connection does exist. With partnering from Blaine, maps of the storm and sewer systems were then sent to DOH in order to precisely identify the overlap of the area drained by the storm system and serviced by the sanitary sewer collection system. Based on these maps, ten manholes were selected for dye testing. It was agreed that after a work plan had been drafted, the City of Blaine would partner with PSRF to complete this follow-up project during the winter of 2002-2003.

This report summarizes the findings of this 2-month test, which was completed in April, 2003.

Methods and Materials

Charcoal packets provided by Ozark Underground Laboratory were used as the primary method to determine whether fluorescein tracer dye placed in sewer manholes made its way into storm water drainages or into marine waters. Each packet contains 4.5 grams of 12- mesh coconut-activated charcoal. Two weeks before the dye test, duplicate charcoal packets were place at three locations, Port of Bellingham sampling station E (POB E) and at the end of storm drains 2 and 3 (see figure1). These packets were collected and replaced seven times during the course of the study. This provided information on background levels of dye two weeks before and the week before the dye test as well as on days 1,3,5,7, and 14 after dye was delivered to the sewer manholes. One set of charcoal packets was sent routinely during the study period to DOH for initial analysis. The duplicate set of packets were stored in a refrigerator during the study and sent to Ozark Underground Laboratory (OUL) for analysis once the field work was complete.

Charcoal packets were also placed and collected in a third storm drain (drain 2.5) on four occasions after the dye test began; days 1,3,5, and 7. These were also analyzed by both DOH and OUL. Charcoal packets were placed in the water stream of each storm drain by attaching them

with a plastic tie to a 10-inch length of plastic coated electrical wire that was attached to a 3-holed brick, which was inserted upstream inside of each drain pipe. The charcoal packets used at POB E were attached with a plastic tie to a nylon line below a crab pot float anchored at this location.

In addition to charcoal packet analysis by both DOH and OUL, visual observations for dye were made in the field on every occasion that charcoal packets were collected and replaced. Immediately after dye was placed in the manholes, several volunteers were positioned along the storm water drainage area for three hours to look for signs of fluorescence in the runoff.

The depth of storm water flow at the end of each drain was measured every time charcoal packets were replaced to assess relative flow in the storm drains during the test period.

Two pounds of Fluorescein dye (powder, 75%AI) was provided by OUL for this study. It was well mixed with 2 gallons of water, then divided into 10 separate 26 -ounce containers, which were delivered to staff persons from the City of Blaine one day prior to the test. Between 8 and 10 a.m. on March 25th, Blaine staff poured one 26-ounce container of dye into each of the following manholes: D6-5C0, D6-3, D5-5, D5-4(west end of alley, north of Boblett between Peace Portal and 3rd), E6-10, E6-9, D4-5, D4-6, D5-4(Peace Portal), and the unnumbered manhole on the corner of Cedar St. and Peace Portal which feeds directly into D6-1. Delivery of dye to each manhole was immediately flushed with about twenty gallons of water.

Dye Recovery Analytical methods

The procedures used by Ozark Underground Laboratory to extract, identify, and quantify Fluorescein dye is described in detail in the publication titled: "Procedures and Criteria Analysis of Fluorescein, Eosine, Rhodamine WT, Sulforhodamine B, and Pyranine Dyes in Water and Charcoal Samplers, January 2, 2001", written by Thomas Aley, PHG 179, President of Ozark Underground Laboratory, Inc.. Charcoal packets upon receipt are refrigerated, then cleaned by spraying them with jets of clean water. An eluting solution is then used to recover the dye if present from each charcoal packet. A sample of the elutant is then placed in a Shimadzu spectrofluorophotometer. Where dye is detected, results are reported as peak wavelength in nanometers and the dye concentration, based on either the height of the fluorescence peak or the area within the fluorescence peak, is reported in parts per billion. The fact that a fluorescence peak is identified in their analytical results is <u>not</u> proof that it is fluorescein dye or that it is fluorescein dye from the trace of concern. There are several criterion which must be met in order to confirm that fluorescein dye detected from charcoal packets is from the trace of concern. These include all of the following factors: the fluorescence peak, dye concentration relative to the detection limit, dye concentration relative to background levels, and finally the shape of the fluorescence peak.

DOH used the following procedure to analyze charcoal packets. Charcoal packets were processed chronologically, one sample day of packets at a time. Each packet was rinsed with non-chlorinated water to clean off any loose dirt and organic solids in the packet. Then the charcoal in each packet was covered with a 5% solution of potassium hydroxide (KOH) in 70% isopropyl alcohol in a glass test tube, capped, and set in a dark room for several hours before

assessment. Presence of dye was assessed visually in a dark room with a pen light (white light) with a narrow beam for the presence of fluorescence. A white background was provided to aid in the visual determination of any green fluorescence. This assessment was conducted for each test tube approximately three and six hours after the charcoal was immersed in the KOH solution.

