Quality Assurance Project Plan

Stormwater Quality Survey of Western Washington Construction Sites: Year 2

by
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December 2004

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Abstract

This is the second year of a two year project to characterize stormwater discharged from western Washington construction sites, surveying 45 construction sites to provide a quantitative description of stormwater quality. Sites are to be monitored during the wet season from November 1, 2004, to April 30, 2005. The impacts of construction site discharges on receiving water will be investigated. Site characteristics will be compared and correlated with stormwater discharge quality. Turbidity will be compared and correlated with transparency tube results. Results will be summarized in a report intended for both technical and non-technical audiences.

Background/Problem Statement

Under the NPDES and State Waste Discharge General Permit program, the Washington State Department of Ecology (Ecology) has regulated discharges associated with construction activity since 1992. Prior to this study, stormwater sampling and analysis has been conducted only on certain sites when it was necessary to address specific water quality issues. Ecology had not obtained systematically collected, representative data to characterize stormwater discharged from construction sites. Data to characterize these discharges is useful to state and local government agencies involved in the permitting and inspection of construction activities as well as to contractors and their consultants who develop Stormwater Pollution Prevention Plans (SWPPs).

Project Description

This project plan describes the second year in a two-year study to provide a survey of stormwater discharge quality of western Washington construction sites during the winter wet season when discharges and potential impacts are greatest. The second year will be a continuation of the first year of the study, conducted in the same way. The aim of the second year is to collect additional data beyond that of the first year. An interim report was published at the end of the first year (Golding, 2004) www.ecy.wa.gov/biblio/0403036.html .

During the first year of the study, fifty-one sites were visited and the eleven that were discharging were sampled. With the aim of sampling up to 45 sites overall, the goal for the second year of the study is to sample 34 construction sites. As in the first year of the study, sites to be visited will be grouped in two site-size categories and an equal number of visits will be made to sites of both categories. As in the first year of the study, for sites discharging to receiving waters, samples will be collected upstream and downstream of the discharges.

Figure 1 shows the study area. This study is limited to western Washington which has a distinctly different climate and soil characteristic than the eastern portion of the state. Western Washington has wet winters with saturated soils and a high potential for erosion problems. Most of the state's construction activity is taking place in western Washington. Logistical limitations favored limiting this study to the western portion of the state.

The study area for the first year of the study was limited to Pierce and Thurston counties. It will be expanded for the second year to King and Snohomish counties, as well.

Figure 1. Study area. Shaded areas are counties to be included in the study.

Project Objectives

Project objectives for year two of the study include:

1. Survey stormwater discharge quality from western Washington construction sites.
2. Relate and correlate site characteristics to stormwater discharge quality.
3. Assess impacts of construction site discharges on receiving water turbidity.
4. Verify the correlation between transparency tube and turbidity measurements established in year one of the study.

In year one, field and laboratory methods for determining turbidity were compared. Turbidity measurements in the field were as accurate as those in the laboratory. Consequently, during the second year of the study, all measurements for turbidity will be made in the field. No correlation was found between turbidity and Total Suspended Solids (TSS).

An objective of the study, to correlate nephelometer readings with measurements with a simple transparency tube and to develop a mathematical relationship between the two, was completed in the first year of the study. With additional data, this relationship will be verified in the second year.

A secondary objective of this study is to investigate other factors affecting stormwater quality. These factors include site characteristics, stage of the project, and best management practices. Receiving water turbidity upstream and downstream of the site outflow will be measured to assess the potential impacts of construction site stormwater discharges.

Responsibilities

- Steven Golding (360-407-6701) – EA Program Project Manager. Prepares Quality Assurance (QA) Project Plan, project oversight, draft and final report, and EIM data entry.
- Brandi Lubliner (360-407-7140) and Kristin Kinney (360-407-7168) – EA Program Field Samplers. Conduct field sampling and on-site site evaluation.
- Dale Norton (360-407-6765) – Toxics Studies Unit Supervisor. Reviews QA Project Plan and report.
- Jeff Killelea (360-407-6127) – WQ Program Client. Provides input during project planning, reviews QA Project Plan and report.
- Stuart Magoon (360-871-8801) – Manchester Environmental Laboratory Director. Oversees laboratory analyses and quality assurance.
- Cliff Kirchmer (360-407-6455) – Ecology Quality Assurance Officer. Reviews QA Project Plan.
- Carolyn Lee (360-407-6430) – EIM Facilitator. Enters data into EIM.

