

APPENDIX A

STATEMENT OF WORK

Task 1 (Total Cost \$26,839)

Build, install and condition bioretention cells

Deliverable 1 = Final design drawings and pictures of the four completed bioretention cells

Cost: \$26,839 Due Date: January 31, 2015

USFWS will construct four 200-L (55-gallon) bioretention cells at Grovers Creek Salmon Hatchery plumbed with under drains following guidelines outlined in the Stormwater Management Manual for Western Washington (Department of Ecology 12-10-030, Aug 2012). Bioretention cells will be filled with a drainage layer of gravel aggregate overlain by a mixture of 60 percent sand; 40 percent compost.

Clean water will be run through the bioretention cells to 'age' them to 20 pore volumes, equivalent to one month of rainfall on an appropriate contributing area (treatment area = 2.5% of contributing area).

Task 2 (Total Cost \$2,982)

Compost used in bioretention cells will be tested for metals before conditioning. Water chemistry of effluent following conditioning will be tested for the analytes including several metals; conventionals including nutrients, bacteria; and a suite of PAHs. Tables excerpted from the final proposal appear at bottom of the Scope of Work and these are the parameters that will be summarized in these brief reports.

Deliverable 2.1 = Brief report on metal concentration of compost used in bioretention cells

Cost: \$800 Due Date: January 31, 2015

Deliverable 2.2 = Brief report on baseline water chemistry of effluent from conditioned bioretention cells

Cost: \$2,182 Due Date: January 31, 2015

Task 3 (Total Cost \$59,642)

Highway runoff transported to the Suquamish Tribal Hatchery at Grovers Creek will be filtered on-site where adult coho spawners and coho embryos will be exposed to one of three treatments; unfiltered runoff, filtered runoff, or well water. Exposures and water chemistry measurements will follow those in our existing EPA QAPP and overall scope of work.

Deliverable 3.1 = Brief report on effects of treated effluent on female adult coho

Cost: \$22,366 Due Date: January 31, 2015

Healthy female adult coho returning to the Suquamish Tribal Hatchery on Grovers Creek will be placed in PVC holding tubes in experimental waters as described. Each holding tube will be equipped with a hose to pump water flow across the fish gills and each treatment tank will be aerated to maintain dissolved oxygen at optimum levels for adult coho health during exposures.

After four hours of exposure, each coho will be removed from the holding tube and released into a tank of clean water for observation. Adults exposed to untreated runoff typically show overt symptoms of pre-spawn mortality (disorientation, unresponsiveness, loss of equilibrium, or death) after four hours. Exposures will be extended for 24-48 hours to compare mortality rates among treatments and to note if there are delayed effects from exposure to treated runoff compared with controls.

The brief report will summarize the number of successful trials performed during the performance period, as well as rates of survival and sublethal symptoms in adults for each treatment for each trial. This report will be used to construct the final report summarizing the findings of the entire study.

Deliverable 3.2 = Brief report on effects of treated effluent on coho embryo development

Cost: \$29,821 Due Date: March 31, 2015

Coho eggs spawned and fertilized at the Suquamish Tribal Hatchery on Grovers Creek will be reared on-site by hatchery personnel. Eggs will be divided into three treatment groups episodically exposed to untreated runoff, bioretention-treated runoff, or clean well water (no episodic exposures). Between episodic runoff exposures, eggs will be reared in clean well water. The experiment will run for up to six months – covering the developmental period of coho salmon eggs. Replicate exposures will allow for destructive sampling of coho eggs during the experiment (e.g., 1-mo sampling intervals).

Endpoints will include coho egg survival and development including morphometrics previously shown to be affected by stormwater runoff including length, eye size, and pericardial area. Developing fish are particularly susceptible to cardiotoxic contaminants in stormwater runoff,

thus special attention will be paid to cardiovascular abnormalities in coho embryos. Stereomicroscopic digital images will be taken of each embryo sampled for later analysis.

This experiment will make use of the expertise of our multiple partners including GSI treatment (WSU), salmon rearing (Suquamish Tribe), fish developmental toxicity (NOAA), and fish health (USFWS).

The brief report will summarize the number of exposures performed on coho embryos, the conditions of each exposure (diluted vs whole runoff, durations of exposure), and the results in terms of survival and sublethal effects on coho embryos. This report will be used to construct the final report summarizing the findings of the entire study.

