PROPOSAL TO PROVIDE

Stormwater Action Monitoring (SAM) Effectiveness Study and Source Identification Projects

Development of a Catch Basin Model to Predict Sediment Accumulation and Clean Out Frequency (LOI #6)

May 31, 2023 |King County

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Prepared by:

King County

Geosyntec consultants

Prepared for:

SAM Stormwater Action Monitoring

Project Purpose

This proposal addresses the SAM Research Priority #4 in its 2023 Request for Proposal (RFP). Priority #4 is described as "Develop or Modify a Model to Predict Catch Basin Accumulation for Predicting Maintenance Frequencies."

More specifically this proposal will provide:

- A synthesis of existing data and modeling methods supporting a catch basin (CB) tool and future tools
- A CB tool to help operation and maintenance (O&M) teams predict maintenance frequencies for catch basins protective of receiving waters in compliance with permit requirements
- Recommendations for using the tool to schedule maintenance and estimate CB sediment loads to help evaluate resource and equipment needs

The Municipal Separate Stormwater Sewer (MS4) permits require adequate long-term O&M of stormwater treatment and flow controls including CBs. For most permittees, that means inspection of CBs every one or two years and required cleaning if the inspection indicates cleaning is needed. Timely cleaning prevents downstream contamination that results from CB bypass flow, which causes resuspension and mobilization of previously captured sediment when CB retention capacity is exceeded. This project will allow the calculation of CB cleanout frequency for any type of catchment and CB, thus providing a tailored predictive approach to support timely CB inspection and cleaning. Because there are tens of thousands of CBs in Western Washington, even a small reduction in time per CB could result in large cost savings for permittees.

Project Description and Scope of Work

The objective of this study is to create a simplified model to help MS4 permittees establish an optimal cleanout frequency of catch basins (CBs). The work will advance our understanding of sediment dynamics in CBs and identify and/or modify existing models that capture those dynamics. The outcome will make CB cleaning more predictable, reduce downstream pollution and reduce costs for stormwater permittees.

The project team has reviewed the findings from the 2018 SAM Effectiveness Study on CB inspection and maintenance frequency. In that study, Phase II permittee data reflected CB inspections and maintenance were performed once per permit cycle (~5 years), data were mostly recorded on paper, and some permittees used a rotating circuit approach, where certain areas were lumped together for convenience so not all areas were monitored under the same weather conditions. Since that study, permit requirements have been updated to mandate more frequent and consistent inspections (1-2 years). Many permittees have migrated inspection and maintenance data into structured databases, and Phase I jurisdictions have moved away from the circuit approach. These changes will provide more consistent and extensive CB data for our proposed study and limit the data problems experienced in the prior study.

Task 1. Project Management

Task 1 will provide project administration and management, which is expected to include tracking and reporting project costs; developing, managing, and adjusting the project schedule as needed; preparing progress reports and invoices; and general project communications and coordination. The expected duration

of this proposed project is 12 months. More details on this task are given in the Project Management Strategy Section.

Deliverables (Total $16,095)

i. Final project schedule — two weeks after contract execution
ii. Quarterly progress reports – Months 4, 7, 10 etc.
iii. Three bi-annual reports, excluding the end of project — Months 7, 13, and 19

Task 2. QAPP Development

We will develop a Quality Assurance Project Plan (QAPP) in accordance with Washington State Department of Ecology (Ecology)'s quality assurance framework. We will use Ecology's QAPP template for grantees and data gatherers to document the study design, data acquisition procedures, and other items necessary to achieve the objectives of the study. The QAPP will be submitted to the SWG for approval.

Deliverables (Total $23,958)

i. Draft and final QAPP—Month 4

Task 3. TAC Formation and Coordination

In Task 3, we will organize a Technical Advisory Committee (TAC) for the project. The TAC will review the study design, provide feedback and suggestions on project approach, and review deliverables. The TAC will consist of five to six members. Potential TAC members have been identified and are listed below. We envision four TAC meetings including 1) a project kick-off meeting, 2) Task 4 data findings review, 3) Task 5 model findings review, and 4) Task 6 CB Model demonstration.

Draft deliverables will be submitted to the TAC for their review and comment. We will prepare responses to comments on draft deliverables and communicate with the TAC via email when there is a need to discuss and clarify comments. Each TAC meeting will have a meeting agenda. Meeting minutes will be recorded and distributed to the Ecology and the TAC.

