



LOI # 7

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Study Title: Biochar Specification for Stormwater Treatment

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

Best Management Practice (BMP) Effectiveness: 15. Determine a biochar specification that produces the best pollutant removal treatment. Consider feedstock type, pyrolysis temperature, particle size, and post-processing treatments and how they can influence biochar's physical and chemical properties. Determine the effectiveness of biochar in removing contaminants such as nutrients, metals, hydrocarbons, PFAS and 6PPDQ.

What type of project is being proposed?

Laboratory research project

Short description of the proposed project

Ecology and King County added the high performance bioretention soil mix (HPBSM) to their stormwater manuals (SWWMM and SWDM respectively) as a default mix for use in stormwater treatment BMPs. This mix contains high carbon wood ash, a specific type of biochar (see specification in Ecology's 2021 bulletin). The wood ash is a key media component in the mix that provides water holding capacity and contaminant removal capability (specifically metals and organics, perhaps including 6PPD-Q). However, there is currently no biochar specification(s) for stormwater treatment of multiple contaminants. Biochars as treatment media by themselves or blended with soil or sand could be less costly in stormwater BMPs than other media for specified contaminants. The open-source biochar specifications produced from our project will expand options for stormwater treatment for the whole region including treatment for 6PPDQ while at the same time providing new local business opportunities that use waste materials for a carbon negative product. The resulting specifications could be adopted by Ecology and/or King County and used to refine the biochar specifications for HPBSM, making this mix more flexible and feasible for use. Our team brings unique capabilities to this project including members that led all research to develop the HPBSM specification, regional experts in



biochar science, production, and commercialization, and local biochar production facilities where we will experiment with burn and chemical modification techniques to produce the optimum biochar. This proposal ends after laboratory testing, but we could expand it to include field pilot testing if desired by Ecology.

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

We propose a study consisting of three phases:

- 1) Develop several biochars with various feedstocks, pyrolysis processes, and chemical modifications expected to achieve effective contaminant removal for nutrients, metals, hydrocarbons, PFAS, and 6PPDQ (based on information from the literature).
- 2) Conduct batch tests of these biochars to determine their potential for leaching contaminants (e.g., nutrients and metals) and their ability to sorb contaminants (e.g., 6PPDQ, PFAS, hydrocarbons).
- 3) Select a few of the best performing biochars from step #2 and test their effectiveness for treating nutrients, metals, hydrocarbons, PFAS, and 6PPDQ in a series of bench-top stormwater dosing experiments.

This laboratory study will provide data on the physical and chemical properties of several biochar feedstock types produced through different pyrolysis temperatures and chemical modifications. We will determine how effective each biochar is at removing nutrients, metals, hydrocarbons, PFAS, and 6PPDQ from stormwater. We will thoroughly describe the production process for each biochar and document the characteristics achieved which can then be used in future stormwater manual specifications.

This work could be extended to a pilot field study if desired by Ecology. King County's Stormwater Services is planning to conduct a study on contaminant-treatment effectiveness of a modified ditch using engineered media, and we could potentially leverage this as an opportunity for a low-cost field pilot study of the best performing biochar(s) from this project.

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?

King County aims to broaden the sources for biochar materials to make this option more feasible for use in HPBSM and develop a stand-alone treatment media. This project will focus



on optimizing biochar production for treatment of multiple stormwater contaminants and provide information to expand source options for biochar. The key deliverable of this project will be a biochar specification developed and tested through research-based processes in a laboratory (field testing not included) that is cost effective and readily available for Washington permittees and stormwater management engineers. We will produce other deliverables including a Quality Assurance Project Plan, biochar and stormwater treatment analytical data, a final specifications report and a presentation.

Expanding source options for biochar will provide valuable information on additional, cost-effective stormwater treatment media for protecting Washington's receiving waters. This project will also provide information on additional uses of biochar as a stand-alone product, which could provide simpler and more cost-effective stormwater treatment.

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

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