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DEPARTMENT OF ECOLOGY

March 8, 1994

TO: Joyce Mercuri

FROM: Dave Serdar DS

THROUGH: Dale Norton D.N.

SUBJECT: Evaluation of Thea Foss Waterway Storm Drain Data

BACKGROUND

Thea Foss Waterway, located in inner Commencement Bay, is heavily contaminated with a variety of pollutants from point and non-point sources (Tetra Tech, 1985; City of Tacoma, 1990; Norton, 1993). A number of storm drains discharging into the waterway have been shown to be substantial contributors to the problem. Remediation of the waterway is scheduled to begin in the near future. In order for the City of Tacoma, as well as other parties, to begin the remediation process, information on existing sources of contamination is needed so that the city may begin to identify and eliminate these sources.

In November 1993, the Environmental Investigations and Laboratory Services (EILS) Program at Ecology was asked to review existing Thea Foss storm drain data. Most of these data were generated by the City of Tacoma during a 1987-1989 study of water quality in Foss (then called City Waterway) and other areas of inner Commencement Bay. The objectives of this review are to: 1) provide staff of the Commencement Bay Urban Bay Action Team an evaluation of the usefulness of these data in efforts to identify contaminant sources, and 2) make recommendations on actions to better identify sources of contaminants in Foss storm drains.

RESULTS

The following is a reply to specific questions listed in a memorandum from Joyce Mercuri to Dave Serdar dated November 24, 1993. In some instances, the questions were lumped together to avoid redundancy of the replies.

Q: Does the information we currently have tell us anything useful? can we tell which drains really cause the worst problems and how bad these problems are? Can we make judgements about sediment impacts to the waterway from the existing information? Is more information needed before we can tell how much of a problem individual drains are? What kind of info?

As mentioned previously, the bulk of the data comes from suspended particulates collected by the City of Tacoma during 1987-1989. Some Ecology and City of Tacoma catch basin sediment data are also available. In general, the City of Tacoma data are of limited use in quantifying and prioritizing pollutant loadings to the waterway. This is primarily due to the lack of quality assurance (QA) data and comprehensive flow information.

The absence of QA data does not allow a means to evaluate the precision and accuracy of the data set and associated uncertainty of the chemical results. In addition, the lack of flow data makes it difficult to quantify pollutant loadings from individual drains and subsequently prioritize the contributions of individual drains.

One approach to evaluating these data is shown in Table 1. The available data were summarized and compared to the Sediment Quality Objectives (SQOs) for Foss Waterway described in EPA's Record of Decision for Commencement Bay (EPA, 1989) and contaminant concentrations found in Foss settling particulate matter during 1989-1992 (Norton, 1993). Chemicals chosen for this comparison were those exceeding the SQOs in Foss Waterway settling particulate matter. Note that values for settling particulate matter were calculated differently than in Norton's 1993 report. Several conclusions may be drawn from this table:

1. Each one of the nine storm drains considered exceeds SQOs for at least two chemicals.

2. Drain No. 230, the 15th St. drain, exceeds SQOs for more chemicals than any other drain. No. 230 also has the highest median values for zinc, mercury, LPAH, HPAH, bis(2-ethylhexyl)phthalate, and butyl benzyl phthalate. This drain is most likely the source of elevated mercury in settling matter at station TF-2, and probably a significant contributor to mercury levels at TF-3.

3. Drains 237.2 and 237.1 (twin 96ers) exceed SQOs for four and six chemicals, respectively. Considering flows from each of these drains is an order of magnitude higher than other drains (Tetra Tech, 1985), they represent a serious problem in terms of contaminant loading. These drains probably represent the greatest contribution to elevated concentrations of copper, zinc, mercury, LPAH and bis(2-ethylhexyl)phthalate in settling matter near the head of the waterway. Drain 245 appears to represent a substantial copper and mercury source, and Drain 235 a substantial HPAH and phenol source to the head of the waterway.

4. Drains 254 may contribute somewhat to elevated copper and bis(2-ethylhexyl)phthalate in settling matter at station TF-3. However, contaminant concentrations at TF-3 are probably strongly influenced by discharges from Drain 230.

5. Drain nos. 243, 218, and 214 do not appear to be a high priority due to relatively low contaminant levels in drain sediments and settling matter near the area of discharge.

The quickest and most straightforward way to determine if individual drains are currently a problem is to analyze drain sediments near their outlets. Data should be of the highest quality available with a full complement of QA data. At the very least, samples should be analyzed for copper, zinc, mercury, PAH and other semi-volatile organics, TOC, and grain size.

