EWEB STORM EVENT SAMPLING PROCEDURES
Step-By-Step Description of Sampling Protocol
For USGS Pesticide Sampling Events
April 9, 2003

The following sampling protocol were developed based on the USGS *National Field Manual for the Collection of Water-Quality Data (September 1999),* EWEB *Lower McKenzie River Watershed, Stormwater and Urban Runoff Monitoring Plan (November 2001),* EWEB *Revised Proposal for Storm Event Pesticide Monitoring (August 2002);* and personal communication with Chauncey Anderson (USGS, Portland Office).

Scope

A total of eleven locations will be sampled as part of the first flush storm monitoring effort. Water sample aliquots will be collected over the rise of the hydrograph. These aliquots will be composited to represent the initial flush associated with a storm. Table 1 summarizes the equipment type and other information associated with each monitoring site.

Table 1
Summary of Monitoring Sites

Monitoring Site	Auto Sampler	Flow Meter	WQ Sonde	Turbidity Meter	Additional Samples
72nd Street	Yes[1]	Yes[3]	No	Yes	No
69th Street	Yes[1]	Yes[3]	Yes	No	(4) Pre-storm Composite; 2-Pest Grabs; Tail Composite
64th Street	Yes[1]	Yes[3]	Yes	No	No
52nd Street	Yes[1]	Yes[3]	Yes	No	2-Pest Grabs
42nd Street		Yes[3]	Yes	No	2-Pest Grabs
Cedar Cr-Saunders	Yes[2]	Yes[3] plus USGS Gauge	Yes	No	No
Cedar Cr-Billings	Yes[1]	Yes[3]	No	Yes	No
Keizer Slough	Yes	Yes[3]	No	Yes	No
Camp Creek	Yes[1]	Yes[3]	Yes	No	No
McKenzie R.-Hendricks	No	No	No	No	Replicate
McKenzie R.-EWEB Intake	No-Operator Collected	EWEB River Level	EWEB Intake Sensors	EWEB Intake Sensors	MS/MSD

[1] – Automated samplers will be set up at these monitoring sites prior to storm event.
[2] - Timed sample collection (e.g., every 3 minutes sampler collects an aliquot).
[3] – Area/Velocity flow meters will be set up at these monitoring sites prior to the storm event.

As indicated in Table 1, each monitoring station will have an assortment of equipment. EWEB anticipates that prior to the storm event the equipment will be cleaned, calibrated, pre-positioned, programmed, and ready to initiate sampling at a majority of the monitoring sites. The WQ sondes will be cleaned and calibrated, but may not be pre-positioned prior to the storm event.

The Cedar Creek Saunders Bridge monitoring station will use an automated sampler (equipped with a rain gauge) that will be programmed to collect samples based on time. At the McKenzie River Hendricks Park location a water sample will be collected manually using a peristaltic pump. EWEB's Hayden Bridge treatment plant operator or one of the sampling crew will collect samples manually from the raw water sampling port.

Sample Teams

Storm Prediction/Notice

EWEB will be monitoring the 10-day and long term forecasts published on the National Weather Service's secured website and the 15-day and long term forecasts published on Accuweather.com. Both weather forecasts are able to predict rainfall amounts associated with the storm. If a storm is predicted in the 7-10 day forecast to have significant rainfall (0.35+ inches), team members will be notified that this storm will be targeted for monitoring and will be updated daily as the front approaches. On the day of the storm, team members will be asked to meet at the equipment staging area (EWEB's OrAqua site near Hayden bridge) at a certain time.

Sampling Teams

It is anticipated that there will be three sampling teams (two people per team). The following table assigns monitoring locations for each sampling team.

Table 2
Three Team Sample Location Assignments

Team 1	Team 2	Team 3
42nd Street Stormwater	64th Street Stormwater	Cedar Creek @ Billings Ln Brdg
52nd Street Stormwater	69th Street Stormwater	Camp Creek @ Bridge
Keizer Slough	72nd Street Stormwater	McKenzie River @ Hendricks Pk
	Cedar Creek @ Saunders Bridge	
(two sets pesticide grab samples)	(Pre-Storm and Tail Composite Samples and one set pesticide grab samples)	(Replicate)

Sample Collection Methods

Each sampling team will wear disposable surgical gloves during sampling and sample processing and change gloves between sample locations. The teams should try to practice "clean hands/dirty hands" sample collection techniques as much as possible. Basically one person in the team will be designated as clean hands (CH) and handles all equipment that comes in contact with the sample (i.e., sample bottles, discharge end of tubing, auto sampler bottle chamber, field documentation). The other person is designated as dirty hands (DH) and handles all equipment that comes into contact with potential sources of contamination (i.e., WQ sondes, intake tubing, opening sample vaults, removing auto sampler from vaults, drives vehicle, uses tools, runs pumps).