Schedule

Field Work	November 2004 – April 2005
Laboratory Analysis	November 2004 – May 2005
Draft Investigative Report – Year 1 &2	August 2005
Final Investigative Report – Year 1 &2	October 2005

Project Costs

Estimated Lab Cost = $420 (42 TSS samples @ $10 each)[1]

Estimated EA Staff Time = 0.2 FTE

Data Quality Objectives and Decision Criteria

This project is a screening level study. The intent is informative and descriptive as an indication of typical turbidity and solids concentrations associated with stormwater from construction sites.

Hach Portable Model 2100P turbidimeters (nephelometers) will be used for this study to provide for uniformity of results. The Hach 2100P is a ratio nephelometer, with a two-detector optical system that compensates for color in the sample, light fluctuation, and stray light. The manufacturer states that it is a laboratory grade instrument, and it has correlated well with the Manchester Laboratory's Hach 2100N ratio nephelometer (Golding, 2004). The meter has a range of 0 – 1000 NTU, with a manufacturer-stated resolution of 0.01 NTU on its lowest range, an accuracy of +/- 2% from 0 – 1000 NTU, and a repeatability of +/- 1% of reading or 0.01 NTU, whichever is greater. Correlations between laboratory and field turbidimeter measurements during the first year of this study showed that field measurements are as accurate as laboratory measurements.

Water quality standards for core and non-core spawning and rearing waters (formerly Class AA and A waters) require turbidity not to exceed 5 NTU over background turbidity when background turbidity is 50 NTU or less, or a 10 % increase in turbidity when the background turbidity is more than 50 NTU. This also applies to waters for which char have been designated as the key aquatic life use.

[1] Costs include 50% discount for Manchester Laboratory

For a receiving water with a background of 50 NTU, a 10% level of accuracy corresponds to +/- 5 NTUs. At a 10% level of accuracy, a determination of whether a receiving water of 50 NTU or lower is elevated by 5 NTU downstream of a stormwater discharge can be made. Turbidity in western Washington streams and rivers is generally below 50 NTU (review of data from an EA Program website http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html). It is expected, therefore, that the accuracy of both portable and laboratory nephelometers (turbidimeters) will be adequate, in most cases, to determine whether receiving water background levels have been exceeded by more than 5 NTU.

TSS concentrations of typical construction site stormwater discharges are expected to be higher than a 1 mg/L detection limit and well within reporting limits. Turbidity and TSS will both be used to characterize stormwater discharges in this study.

Study Design

Sampling will take place between November 1 and April 30, during the winter wet season. The criterion for collection of a sample will be the occurrence of stormwater discharge from a site.

Criterion for Time of Sampling

In most parts of the United States, storm events are discrete, following periodic weather systems. For this reason it is commonly considered appropriate to sample during individual storm events. In western Washington, however, winter wet-weather storm events often overlap, so that long periods of precipitation, days and even weeks at a time, characterize the precipitation pattern. For this reason, sampling during the wet season in western Washington can take place during long, continuous, or nearly continuous, precipitation events.

For some forms of stormwater sampling, the “first flush” or “first discharge” of stormwater after a period of dry weather is considered the worst case. The first period of precipitation after a period of dryness can wash off and entrain contaminants that have accumulated during dry weather. This “first flush” may contain high concentrations of pollutants. For construction sites, “first flush” is not considered to be necessarily the worst case, as soil erosion is the principal cause of high contaminant concentrations, particularly the soil particles affecting turbidity as measured in this study. This, in addition to the overlapping nature of storms in Western Washington, is the basis for the decision that stormwater sampling for this project will take place not associated with individual rain events or during any particular portion of a rain event. Instead, sampling will take place throughout the wet weather season at any time that a facility is discharging stormwater. Care will be taken to represent wet weather conditions by sampling throughout the wet season, including periods of intense rainfall events.

Site Selection

Thirty-four construction sites in Thurston, Pierce, King, and Snohomish counties will be sampled during the second year of the study. The four counties include most construction permits issued in the state, roughly 580 of 800 sites.

Site selection will be stratified so that the number of sites to be sampled in each county is proportional to the number of permits in the county.

Sites will be categorized as being in one of two size ranges:

1. Less than 20 acres
2. 20 acres and larger

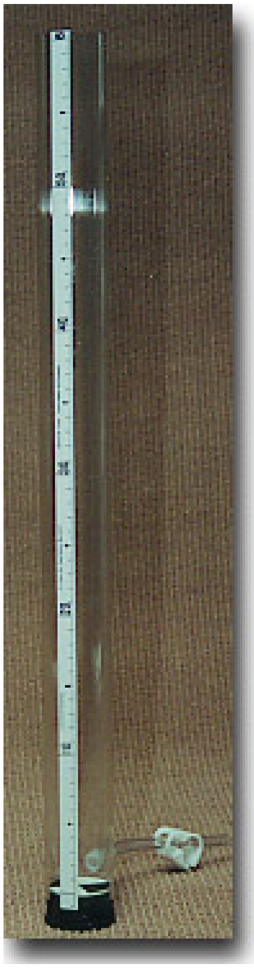
Within each county and size range, sites will be selected from those with construction permits listed in the Ecology Water Quality Permit Life Cycle System (WPLCS) database http://www.ecy.wa.gov/programs/wq/permits/wplcs/index.html.

During year one of the study, sites were selected at random from each county and the sites were visited in the order selected. This procedure proved inefficient, with excessive driving time between sites. As a result, fewer sites than desired were visited. For year two of the study, all potential sites will be plotted on a GIS map layer and grouped within circular local areas. In this way, field visits can be made to a maximum number of sites in one localized area per field day. The selected local areas will be deliberately scattered throughout the counties so that samples will represent the counties as a whole.

The county and latitude/longitude of each site will be noted. To prevent bias in site selection and allow as many sites to be sampled as possible, no preference will be given to sites that discharge directly to surface water. Only active sites will be included in the study. An active site is defined for this study as one in a stage between initial ground clearing and final site stabilization. Phone calls will be made just prior to sampling to explain the project to construction site personnel and to ascertain that the site is an active construction site.

Of the 34 sites to be sampled during the second year, there will be 17 from each of the two size ranges. In this way, sufficient data to represent each site range will be collected.

Sampling Design



During the second year of sampling, field turbidity measurements will be made at 34 sites. Each site will be sampled on only one occasion.

A Lawrence Enterprises Inc. transparency tube will also be used to make a quantified estimate of transparency from each discharge by simple, visual means. A transparency tube is a simple field device used to estimate the transparency of a water column by noting the depth at which a black and white secchi disk affixed to the bottom of the clear tube is no longer visible. A comparison will be made between transparency tube results and conventional turbidity readings and a correlation between the two, already developed from the first year's data, will be verified.

Figure 2. A transparency tube.

In addition to determining turbidity and TSS of stormwater discharges from construction sites, water turbidity upstream and downstream of discharges directly to a receiving water will be measured. Turbidity downstream will be measured from the bank from which the discharge is taking place, sufficiently away from the bank to obtain samples where the receiving water is free-flowing rather than stagnant. Measurements will be taken 100 feet downstream from the discharge point, as determined by pacing, or as close to 100 feet as practical. Downstream turbidity will also be measured at a site along the bank, a distance three times the width of the receiving water from the discharge. For construction projects where stormwater discharges to a storm drain, rather than directly to a receiving water, receiving water data will not be collected.

Table 1 summarizes measurements and samples for year two of this project, including 20% of samples as replicates for quality assurance. Grab samples for laboratory analysis of TSS and field measurement of turbidity will be taken at the 34 sites. Only one sample will be collected or field measurement made at each location where a sample is obtained, except when a field replicate is taken as a second sample or measurement. Note that all transparency determinations will be made twice, the second to be reported as a field replicate result. Field replicates will be collected from the first four sites sampled.

Table 1: Sampling Summary for the Second Year of the Study.

Construction Site Discharge	Number of Samples	
	Small Sites (< 20 Acres)	Large Sites (20 Acres or Greater)
Turbidity, field analysis	17	17
Turbidity, field rep (field analysis)	17	17
TSS (lab analysis)	17	17
TSS, field rep (lab analysis)	4	4
Transparency tube, field measurement	17	17
Transparency tube, field rep	17	17

Receiving Water (for all-sized construction sites)*	Number of Samples		
	Upstream of Discharge	100 feet Downstream of Discharge	3x Stream Width Downstream of Discharge
Turbidity, field analysis	34	34	--
Turbidity, field rep (field analysis)	34	34	--

*Discharges from some sites will enter a storm drain or the affected receiving water otherwise unavailable for sampling. Therefore, the number of receiving water sites for field analysis will be somewhat fewer than 34.

Correlations with Site Characteristics

The following site characteristics will be assessed for their correlation with turbidity:

1. Precipitation duration and intensity
2. Site size
3. Type of construction
4. Stage of project
5. Land drainage characteristics
6. Type of best management practices (BMPs)/treatment
7. Soil type

These variables will be assessed in the following ways:

1. Precipitation duration and intensity will be estimated for each site. The project manager will obtain weather information from the internet and/or government sources from which site-specific estimates of preceding weather and storm intensity will be developed.

2. Determinations of site size will be as reported on the permit application as "size of disturbance."

3. Type of construction site will be categorized as follows:
   - Residential, multiple unit (e.g., subdivision)
   - Residential, single unit only
   - Commercial
   - Industrial
   - Highway/transportation
   - Utility
   - Other

4. Stage of project will be categorized in the field as follows:
   - Initial ground clearing, grubbing, or stump clearing
   - Cut and fill, or mass grading
   - Final grading, road, utilities construction
   - Exposed soil throughout most of site
   - Final stabilization of soils in place

5. Land drainage characteristics will be categorized in the field as follows:
    - Sloped, well-drained
    - Slightly sloped to flat, less than well drained
    - Slightly sloped to flat, well drained
    - Low, flat, often wet, poorly drained

6. Type of best management practices will be categorized in the field as
    - BMPs that include sedimentation control facility. This may include a settling basin or pond for larger sites, a sediment trap for smaller sites. (Functional/non-functional.)
    - Erosion control such as mulch, fabrics, vegetation. (Functional/non-functional.)
    - Chemical or electrical treatment. (Functional/non-functional.)
    - No BMPs in place.

7. Soil type will be determined for GPS site locations from GIS or other mapping sources.

Field Procedures

The project lead will provide field personnel with a list of pre-selected sites grouped geographically and by size range. Table 1 summarizes the number of sample sites to be included by size category.

Sites will be visited throughout the wet weather period of November 1, 2004, to April 30, 2005. The criterion for sampling is the presence of a stormwater discharge from the site.

Field personnel will plan visits so that an equal number of visits to sites from the two size categories will be made during the study.

To supplement information appearing here, *Samplers' Summary Instructions* are included in Appendix B.

Field personnel will record, for every site visited, whether or not the site was active, whether it was discharging, and whether it was discharging directly to a receiving water. Field personnel will also fill out a copy of the form/checklist that appears in Appendix A of this project plan. Information to be included on the form and checklist includes latitude and longitude as measured by a portable GPS receiver, weather observations, site size, project stage, land characteristics, and type of BMPs and their functionality.

Samples will be taken where the discharge leaves the construction site or property upon which the site is located, the point where the stormwater discharge leaves a final treatment process, or where it enters a ditch or other conveyance to leave the site.

A discharge point representing the principal, or sole discharge, will be sampled at each construction site. In cases where there is more than one discharge, field turbidity measurements will be taken and recorded for the most significant discharges.

For sites discharging directly to a receiving water, turbidity will be determined in the receiving water upstream of the discharge and at two locations downstream (100 feet downstream of the discharge and also downstream a distance three times the stream width), as described in the *Sampling Design* section of this QA Project Plan. Field personnel will note on the sampling form/checklist receiving water conditions, the distance from the site discharge to the two downstream sampling points, and the degree to which the discharge appears to be mixed with the receiving water.

Field personnel will collect samples and replicates as shown in Table 1. Replicates for field turbidity measurements and laboratory analysis of TSS will be grabbed as separate samples after the principal turbidity and TSS samples are grabbed. Field turbidity and TSS replicates will be collected from randomly chosen sites. At each construction site chosen for field replicate collection, all discharge and receiving water measurements and samples will be done twice, the second being a replicate.

Hach 2100P field turbidimeters to be used in the study will be calibrated before the study begins. The manufacturer recommends recalibration every three months or as needed. Field meters will be checked with factory-sealed formazin standards with each day's use and calibrated as necessary.

Field personnel will use a transparency tube at each site to determine the transparency of the site's discharge. This will be repeated for each discharge as a field replicate. The transparency tube is to be used outdoors but not in direct sunlight. It should be read either on a cloudy day or in the shade. The shade of one's body is adequate. The tube is filled with stormwater and while looking down at the disk, water is slowly released from the valve until the disk is visible. The water depth is then read.

Samples will be collected directly into sample containers using nitrile gloves to protect field personnel, or with the container attached to a pole. The samples will be given a field identification, tagged, and kept cool. Chain-of-custody procedures will be observed and samples will be delivered to the laboratory within the 48-hour holding time for turbidity analysis.

A summary of parameters, collection containers, preservation, and holding times appears in Table 2.

Table 2. Sample Size, Container, Preservation, and Holding Time by Parameter.

Parameter	Sample Size	Container	Preservation	Holding Time
TSS	1000 mL	1000 mL w/m poly	Cool to 4ºC	7 days

Analytical Procedures

Laboratory samples will be analyzed for total suspended solids at the Ecology Manchester Laboratory (MEL) using EPA Method 160.2 or *Standard Methods for the Examination of Water and Wastewater*, 19th Edition, 2540D.

A summary of laboratory procedures for the analysis of project samples appears in Table 3.

Table 3. Laboratory Methods and Anticipated Range of Results.

Analyte	Sample Matrix	Samples (Number/ Arrival Date)	Anticipated Range of Results*	Sample Prep Method	Analytical Method
TSS	Water	54/ Nov 03 – Apr 04	12 – 40,000	--	Standard Methods 2540D

*Based on construction site monitoring, Kayhanian et al. (2001).

Quality Control Procedures

Field Quality Control

Formazin check standards will be analyzed daily. Each field nephelometer reading will be paired with a replicate field reading. This will enable precision of field turbidity measurements to be determined. All transparency tube readings will also be replicated in the field.

Field replicate samples for TSS analyses will be collected for 20% of the samples (8 field replicate samples for 34 samples taken – see Table 1).

Lab Quality Control

One laboratory replicate will be analyzed per 20 samples.

Data Reduction and Management Procedures

Data will be grouped by site, and turbidity and transparency data will be compared and correlated. The correlation between turbidity and transparency developed during the first year of the study will be verified during the second. Because the correlation may be dependent upon soil type and it is possible that soil type will vary with the county sampled, it is possible that the correlation developed during the first year of the study may be less good for the second year's data.

Upstream and downstream turbidity will be compared and evaluated with respect to the Washington State water quality standard defining an exceedance as 5 NTU above background. A comparison will be made between turbidity measured at three times the stream width and that measured at a portion of receiving water where the discharge is believed to be well mixed.

Using the form/checklists filled out by field personnel, the project manager will group data by site characteristic and then compare turbidity data to potentially relevant characteristics including preceding precipitation and storm intensity, size of site, stage of project, land drainage characteristics, best management practices, and soils type. The project manager will link mapped soil permeability to each site visited. The project manager will obtain weather information and prepare estimates of storm intensity as the project progresses and field personnel report the locations of sites visited.

Data Verification and Validation

Data generated at Manchester Laboratory will be reviewed by laboratory staff who will prepare a case narrative and submit it to the project manager. All field and laboratory data will be reviewed by the project manager for reasonableness and consistency. Calibration, blank, and check standard results will be reviewed and compared with acceptance limits.

Data Quality Assessment

Check standards will provide some indication of precision and even accuracy, at least as applied to the matrices of the standards. Variance between lab replicates and sample results will provide a means of assessing precision of laboratory analyses of TSS. The relative percent difference (RPD) of field replicates and sample results will provide a means of assessing overall precision, including the effects of potential errors introduced from sampling as well as analysis.

Because this will be a survey study with data collection taking place over six months, it is expected that the data set will be complete. Site locations will be selected at random so that any data lost from one site can be replaced by data from another.

Data Reporting

The final report will include a map of the study area showing approximate locations of sites included in the study. Data from years one and two of the project will be reported. Aggregate results for each parameter, as well as results grouped by site size and other site characteristics, will be presented. Comparisons and correlations between turbidity-related parameters will be discussed, and correlation coefficients will be reported. Comparisons and correlations of results to site characteristics will be discussed. The distribution of sites from the WPLCS database by size will be determined and reported.

References

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Appendix A.
Field Form and Checklist

Side 1/4

Field Form and Checklist
Stormwater Quality Survey of Western Washington Construction Sites

Field Sampler ______________________________________ Date _________
Site Name ____ Time _________
Lat/Long ________________________GPS datum NAD27 Permit No. _____

Description of construction site sampling location (general, pond outfall, culvert size, and fraction full, etc.)

____
____
____
____
____

Weather (current)____

Weather preceding visit (days of preceding dryness, number of days of precipitation, amount of precipitation, if known):

____
____
____

Type of site
___ residential, multiple unit (e.g., subdivision)
___ residential, single unit only
___ commercial
___ industrial
___ highway/transportation
___ utility
___ other (describe) ______________________________

Size of site
___ small (less than 5 acres)
___ medium (5 or greater but less than 20 acres)
___ large (20 acres or greater)

Size of soil disturbance (acres or square feet) _______________(note if estimate or known)

Stage of project (check one that best describes overall stage of project):

1. ___ Initial ground clearing, grubbing, or stump clearing
2. ___ Initial installation of erosion/sediment control BMPs
3. ___ Rough/mass grading, cut and fill
4. ___ Final/finish grading
5. ___ Temporary stabilization, including winter shut down

Land drainage characteristics (check one that best applies):

___ Sloped, well-drained
___ Slightly sloped to flat and less than well drained
___ Low, flat, often wet, poorly drained

Best Management Practices

1. Are storm drain inlets protected from sediment?
   __Yes __ No
   (Seven types of inlet protection BMPs listed in BMP C220; Stormwater Management Manual for Western Washington, Vol. II, page 4-77.)

2. Is runoff from the site being routed to one or more sediment ponds or basins?
   __Yes __No

3. Are most of the disturbed soils covered or otherwise protected from erosion?
   __Yes __No
   (Cover or protection may include mulch, plastic, vegetation, erosion control blankets. It does not include silt fences, straw bales or other sediment trapping measures.)