Q: Can a judgement be made about if and how this information could be used in sediment impact modeling?

At the very least, data on flow, suspended sediment concentrations, particle size, and probably TOC would be required to model sediment impacts. These data are rather sketchy at present. Lack of QA data also precludes reliable model-making. More complex models may also require water column characteristics (pH, DOC, salinity, temperature, etc.) to draw conclusions about sediment-freshwater-saltwater interactions.

If existing data were used for modeling, the lack of QA would be problematic because reliability of the input data cannot be assessed. This would add a large measure of uncertainty to model predictions.

Q: Are the catch basin, end-of-pipe sediments and particulate data comparable to each other? Does it matter that we don't have flow amounts?

From a qualitative point of view, pipe sediment and particulate data are probably comparable. Pipe sediments are a composite, over time, of particulates settling in the system. Therefore, pipe sediments yield a time-integrated estimate of contaminant concentrations, while particulates provide an instantaneous measurement.

Another consideration is that suspended particulate samples are generally composed of finer-grained particles than catch basin sediments. Normalizing data from each sample type to grain size and TOC would provide a means for direct comparison. The available data set did not include grain size data.

Once again flow data is critical to understanding contaminant contributions from each of the storm drains. Without flow data, loads cannot be calculated.

Q: Do we need to find out how long it took to gather each centrifuged sample and TSS (to get an idea of load)?

TSS data is a requisite for calculating loads. Amount of time spent centrifuging is only useful if the corresponding flow data are available.

Q: How much of an issue is lack of QA?

QA data is essential to determining the accuracy and precision of sample data. Without it, the sample data will always be subject to question. The City of Tacoma report contains little or no QA data (none could be found).

Q: Do the steps in the draft outline for the storm drain order make sense as far as identifying problem areas?

The steps for identifying problem areas in drainages for 230 and 237a&b [237.1 & 237.2] were reviewed. Specific and general comments are listed below. Attached is a copy of the order with numbered bullets.

Specific Comments:

#4. Before a loading analysis is conducted for each sub-watershed, catch basin/manhole sediments and sub-watershed runoff data should be analyzed to determine which sub-watersheds are problems. If sediment samples indicate that the sub-watershed is not contaminated or have a significant contamination source, there will be no value in doing a loading analysis.

#5. If sub-watersheds are to be ranked, it should be on the basis of either sampling/loading analysis or potential problem businesses. If sampling in a sub-watershed shows low contaminant levels, why dwell on potential problem businesses in that watershed? If potential problem businesses are used to rank the sub-watersheds, it should be incorporated into the planning for initial sampling of catch basin/manhole sediments described in #3.

#10. Yearly sampling for each drain may not be required pending results of sub-watershed sampling.

#11 & 12. Should be prioritized based on results of above actions.

General Comments:

Somewhere in the order it should be stated precisely how the effectiveness of source control efforts will be evaluated.

There appears to be too much emphasis on businesses as the source of contamination. Previous investigations of urban stormwater runoff and catch basin sediments have shown high levels of metals and PAH from residential areas, as well as commercial/industrial areas.

Drainage areas for the Nalley Valley and South Tacoma drains (twin 96ers) are only 28% and 10% commercial/industrial, respectively. Therefore, the draft work order may underestimate the contribution from other sources.

Q: After they identify problem areas and conduct source control or treatment, what kind of sampling will be needed to determine if things have improved? Will we even be able to compare to existing information since it is so sketchy? Should we have them do more baseline sampling to compare to over the long term? If so, what should be the parameters for time of year, flow, locations?

Two approaches to sampling would be useful to meet these goals: End-of-pipe loading estimates using particulate data, and analysis of catch basin sediments. The advantages and disadvantages of each are outlined in Table 2.

Table 2. Storm Water Particulate vs. Sediment Sampling.

SAMPLE TYPE	ADVANTAGE	DISADVANTAGE
Particulates	Able to quantify contaminants not detected in whole water.	Requires substantial effort (time, money, expertise, equipment).
	Able to estimate loads to waterway when combined with flow and TSS data.	Can only be conducted during storm events. Can only obtain one sample per storm event.
	Over time, gives good estimate of source control effectiveness.	Samples may not represent average conditions in storm drain.
Catch basin sediments	Can be done any time of year.	Over time, yields only indirect evidence of source control (or lack thereof).
	Can be done at multiple sites - better for tracing sources.	Cannot quantify contaminant contributions from individual sub-basins.
	Provide sample concentrations integrated over time.	Storm drain sediments may be biased toward larger grained particles.