An equipment rinseate sample will be collected from the clean equipment prior to using the equipment in the field. The rinseate sample will be collected by pouring or pumping organic free DI water through/over a representative sample of all the different types of equipment being utilized in the storm event sampling (i.e., intake tubing, interior peristaltic pump tubing, glass jars, plastic churn-splitter, sample filtration equipment, plastic buckets, etc.).

Automated Samplers (- already done prior to sampling effort, crews do not need to do these tasks)*
At each monitoring station with automated samplers the following tasks should be performed:

1. *Install WQ sonde in creek or channel (DH).
2. *Pull auto sampler from vault (if in vault) (DH).
3. *Check battery, intake tubing attachment, & flow meter connection (CH).
4. *Place intake tubing into creek or channel at center of flow (DH).
5. *Remove sampler top and hold (DH) while other team member (CH) operates in manual pump mode to rinse with native water from creek or channel into waste bottle or plastic bucket.
6. *Remove bottle lids (place in clean ziplock bag), check to make sure bottle labels match sampling location (CH).
7. *Replace auto sampler top and place back into vault (DH).
8. Collect approximately 3-gallons of native water in 5-gallon plastic bucket (marked "native H_2O rinse") for later native water rinses, place lid on bucket & label (DH).
9. *Review sampler program (per attachment) and enter flow weighted sampling criteria (CH).
10. *Initiate auto sampler program (CH).
11. Close vault lid (DH).
12. Fill out field documentation form (as much as possible), note sampler start time (CH).
13. Revisit site periodically (approximately every 20-25 minutes), remove protective cover (DH), review sample progress (CH) by pressing (from main menu) "Display Data" then "Sample History". This will allow you to assess if bottles are nearly full. If nearly full a new set of bottles should be installed. Also use "Display Data" to look at level data and determine if sampler is still on the rise in the hydrograph.
14. Label bottle lids and/or carousel with sample location and if the sample set if the first or second set from that location. Leave bottle in carousel so we know what number the bottles are in the sample collection process.
15. To install new set of bottles:
    a. Press the "run/stop" button (twice) and remove sampler from vault (if in vault) (DH).
    b. Remove top and check sample bottles to make sure sampler filled bottles as desired. Place lids on bottles (CH), dump excess water from bottom (DH), and place bag of ice in middle of carousel.
    c. Replace with new set of bottles, remove lids and place lids in clean zip lock bag (CH).
    d. Replace top on sampler and hookup computer cable from hand held data transfer unit (DTU) to the RS232 port on the sampler (once plugged in the DTU will turn on).
    e. Select a data cell that is not already full of data. To do this press the "Data Cell" button on the DTU unit and it will scroll thru each data cell (data cells # 1 thru 20), a red light in lower left corner of the DTU indicates data cell is already full.
    f. Press "Data Transfer" button on the DTU and this will initiate downloading of data from the sampler to the DTU. When data is being transferred, the DTU will flash "percent complete" on the display. Upon completion, unhook cables.
    g. Press "run/stop" button to restart sampler program. It will ask you to "resume" or "Start at Beginning". Select to start at beginning. It will then say that you will lose all your data

(that is ok, because you downloaded it), hit Start at Beginning again. Make sure you start the program (you need to press any key) and see that it is running.

h. Replace protective cover, and place back in vault.

16. When sampling is complete (when rain fall decreases and flow drops off OR three hours elapse), press "off" and remove sampler from vault (if in a vault) and detach flow meter cable and intake tubing (DH) (and turbidity cable or rain gauge cable if applicable). Remove top (DH) and place lids on bottles (CH). Dump excess water out of sample base (DH) and place bag of ice in middle of carousel and replace sampler top. Place entire auto sampler (w/samples and ice in base) into vehicle. If turbidity meter is attached to sampler please take this with you and place in vehicle (be gentle with turbidity probe).
17. Leave sample tubing and flow meter in place (EWEB will pickup later). Please put tape over connection fitting at end of flow meter cable (to keep dry) and hide in brush or put back in vault.
18. Leave WQ sondes in water (EWEB will pickup later).
19. Complete sample documentation, note time sampling ceased (CH).

Manual Sampling (- already done prior to sampling effort, crews do not need to do these tasks)*
At the McKenzie River @Hendricks Park Boat Ramp sample location a manual grab sample will be collected. A peristaltic pump will be used to collect the grab sample from the McKenzie River.

1. *Put new tubing in peristaltic pump (if not already done). Measure and cut new intake tubing and attach to pump (CH).
2. Place intake tubing as far into the river as possible using length(s) of pipe provided (i.e., attach tubing to pipe sections via tape) and pump native water through tubing and into a clean churn-splitter. Rinse churn-splitter well with native water and dump out (DH).
3. Record time on field sheet (and other sample information) and collect approximately 3.5 to 4 gallons of water into the clean plastic churn-splitter properly labeled for the site. Also continue to collect approximately 3-gallons of native water (for later rinse during sample processing) into a clean plastic bucket (marked "native H_2O rinse"). Place lid on "native H_2O rinse" bucket.
4. Place secured churn-splitter in trash bag with ice.
5. Record sample completion time and complete field documentation form.
6. Change out tubing in peristaltic pump and put pump in clean bag (DH).

Storm Composite Samples
At one location (69^{th} Street) a pre-storm, first flush (composite over rise in hydrograph), and composite over the tail of hydrograph samples will be collected. This means that this sampler will run longer then the first flush samplers and collect more volume (will require multiple bottle change-outs). The sample method will be the same as the automated sampler protocol, except when it comes to processing the samples (see Sample Processing section).

Replicate Sample
At the McKenzie River-Hendricks Park site, a replicate sample will be collected (double volume) while collecting the grab sample. The sample volume will be increased to allow for collection of a replicate sample. The sample will be processed as normal except two samples will be extracted from the churn-splitter instead of one (see Sample Processing section).

Matrix Spike/Matrix Spike Duplicate
At the Hayden Bridge treatment plant, the shift operator will collect aliquots every 5 minutes for 45 minutes of the raw water. This sample will be processed as normal, except extra sample volume will be sent to the labs for them to spike. Organics will require triple volume and inorganics double volume.

Pesticide Replicate Grab Samples
At 42nd, 52nd Street, and 69th Street stormwater monitoring sites a set of grab samples will be collected during the storm event to evaluate potential pesticide attenuation to the vinyl tubing and plastic churn-splitter. At some point during the storm, a sample will be collected from the channel by dipping two pesticide sample containers (1-liter amber baked glass bottles) into the channel and filling to the top of the bottle. At the same time, the automated sampler will be used in "manual mode" to fill two 1-liter Teflon lined glass bottles. The Teflon-lined glass bottles will be processed as normal to evaluate pesticide attenuation to the sampler and sample processing equipment. The samples from the two USGS glass pesticide containers will be filtered into new clean bottles, but will not be processed.

Rinseate Blank Samples
Rinseate blanks will be used to determine if decontamination procedures were adequate and to determine if cross contamination has occurred during sampling. Rinseate samples will be collected by pouring or pumping Organic free DI water through clean equipment and collecting the rinse water into the appropriate laboratory containers for analysis. Rinseate samples will be collected from the following equipment:

- Clean Teflon-lined 1-liter glass bottles, intake tubing, internal peristaltic pump tubing, churn-splitter, stainless steel filtration unit, and Teflon tubing prior to use of the equipment in the field; and,
- Decontaminated churn-splitter, stainless steel filtration unit, and Teflon tubing between samples.

Sample Processing
After completing sample collection, the crews will drive to the EWEB Hayden Bridge treatment plant for processing, labeling, and preparing samples for shipment to labs. The best approach is to setup an assembly line type operation to move samples through quickly and efficiently. Decontamination of the processing equipment is critical to avoid cross-contamination. Table 3 summarizes analytical requirements and appropriate lab containers for this monitoring effort.

First Flush Samples

1. Start with samples from the cleanest monitoring locations first. Label and tape laboratory sample bottles for sample being processed (EWEB will have pre-printed labels).
2. Download data from auto sampler. Evaluate hydrograph for that sample location and select appropriate sample bottles that correspond to the rise in the hydrograph. Sample bottles will be removed from the sampler and passed along for homogenization in the churn-splitter.
3. Rinse the churn-splitter with native water from that sample location (collected in the clean plastic bucket labeled "native H_2O rinse").
4. Sample bottles will be gently shaken to mobilize sediment and dumped into the churn-splitter.
5. Churn-splitter will be operated by using smooth strokes up and down (not vigorous) without breaking the plane of the water. This will be done for at least one minute. As you slowly churn the water use the spigot near the bottom of the churn to fill whole water sample bottles. Make sure sample bottles are properly labeled for the monitoring site being processed.
6. After filling all the whole water sample containers, use the remaining water for the filtered sample containers (pesticides and metals). Insert the Teflon intake tubing from the stainless steel glass filtration unit and the peristaltic intake tubing for filtering metals samples into the churn splitter. Pump some water through into waste bottle (50-100ml) prior filling the two 1-liter baked amber

glass bottles (for USGS pesticide analysis) and one 250ml plastic bottle for dissolved metals analysis (preserved with HNO_3).