Potential TAC members include:

- Sarah Norberg/Merita Trohimovich, City of Tacoma
- Brandon Stone/Alex Nguyen, Washington State Department of Transportation (WSDOT)

Deliverables (Total $24,168)

i. Confirmed List of TAC Committee Members —Month 1
ii. Four Meeting Agendas, Minutes, Comment Responses — Months 2, 10, 19, and 23

Task 4. Collect and Examine Existing Sediment Data

Task 4a. In this task, we will investigate MS4 permittee municipal records in western Washington to identify a consistent dataset on CB sediment accumulation and cleanouts. The collected data will be used to evaluate available models and identify/modify the best one. We expect to work with three to five MS4 permittees to find suitable and meaningful CB data. These data are important for determining actual CB sediment accumulation rates and cleanout frequencies. The data should cover a range of conditions including catchment land use and average annual traffic volume. Some follow-up inspections of CBs will be needed to field-verify and/or fill in data gaps.

Task 4b. In this second subtask, we will examine the reported particle size distributions (PSDs) in the available literature. PSD data is important for determining which particles are likely to settle out in the CB and is used

in most CB models. We will examine the available literature, the Environmental Information Management database maintained by Ecology, the International Stormwater Best Management Practices (BMP) Database, a previous SAM study on PSD by Evergreen H2O, and curves based on real data in stormwater quality models, like the Source Loading and Management Model (WinSLAMM).

Deliverables (Total $65,147)

ii. Draft and final technical memorandum on CB sediment data — Month 7
iii. Draft and final technical memorandum on available PSD data — Month 10

Task 5. Evaluate Available Catchment and CB Models

Task 5a. In this first subtask, we will evaluate available catchment models for predicting sediment load. CB models are typically driven by sediment load as a primary input (i.e., sediment concentrations and water volumes). Candidate models to be evaluated include Hydrologic Simulation Program Fortran (HSPF), United States Environmental Protection Agency (US-EPA) Stormwater Management Model (SWMM) and WinSLAMM.

HSPF and derivatives, such as the Western Washington Hydrology Model (WWHM), are widely used for stormwater design in Washington State. SWMM is a standard for urban stormwater modeling nationally and internationally and is part of the National Stormwater Calculator. WinSLAMM is the only urban stormwater model that evaluates runoff volume and pollution loading for each source area within each land use for each rainfall event.

The most desirable catchment model for this project is one that can reliably estimate daily sediment loads without local calibration.

Task 5b. In this second subtask, we will evaluate available CB models to identify the most suitable approach with the least data-intensive need. Candidate models for review include the Sizing Hydrodynamic Separators and Manholes (SHSAM) model and WinSLAMM.

SHSAM is based on data derived from a laboratory study on specific hydrodynamic devices and is widely used for sizing hydrodynamic devices, manholes, and CBs. WinSLAMM includes an internal algorithm for modeling CB effectiveness and sediment accumulation. In our approach we would verify and potentially modify the models based on comparisons to actual field data. The models will be evaluated for ease of use, input needs, and accuracy based on collected data.

Task 5c. Due to potential differences between CB geometries and operations in the field compared to the laboratory studies for which they were parameterized, there may be parameters within the models that need refining. To assist in this, computational fluid dynamics (CFD) using Flow-3D will be used to evaluate the CB conditions identified in Task 4 in more detail enabling a detailed understanding of the flow directions and sediment paths and settling, and improvements to the simplified models. The CFD model could potentially be used to optimize/modify CB design, but this work is not included as part of this proposal.

Deliverables (Total $111,256)

i. Draft and final technical memorandum on Total Suspended Solids (TSS) models — Month 13
ii. Draft and final technical memorandum on CB models — Month 16

iii. Draft and final technical memorandum on the CFD role in CB modeling — Month 19

Task 6. Creating a Simple Usable CB Tool

This task will synthesize the findings of the previous two tasks to create a CB tool that will be useful for SAM permittees. The tool will be tailored to Western Washington conditions but extendable to other regions with appropriate input data. The approach will develop scripts or worksheets to represent the best available algorithms that reproduce the CB sediment accumulation rate and provide optimal clean-out dates.

The Flow-3D model will be used as a powerful guide to ground-truth the CB tool especially when it extends beyond observed conditions and geometries. This will enable a detailed understanding of the flow directions, sediment pathways, and settling dynamics and point to improvements of the tool. The project outcome will be a simple open-source CB tool. The project team will evaluate the merits of releasing the tool as a workbook (e.g., Excel®) with formulas for calculations, a simple desktop tool with a user interface, or a simple web application.

Deliverables (Total $51,219)

i. Draft and final CB tool with simple instructions — Month 22

Task 7. Reports and Communications

This SAM project will provide multiple ways to communicate the study findings. At a minimum it will include a presentation to the SWG and a SAM two-page fact sheet to summarize the project findings.