Existing information is useful in focusing on contaminants of concern. However, due to lack of QA and flow/TSS loads, these data should not be used as baseline. It is unfortunate that this is the case since the City of Tacoma apparently put a substantial amount of effort into the particulate study.

CONCLUSIONS AND RECOMMENDATIONS

The Foss Waterway data on stormwater particulates and storm drain sediments reported by the City of Tacoma (City of Tacoma, 1990), Ecology (Norton, 1988), and others indicates that at least nine drains discharging to the waterway represent significant contamination sources. However, the City of Tacoma data should be used with caution due to lack of QA. Of the nine drains considered here, three (230, 237.1, and 237.2) appear to contribute a substantial portion of total contaminants entering the waterway. This conclusion is supported by data from the remedial investigation (Tetra Tech, Inc., 1985) and sediment trap monitoring (Norton, 1993).

Preliminary objectives of source control efforts should be to identify contaminant sources and establish a method for gauging the effectiveness of these efforts. To this end, the following is recommended:

1. Sample catch basin/storm drain sediments for chemical contaminants and physical characteristics from all significant drains in a comprehensive manner. At the very least, samples should be analyzed for copper, zinc, mercury, PAH and other semi-volatile organics, TOC, and grain size. Preliminary sampling should be done near the outlets of the storm drains. As hot-spots are identified, subsequent sampling may be worked "upstream" to better characterize problem sub-basins. This process is also described in the Elliott Bay storm drain monitoring approach (Tetra Tech, 1988).

End-of-pipe sediment sampling in Drains 230, 237.1 and 237.2 is probably not necessary based on a preponderance of evidence showing these drains to be substantially contaminated. Source tracing activities in these watersheds could begin immediately.

Initial screening of the individual drains should be conducted with several considerations in mind. Sample analysis should be of the highest quality available, and should include a full complement of QA data. To the extent possible, a screening survey should build on existing data in order to expand the existing data set on Foss waterway. This may include obtaining consistent sample types, analyses, etc. with previous surveys. Finally, any data generated may be used in the design of subsequent studies by the City of Tacoma. A specific proposal for sampling should strive to integrate existing or future sampling efforts by the city.

2. Obtain end-of-pipe contaminant load estimates for Drains 230, 237.1, and 237.2 by collecting particulate samples. Centrifugation is probably the best method of obtaining particulates. This should be conducted at least twice each during dry and wet seasons,

conditions permitting. The purpose of this recommendation is to establish high quality data on contaminant loads entering the waterway through these drains. These data may then be used to evaluate the success of subsequent source control work.

Dale and I would be happy to discuss any questions or comments you have regarding this memo. In addition, we would be interested in helping review or plan any upcoming studies in Foss waterway.

REFERENCES

City of Tacoma, 1990. Surface Water Quality Study. City of Tacoma, Public Works Department Sewer Utility.

EPA, 1989. Commencement Bay Nearshore/Tideflats: Record of Decision. U.S. Environmental Protection Agency Region 10, Seattle, WA.

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Norton, D., 1993. Spatial and temporal Trends in Contaminant Levels in Settling Particulate Matter: Thea Foss Waterway (Commencement Bay)-June 1989 to November 1992. Washington State Department of Ecology, Olympia, WA.

Tetra Tech, Inc., 1985. Commencement Bay Nearshore/Tideflats Remedial Investigation. Prep. *for* Washington State Department of Ecology and U.S. Environmental Protection Agency.

Tetra Tech, Inc., 1988. Elliott Bay Action Program: Storm Drain Monitoring Approach. Prep. *for* U.S. Environmental Protection Agency Region 10 - Office of Puget Sound, Seattle, WA.

Table 1. Contaminant Concentrations in Foss Waterway Drain Sediments (suspended and bed sediments), Settling Particulate Matter, and Sediment Quality Objectives for Foss Waterway (median values; mg/kg, dry).