Results

The table below (Table 1) on the following page summarizes the results. See Appendix A (Hard Copy only) for complete package of results from Ozark Underground Laboratory which includes: Certificate of Analysis, Results Summary Table 1, field data sheets, and Fluorescence magnitude graphs for each detection.

Table 1: Peace Portal Dye Test Results - March - April, 2003

						Dye results		Ozark Lab Results	
Charcoal Pack	Placement Date	Placement Time	Collection date	Collection Time	Flow (" deep)	Field search	DOH Detection	Peak wavelength (nanometers)	Conc. (ppb)
PRE DYE									
POB E	11-Mar	1200	18-Mar	1136	na	none	none	ND	
Drain 2	11-Mar	1300	18-Mar	950	2.5	none	none	513.8	0.624
Drain 3	11-Mar	1330	18-Mar	1011	0.5	none	none	513.0 *	0.487
POB E	18-Mar	1140	25-Mar	755	na	none	none	ND	
Drain 2	18-Mar	1000	25-Mar	703	2	none	none	513.8	1.160
Drain 3	18-Mar	1015	25-Mar	718	0.75	none	none	513.9 *	0.396
	Fluorescein tracer dye was poured into sanitary sewer manholes on 3/25 between 8 a.m. and 10 a.m.								
POST DYE									
POB E	25-Mar	757	26-Mar	1128	na	none	none	ND	
Drain 2	25-Mar	707	26-Mar	1015	2	none	none	514.0 *	0.374
Drain 3	25-Mar	722	26-Mar	1040	0.5	none	none	513.7 *	0.290
Drain 2.5	25-Mar	733	26-Mar	1055	0.25	none	none	515.8 *	0.146
POB E	26-Mar	1132	28-Mar	730	na	none	none	ND	
Drain 2	26-Mar	1021	28-Mar	750	2	none	none	513.6 *	0.486
Drain 3	26-Mar	1045	28-Mar	815	0.37	none	none	513.0 *	0.300
Drain 2.5	26-Mar	1100	28-Mar	805	0.12	none	none	513.8 *	0.185
POB E	28-Mar	740	30-Mar	1352	na	none	none	ND	
Drain 2	28-Mar	755	30-Mar	1410	2.75	none	none	514.8	0.706
Drain 3	28-Mar	820	30-Mar	1425	0.75	none	none	512.2 *	0.275
Drain 2.5	28-Mar	808	30-Mar	1440	0.25	none	none	513.4 *	
POB E	30-Mar	1357	1-Apr	1115	na	none	none	ND	
Drain 2	30-Mar	1414	1-Apr	1130	2.5	none	none	513.4 *	0.706
Drain 3	30-Mar	1431	1-Apr	1201	0.75	none	none	513.6 *	0.477
Drain 2.5	30-Mar	1445	1-Apr	1145	0.5	none	none	ND	
POB E	1-Apr	1118	8-Apr	1108	na	none	not sent	ND	
Drain 2	1-Apr	1135	8-Apr	1122	2.5	none	not sent	514.2	0.861
Drain 3	1-Apr	1204	8-Apr	1135	0.7	none	not sent	513.2 *	0.609

Footnotes:

ND = No dye detected

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result but has been calculated as though it were the tracer dye.

Results Cont'd:
Environmental conditions were ideal for this study in that there was significant ground saturation at the start of the test, and enough rainfall throughout the test to maintain good flows in all storm drains that were checked. A past indicator of saturated conditions along this drainage is a corrugated metal pipe east of the railroad tracks between drains 2 and 3. This pipe only has groundwater flow under very wet conditions. It was flowing on every day that charcoal packets were replaced during this study.

No dye was observed in the field during the test. Storm Drain #1, which drains the marsh just east of the boat ramp, was observed on every occasion that charcoal packets were replaced. Dye was never seen in this drainage. Tracer dye was first observed at the Blaine wastewater treatment plant at about 12:00 noon on March 25.

DOH did not see any fluorescence in the visual analysis that they performed on any of the charcoal packet samples.

Ozark Underground laboratory detected background levels of some fluorescent material at both storm drains 2 and 3 but not at POB station E. After tracer fluorescein dye was added to the sanitary sewer system, fluorescence was detected at storm drains 2 and 3 in every sample that was submitted, but not at levels significantly higher than the background levels. Ozark also detected fluorescence in storm drain 2.5 from three of four samples that were submitted but at even lower concentrations than were detected in drains 2 and 3. Based on these results, none of the tracer dye that was placed in the sanitary sewer manholes was recovered in any of the sites. This indicates that the occasionally high fecal coliform concentrations detected in these storm drains is not the result of any cross-connection with the sanitary sewer system in this area.