Deliverables (Total $25,262)

i. Draft and final technical report— Month 23
ii. Presentation to SWG— Month 24
iii. Two-page fact sheet— Month 24

Project Team and Project Management

Project Team Description

The project team includes a partnership of King County with Geosyntec Consultants.

King County Profile

King County (the County) is the most populous county (~2.3 million people) in Washington State (the State) and the 13th-most populous in the United States. The County seat is the City of Seattle, which is the State's most populous city. The County has a total area of 2,307 square miles with 191 square miles of water.

There are 23 Departments of Public Works (DPWs) comprising State, County, or local government entities. They are responsible for maintaining and improving public infrastructure and properties and providing utility services. The DPWs are organized in divisions based on different physical asset types, such as roads and highways, parks and recreation facilities, and public buildings, or by service area, such as sanitation, water, and sanitary sewer. The Stormwater Services Division manages stormwater infrastructure like pipes, CBs, manholes, treatment practices, and outfalls within the County.

CB cleanout and maintenance is a time-consuming task that the County takes seriously but would welcome ways to make it more effective and efficient. King County has managed several projects funded by SAM and is well qualified to lead this proposed project to predict CB sediment accumulation and clean out frequency.

Geosyntec Profile

Geosyntec is a multidisciplinary consulting and environmental engineering firm that helps clients solve challenging issues involving the environment, natural resources, and civil infrastructure. With 1,900 employees, the company has 95 offices worldwide with a local office in Seattle, Washington.

Key Client Issues: Watershed managers face a multitude of issues related to surface water, groundwater, and the desire for healthy communities. Our clients rely on us to provide high quality and experienced professionals to help these managers.

Why Geosyntec? Geosyntec works closely and collaboratively with clients to fully understand the nature of the problem. Our experts provide rigorous assessment to investigate causes and deliver a well-conceived plan and design.

Subject Matter Experts: Geosyntec has built a team of nationally recognized technical experts, with 65% having advanced technical degrees and 12% holding doctoral degrees in relevant fields.

Innovations for Delivery: Geosyntec understands that cost, schedule, compliance, and sustainability goals can drive the need for alternative approaches. Geosyntec is a leader in Public-Private Partnerships, as well as integrating social equity, economic, and environmental benefits into projects.

Lead Personnel

Angela Gallardo, Water Quality Compliance Unit Manager, King County (Project Lead). Angela has nearly 20 years of experience in stormwater policy, asset management, operations, and maintenance, retrofit planning and construction oversight. She has managed stormwater programs in both Phase I and Phase II jurisdictions and has focused on finding efficiencies that will accomplish permit requirements while furthering water quality goals.

Nigel Pickering, Ph.D., P.E., Senior Engineer, Geosyntec, MN (Project Manager). Nigel has more than 30 years of experience in the academic, nonprofit, and consulting arenas. He has expertise in agricultural water quality, crop modeling, watershed monitoring and modeling, water resources planning, and stormwater design and modeling. He is proficient with developing and using numerous models including HEC-RAS, HydroCAD, HSPF, P8, and SWMM.

Christian Nilsen, P.E., Senior Engineer, Geosyntec, WA (Watershed Modeling Lead). Christian manages advanced stormwater and watershed planning projects for a clients in the Pacific Northwest. He brings 19 years of experience in water quality, infrastructure planning, and habitat restoration. He has successfully managed a wide range of water resources projects and programs including watershed planning, low-impact design, and stream restoration.

Al Preston, Ph.D., P.E., Principal Engineer, Geosyntec, CA (CFD Modeling Lead). Al has 20 years of experience in hydrology/hydraulics and computational fluid dynamics. He specializes in modeling for water resources. His experience includes modeling of storm channels, rivers, dam breaches, lakes and reservoirs, coastal ocean environments, and groundwater. His Ph.D. dissertation used computational fluid dynamics to study multiphase flows.

Dan Pankani, P.E., Senior Engineer, Geosyntec, OR (CB Tool Lead). Dan has more than 18 years of experience. His water resources skills cover stormwater planning, BMP design and data management. Dan is also proficient in spreadsheet programming (VBA, VB.net), modern programming languages (C#, Java), databases (SQL-Server/MySQL), and web development (JavaScript, HTML5, PHP, Python), and GIS (Python/ArcPy, ArcGIS ArcObjects).

Rica Enriquez, Ph.D., P.E., Project Engineer, MN (Model Review). Rica has more than 15 years of experience, focusing on geospatial data analysis, hydrodynamics, sediment transport, and water quality modeling in rivers, reservoirs, lakes, and estuaries. In particular, she has experience using WinSLAMM for multiple sites. Additionally, Rica is proficient in developing Python tools to efficiently generate model input files and analyze model outputs.

John Gulliver, