LOI # 11

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Organization: WSDOT

Study Title: Retrofitting Stormwater Ponds with Floating Treatment Wetlands to Reduce Contaminants in Highway Runoff.

Which topics from the SWG's priority list (Appendix A) do you propose to address?

9. What are the ways that we can retrofit existing traditional or older pond structures for more stormwater quality treatment? Most were designed for flow control, but can we determine what methods could be used to update them to remove other pollutants (including 6PPDQ, PAHs, metals etc.)?

What type of project is being proposed?

Environmental sampling study

Short description of the proposed project

"Basic wet ponds" are approved by the Ecology as basic BMPs; however, they often elevate temperatures and fail to consistently meet pollutant reduction targets for phosphorus and metals . A before-after-control-impact (BACI) study design will allow differentiating floating treatment wetland (FTW) effects from natural variations or underlying trends. WSDOT basic wet ponds of similar design and with historical monitoring data will be selected for one control pond (no FTW) and one impact pond (50 percent cover by FTWs) and monitored to evaluate pollutant reductions while mitigating thermal impacts.

The three-year study will include the one year of baseline monitoring with no FTW in either existing pond , followed by FTW installation in the impact pond and two years of monitoring both ponds for evaluating effects of plant growth between years and obtaining the required 15 qualifying samples for stormwater treatment certification by Ecology's TAPE program. Automated samplers, flow sensors, temperature loggers, and telemetry will be deployed at the pond inlet and outlet to measure flow-weighted concentrations of TSS, nutrients, dissolved and total metals, and 6PPDQ. We hypothesize that stormwater pond performance improves over time as the FTW plant root mass and attached biofilm increases. Results will quantify

incremental benefits of FTW retrofits to stormwater ponds and provide design and operational guidance for agencies managing legacy facilities along highways and elsewhere in western Washington. Findings will inform whether basic wet ponds with FTWs should be recognized as a certified phosphorus and metals BMP and provide co-benefits for 6PPDQ reduction and thermal mitigation.

What type of information will be collected or analyzed for this proposed study?

The study will collect comprehensive hydrologic and water quality data to evaluate the performance of an FTW retrofit of one stormwater pond in comparison to a control pond without an FTW . Continuous hydrologic measurements of the ponds will include inflow and outflow stage/discharge and rainfall for triggering autosamplers during targeted storm events for flow-weighted composite sampling following long-detention assessment protocols. Experimental design attributes are summarized in Table 1.

Table 1. Proposed Experimental Design for Floating Treatment Wetland Retrofit of Stormwater Ponds Project.

Project Element	Experimental Design
Stormwater Ponds	• Ponds: One control and one FTW pond; single or double cell with similar size, flow path, sediment storage, and basin characteristics
	• Basin Characteristics: Highway runoff in western Washington
	• Hydrology: Permanent pool with one inflow and one outflow location suitable for monitoring
	• Likely to meet TAPE influent pollutant concentration criteria based on historical data
Floating Treatment Wetland	• Modular, sustainable/durable construction, 50 percent pond cover
	• Native herbaceous and shrub plants adapted for life in saturated or inundated conditions, high density and root growth

- Assembled, planted, and installed in May 2027 allowing for 5 months growth before first year of impact monitoring starting in October 2027

Monitoring and Analysis
- Pre-treatment Baseline: 10 events October 2026-May 2027
- Post-treatment Year 1: 10 events September 2027-May 2028
- Post-treatment Year 2: 10 events September 2028-May 2029
- Long detention assessment protocol for sampling inflow/outflow flow-weighted composite samples
- Continuous measurement of precipitation and inflow and outflow stage/discharge/temperature
- 120 grab samples (4 in 30 events) for dissolved oxygen, pH, TPH, and E. coli.
- 120 composite samples (4 in 30 events) for TSS, total and soluble reactive phosphorus, total and nitrate+nitrite nitrogen, dissolved and total copper and zinc, and 6PPDQ.
- Analysis of other metals, PAHs, PFAS, PBDEs, and other stormwater contaminants of concern may be added depending on funding and interest.
- Sample analysis by an Ecology-certified laboratory
- Data analysis of descriptive statistics, hypothesis testing, percent removal comparisons, and effluent concentration comparisons

Deliverables
- QAPP by October 2026
- Baseline Monitoring Report by August 2027
- Post-Treatment Year 1 Monitoring Report by August 2028
- Post-Treatment Year 1 Monitoring and Final Report by October 2029
- 6 Meeting Agendas/Notes

Water quality monitoring will encompass continuous temperature measurements and composite sample analysis of total suspended solids (TSS) and a full suite of nutrients (total phosphorus, soluble reactive phosphorus, total nitrogen, and nitrate plus nitrite). Metals analysis will include both dissolved and total copper and zinc, and specialized sampling will target 6PPDQ to address emerging pollutant concerns. Grab samples of inflow and outflow will be collected for analysis of dissolved oxygen, pH, total petroleum hydrocarbons (TPH), and E. coli. Depending on funding and interest, additional water quality parameters may include additional heavy metals, PAHs, PFAS, and PBDEs.

A QAPP will be prepared for Ecology approval. Monitoring and data analysis procedures will follow requirements of Ecology's 2024 TAPE protocols and guidelines for trace levels of emerging contaminants of concern. Data analysis will include descriptive statistics, hypothesis testing, percent removal comparisons, and effluent concentration comparisons.

Operational data will document FTW installation details, planting density, species composition, floatation integrity, anchoring methods, and maintenance activities. Each spring and fall, FTW plant density and biomass will be estimated using drone imagery, underwater root biomass will be measured by inverted sonar, and root biofilm growth will be documented by vide

What are the anticipated measurable outcomes and key deliverables that will be produced by the proposed study and how will they be used by Permittees and the Washington State Department of Ecology?

The study will produce performance metrics for FTW retrofits of stormwater ponds, including seasonal and annual influent/effluent reduction efficiencies for TSS, nutrients, metals, and 6PPDQ, and evaluation of temperature and dissolved oxygen effects. It will provide design and operational guidance for FTW retrofits of stormwater stormwater ponds, addressing aspects such as pond selection, coverage percentage , anchoring, and maintenance . A major objective is to develop a non-proprietary specification for FTWs in stormwater ponds that defines critical parameters such as plant species selection, planting density, soil and media composition , floatation durability, percent FTW coverage, anchoring methods, and other relevant design and maintenance criteria. This specification will enable agencies to implement FTW retrofits meeting design specifications without reliance on a single manufacturer. Deliverables will include a QAPP, yearly technical reports for baseline and FTW monitoring years, and a final report with methods, QA results, statistical and uncertainty analysis, cost/benefit framing, and a data package suitable to support Ecology program review for phosphorus and metals treatment certification of FTW retrofits of stormwater ponds.

List the permittees or agencies you are proposing to coordinate with.

Project coordination will involve WSDOT as the applicant and owner, including staff from WSDOT's Environmental Services Office, Hydraulics Office, and relevant regional operations staff. Ecology, including TAPE program lead Doug Howie and other relevant staff will be engaged for project review and future BMP recognition pathways. Dylan Ahearn and Rob Zisette and with Herrera Environmental Consultants will lead study design, QAPP development, monitoring, data analysis, and reporting. Biomatrix Water, led by Galen Fulford, will provide FTW systems at reduced cost and installation support. The project's technical advisory committee (TAC) will also include Dr. Lizbeth Seebacher from the University of Washington and Brian Landau, King County's Stormwater Capital Unit Manger (see list above). The TAC will meet on about 6 occasions throughout the 3-year study. TAC members will review and comment on all draft deliverables prior to submission to Ecology.