	Near Head of Foss												
Chemical	Drain 245	n	Drain 243	n	Drain 237.2	n	Drain 237.1	n	Drain 235	n	Settling Particulate Matter* (Station TF-1)	n	Sediment Quality Objectives
Copper	1500	4	244	3	244	18	320	18	139	5	160	11	150
Zinc	663	4	213	3	650	18	1022	18	304	5	410	11	410
Mercury	1.34	4	0.8	2	0.4	16	0.63	17	0.38	5	0.63	11	0.59
LPAH	0.9	4	ND	3	1.4	18	5.3	19	4	5	9.8	7	5.2
HPAH	3.2	4	2.8	3	6.1	18	11.5	19	17.1	6	61	7	17
Phenol	0.09	3	0.1	1	0.1	11	0.1	17	0.6	4	ND	7	0.42
4-Methylphenol	0.05	3	0.05	1	0.1	9	0.1	16	0.6	4	ND	7	0.67
bis(2-EH)phthalate	15	4	5.2	2	15.3	17	47.7	18	9.2	5	11	7	1.3
butylbenzylphthalate	0.4	3	3.4	2	2	17	3.1	16	1.2	4	ND	7	0.9

*during 1989-1992, from Norton (1993)

Exceeds Sediment Quality Objectives

ND=Not Detected

N/A=Not Analyzed

Table 1 (Cont'd). Contaminant Concentrations in Foss Waterway Drain Sediments (suspended and bed sediments), Settling Particulate Matter, and Sediment Quality Objectives for Foss Waterway (median values; mg/kg, dry).

	Near Mouth of Foss						North of 15th St. Drain				Wheeler-Osgood Waterway				
Chemical	Drain 218	n	Drain 214	n	Settling Particulate Matter* (Station TF-4)	n	Drain 230	n	Settling Particulate Matter* (Station TF-2)	n	Drain 254	n	Settling Particulate Matter* (Station TF-3)	n	Sediment Quality Objectives
Copper	269	1	238	3	145	12	567	20	180	9	363	4	225	12	150
Zinc	908	1	505	3	190	12	1652	20	270	9	542	4	330	12	410
Mercury	0.09	1	0.08	3	0.44	12	1.45	18	0.78	9	0.23	3	0.7	12	0.59
LPAH	ND	1	2	3	3.2	6	11.9	20	2.5	5	1.7	4	5.1	7	5.2
HPAH	ND	1	9.4	3	14	6	63.7	20	12	5	10.5	4	17	7	17
Phenol	0.4	1	0.06	2	0.07	6	0.1	20	ND	5	0.34	4	ND	7	0.42
4-Methylphenol	N/A		0.04	2	0.2	6	0.1	20	ND	5	0.34	4	ND	7	0.67
bis(2-EH)phthalate	N/A		2.7	2	2.8	6	74.8	20	ND	5	7.8	4	4.1	7	1.3
butylbenzylphthalate	N/A		0.08	2	ND	6	4.3	20	ND	5	1.0	4	ND	7	0.9

*during 1989-1992, from Norton (1993)

(shaded) Exceeds Sediment Quality Objectives

ND=Not Detected

N/A=Not Analyzed

* Karen Larkin feels that we should not present the specifics of this order at this preliminary stage. Items may change during negotiations.

FOSS STORM DRAIN ORDER -- rough outline

List 3 drains: 230, 237A, 237B, 245, 218, 254

235 may also be a problem. List may change when the new particulate sample analyses are completed.

<u>Drains 245, 218, 254</u> - drainages inspected by Ecology for Milestone 1 effort.

City should:

- commit to a specific timeline to clean out systems
- also clean out 214? (not on list 3 but some problems noted)
- resample in 9 months
- specify long term plan for re-inspecting

<u>Drains 230, 237A & B (235?)</u>

City should:

1 -break watersheds down into sub-watersheds according to logical divisions within the storm drainage system.
2 -identify businesses in sub-watersheds for each drain system with potential to pollute
3 -sample manhole/catch basin sediments at a representative (downstream) point for each sub-watershed
4 -calculate loading analysis using "simple method" for each sub-watershed (may not include this)
5 -rank sub-watersheds for each drain system based on results of sampling and loading analysis and evaluation of potential problem businesses
6 -rank businesses within the worst sub-watersheds for inspections (prioritize according to a strategy - SIC codes, geographic, pretreatment needs, etc.).
7 -provide schedule for inspections (should be coordinated with pretreatment inspections and groundwater inspections where possible)
8 -conduct inspections
9 -develop method for keeping track of new businesses & inspecting them
10 -conduct particulate and whole water sampling twice per year for each drain
11 -develop a schedule for cleaning out catch basins and storm drain lines.
12 -develop a schedule for resampling catch basins

<u>Sampling</u>

Do one wet, one dry sample for water and particulates for 230, 237A & 237B (235?) each year.