Turbidity data at site discharge(s) (for multiple discharges, rate in order from highest estimated flow (1.)):

1. ______NTU Is the discharge from pond, basin or trap? ___Yes ___No
   ______NTU (Replicate – separate, independent sample)
2. ______NTU Is the discharge from pond, basin or trap? ___Yes ___No
3. ______NTU Is the discharge from pond, basin or trap? ___Yes ___No
4. ______NTU Is the discharge from pond, basin or trap? ___Yes ___No

Observations/Comments:

____
____

Transparency tube data for discharge sampling location with highest estimated flow (1., above):

______cm.
______cm. (replicate – second, independent sample)

Observations/Comments:____
____

Receiving Water Sampling: Name of waterbody: ______________________________

Description of **upstream sampling location**:___________________________________
____

Turbidity data collected at upstream (background) location:

1. ______NTU
2. ______NTU (replicate – second, independent sample)

Observations/Comments about upstream sampling point:

____
____
____

Description of **downstream sampling locations:**

Description of sampling location and receiving water **100 feet downstream** of discharge point (include description of mixing, extraneous contributing flows between site discharge and sampling locations):

____
____
____

Estimated receiving water width (ft) ______

Turbidity data collected downstream – 100' from discharge point:

1. ______NTU
2. ______NTU (replicate – separate, independent sample)

Observations/Comments: (Note: If alternate sampling location was required, report the approximate distance from discharge (ft.)

____
____
____

Description of sampling location and receiving water **downstream 3x channel width**:
Estimated distance along bank from discharge to 3x width (ft) ______

Turbidity data collected downstream – 3X stream width:

1. ______NTU
2. ______NTU (Second measurement only if construction site is one where replicates will be taken. Collect from waterbody again as a separate sample.)

Observations/Comments:

____
____
____

Observations/Comments - stage of project:

____
____

Observations/Comments: land drainage, soil type, degree of erosion, site condition:

Observation/Comments: Best Management Practices (BMPs), description, functionality:

Other Observations/Comments:

Appendix B.
Samplers' Summary Instructions

Samplers' Summary Instructions
Stormwater Quality Survey of Western Washington Construction Sites
Second Year of Study: 2004-2005

Order of Sampling

For receiving water, sample at the most downstream point first (3x width or 100 feet downstream, whichever is farther downstream) and work your way upstream, doing the upstream (background sample) last. In this way, you won't stir up the receiving water. If you must disturb the receiving water, make sure to hold the bottle upstream of where you are causing a disturbance.

Order of Turbidity Measurements with Hach 2100P

Start with the cleanest sample, and work your way to the dirtiest:

1. Upstream sample
2. Two downstream samples
3. Discharge sample

Place a drop of oil on the glass cell, spread it, and dry lightly one time for each site location (each set of 4 samples).

Procedure for Measuring Turbidity in the Field

The following procedure will be used to obtain field turbidity measurements. (Turbidimeter procedures are more completely described in the instrument manual):

1. Rinse a 1000 mL TSS bottle with the water to be sampled.
2. Obtain a sample in a 1000 mL TSS bottle from a well-mixed location.
3. Cap the bottle, shake vigorously, and pour immediately into clean turbidimeter cell. *From this point on, allow as little time for sample settling as possible.*
4. Quickly insert rubber stopper with syringe and pull a suction until visible bubbles are removed.
5. Wipe the cell with a clean lint-free cloth.
6. Apply a few drops of oil, just enough to dampen outside of cell. Wipe almost dry with lint-free cloth.
7. Cap cell and place in turbidimeter, with line on cell matching mark on meter.
8. Turn meter on.
9. Select AUTO-RNG and select SIGNAL AVERAGE.
10. Press READ. Write down the first four readings and turn meter off.

Ordering Bottles

Order your own 1000 mL and w/m poly bottles for TSS samples using the lab's container request forms.

Submitting Bottles to Lab with Lab Form

Put tags on bottles at the time of collection and fill out a "Laboratory Analysis Required" form. For "station ID," use an abbreviation for the facility name. Add "REP" to the end of the name for replicated TSS samples. The station ID names on the tags should be the same as on the lab request form.

Each row of the "Laboratory Analysis Required" form should have its own field station identification and lab log number. Ordinarily, each facility site location will be represented by one row on the form. Check off the box under "TSS." Assign a different lab log number for replicate samples.

The lab assigns each week of the calendar year a unique week number. The week number becomes the first two digits of the lab log number (sample number). Call the lab at 360-871-8827 to talk to Pam Covey and get week numbers.