Deliverable 3.3 = Brief report on chemistry of treated effluent

Cost: \$7,455 Due Date: June 30, 2015

For each coho exposure, water samples will be taken from each treatment. Analytes to be measured include metals (Cd, Cu, Ni, Pb, Zn, Ag, As, Cr), a suite of conventional water chemistry parameters (including nutrients), bacteria, and a suite of parent and alkylated homologue polycyclic aromatic hydrocarbons (PAHs). Tables excerpted from the final proposal appear at bottom of the Scope of Work. PAH analyses will be performed by the Environmental Chemistry Program at NOAA Fisheries' Northwest Fisheries Science Center. Additional analyses will be performed by AmTest Laboratory (Kirkland, WA). Dissolved oxygen, pH, temperature and conductivity will be measured on-site. Water chemistry measurements for PAHs will follow QA/QC established by NOAA-Fisheries (Sloan et al. 2014).

A brief report will summarize the chemistry findings and this report will be used to construct the final report summarizing the findings of the entire study.

Task 4 (Total Cost \$59,642)

Two presentations and final, cumulative report

Analysis for effect of treatment on water chemistry, adult coho, and coho embryos will culminate in a final report. This final report constructed in part by using the brief reports that were deliverables in Task 3. The final report will summarize the findings of the entire study. Results will also be directly presented to public, regulatory, and/or scientific audiences in at least two formal presentations.

Deliverable 4.1 = Presentation (#1) on study findings

Cost: \$2000 Due Date: June 30, 2015

Results of this project will be presented at a minimum of two public meetings; including the SWG meeting in June 2015 (presentation #1) and at another regional stormwater forum (presentation #2); perhaps like at the 2015 WSU LID Annual Review in Puyallup, WA. The WSU LID Annual Review is widely attended and draws a mixed public, regulatory, and scientific audience.

Deliverable 4.2 = Presentation (#2) and Final, cumulative report

Cost: \$57,642 Due Date: September 30, 2015

The final report will describe the entire study and will include all prior deliverables. Following ECOLOGY's approval, and publication of the data in a peer-reviewed scientific journal, the report will be available on the Washington Stormwater Center's website.

Calendar Year	2014		2015		
	3	4	1	2	3
Task and Deliverables					
1. Build & condition bioretention cells D1. Bioretention cells for treatment of runoff					
2. Baseline water quality & compost testing D2. Brief report on baseline conditions					
3. Coho exposures & chemistry D3. Brief preliminary reports					
4. Data analysis and communications D4. Presentations & final, cumulative report					

Budget by Task

- Task 1: \$26,839
- Task 2: \$2,982
- Task 3: \$59,642
- Task 4: \$59,642
- Total : \$149,105**

List of metals, conventionals, and bacteria to be analysed

Analytes to be measured

Total and dissolved Cd, Cu, Ni, Pb, Zn, Ag, As, Cr
 Total suspended solids
 Suspended sediment concentration
 Dissolved organic carbon
 Chemical oxygen demand
 Hardness
 Alkalinity
 pH
 Ammonia
 Total nitrogen and nitrates
 Total Phosphorus and ortho-P
E. coli, fecal coliform

List of PAHs to be analyzed

Abbreviation	Rings	PAH Name
NPH	2	Naphthalene
C1-C3NPH	3	Alkylated naphthalenes
ACY	3	Acenaphthylene
ACE	3	Acenaphthene
FLU	3	Fluorene
C1-C4FLU	3	Alkylated fluorenes
DBT	3	Dibenzothiophene
C1-C4DBT	3	Alkylated dibenzothiophenes
PHN	3	Phenanthrene
C1-C4PHN	3	Alkylated phenanthrenes
ANT	3	Anthracene
PYR	4	Pyrene
FLA	4	Fluoranthene
C1-C4FLA	4	Alkylated fluoranthenes
CHR	4	Chrysene
C1-C4CHR	4	Alkylated chrysenes
BAA	4	Benzo[a]anthracene
BBF	5	Benzo[b]fluoranthene
BKF	5	Benzo[k]fluoranthene
BEP	5	Benzo[e]pyrene
BAP	5	Benzo[a]pyrene
PER	5	Perylene
IDP	5	Indeno[1,2,3-cd]pyrene
DBA	5	Dibenz[a,h]anthracene (and [a,c])
BZP	6	Benzo[ghi]perylene