Fluorescence that was detected in background samples and after the initiation of the dye test is probably due to the presence of fluorescein, which is a common ingredient in anti-freeze. It is not unusual for small quantities of anti-freeze to be detected in storm water drainage.

Acknowledgements
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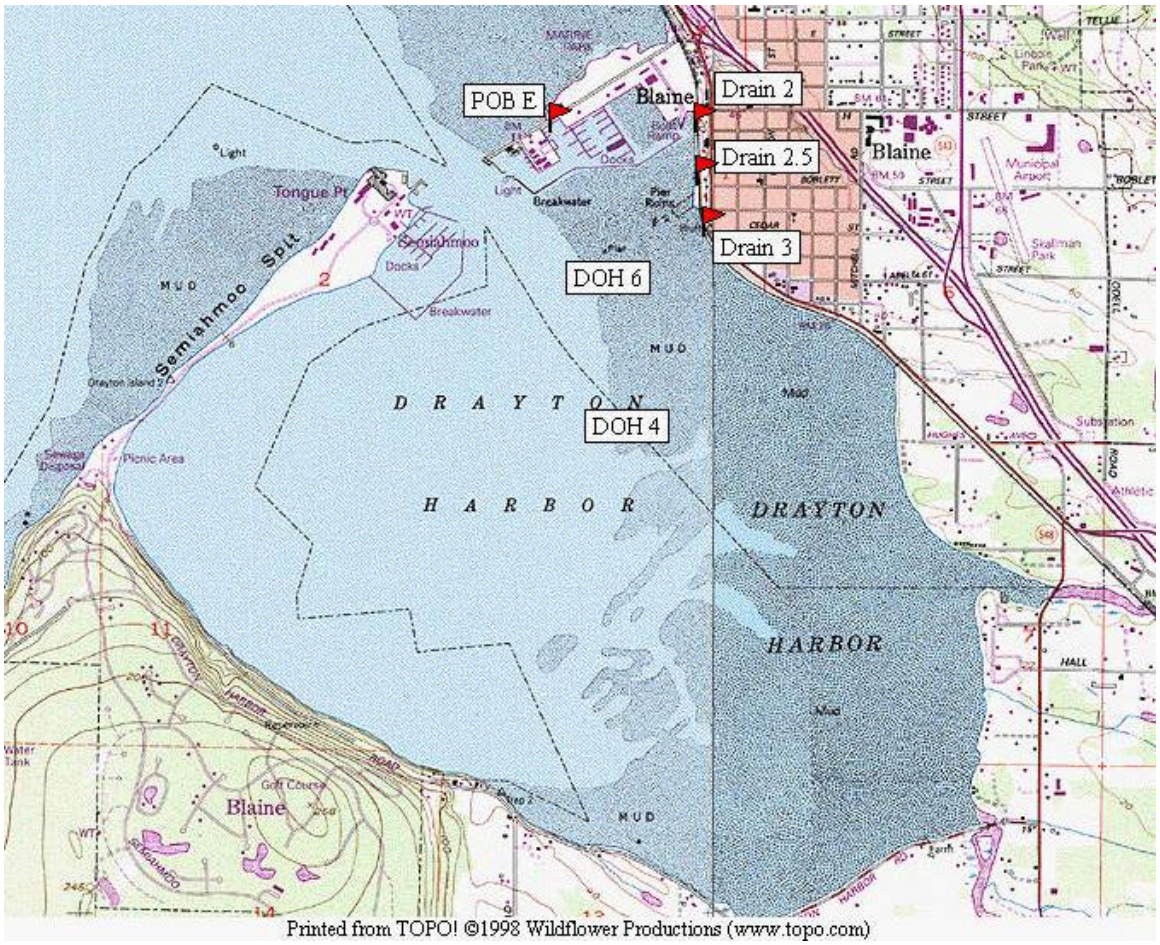

Figure 1: Peace Portal Dye Test; red flags denote location of charcoal packets

Drain 2: Culvert below railroad tracks which drains to small surface stream into marine waters near Blaine Harbor boat ramp . (Lat. N48.99306, Long. W 122.75294)

Drain 2.5: 18 " diameter culvert under railroad tracks which drains surface flow east of railroad tracks and discharges to bank above Drayton Harbor (Lat. N48.98956, Long.W122.75248)

Drain 3: 36" diameter culvert near Peace Portal and 3rd which discharges directly to Drayton Harbor (Lat. N48.98774, Long. W122.75134)

POB E: Port of Bellingham marine water quality station "E"

DOH 4 and 6: Department of Health ambient marine water quality stations which represent the primary commercial oyster growing areas in Drayton Harbor.