7. Decontaminate the churn-splitter and stainless steel filtration unit and change out tubing in the peristaltic pump with a new filter unit (see Decomntainations Procedures section).

Table 3
Analytical requirements

Analysis	Container Type	EPA Method	Preservative	Holding Time
Total Metals	250ml Plastic	200 Series	HNO_3 & Ice	6 Months
Dissolved Metals	250ml Plastic	200 Series	HNO_3 & Ice	6 Months
Nitrate, Nitrite, & TSS	1-Liter Plastic	300 & 160.2	Ice	28 Days 7 Days (TSS)
Total Phosphorus, TKN, Ammonia, and COD	500ml Plastic	365.1, 365.3, 351.3, 351.4, 350, 410.4	H_2SO_4 & Ice	28 Days
Semi-Volatile Organics	1-Liter Amber Glass	8270C	Ice	7 Days
Pesticides (USGS)	1-Liter Baked Amber Glass	USGS 2001	Ice	7 Days
HPLC/S-SPE Polar Pesticides (USGS)	1-Liter Baked Amber Glass	USGS 2001	Ice	7 Days
Petroleum HCID	1-Liter Amber Glass	HCID	HCL & Ice	7 Days
Petroleum HCID-Gx	2-40ml vials	HCID-Gx	HCL & Ice	7 Days
Fecal Coliform & E. Coli	150ml Plastic	SM 9222	Ice	30 Hours
Fecal Streptococcus	150ml Plastic	SM 9230B	Ice	30 Hours
Enterococci	150ml Plastic	SM 9230B	Ice	30 Hours
TOC, DO, Turbidity	250ml Glass	Hayden Bridge Lab	Ice	48 Hours

Storm Composite Samples

1. Two clean churn-splitters are necessary to process the additional storm composite samples from 69th Street.
2. Download data from the automated samplers and evaluate hydrograph to select sample bottles associated with the pre-storm period and those associated with the tail of the hydrograph (bottles from rise in hydrograph or first flush were processed per instructions above).
3. Gently shake bottles associated with the pre-storm period and pour into one churn-splitter and bottle associated with the tail of the hydrograph will be poured into a second churn splitter.
4. Process both churn splitters as discussed above (make sure the churns are labeled or marked to avoid mix up).

Use of Glass Fiber Filter Unit

1. Open clean stainless steel filter unit and use tweezers to grab and place glass fiber filter on unit (coarse side up).
2. Wet down surface of the filter with Organic free DI water.
3. Reassemble filter unit and hook up Teflon tubing from pump (leave pressure valve open).
4. Close pressure valve when starting to filter water.

5. Pump 50-100 ml of native sample water through filter system before starting to collect filtered water in pesticide 1-liter amber glass bottle (positioned underneath filtration unit).
6. Fill two 1-liter amber glass bottles to the shoulder of the bottle (not completely full) for USGS pesticide analysis.
7. Do not run pump without water running through the system (can damage pump).

Decontamination Procedures

1. Rinse with tap water to remove large material (sediment).
2. Wash with 2% alconox solution.
3. Rinse with hot tap water.
4. Rinse with Hayden Bridge lab DI water.
5. Rinse with methanol (use methanol under hood or outside in well ventilated area).
6. Final rinse with Organic free DI water.

Sample Shipment

Two analytical labs will be used for this sampling effort. The USGS lab in Denver will be used to analyze samples for pesticides and a commercial lab will be used to analyze samples for metals, nutrients, semi-volatile organics, petroleum hydrocarbons, bacteria, TOC, COD, and TSS.

1. Glass sample containers should be wrapped in bubble wrap and bubble wrap placed on the bottom of the cooler.
2. Each USGS sample will have two 1-liter bottles. These pairs of bottles for each monitoring location should be placed in the same cooler (i.e., do not split up bottle pairs into two different coolers). Double bag samples in cooler.
3. Double bag ice and place on top of samples.
4. Place completed sample documentation (and return shipping label) for the samples contained in that cooler (Chain of Custody for commercial lab and Analytical Services request form for USGS lab) in a large ziplock bag and taped to the top of the cooler. Double check that sample bottles in cooler match sample bottles on documentation.
5. Use strapping tape to seal coolers closed.
6. Place pre-printed shipping labels on coolers (make sure USGS label goes on USGS sample coolers).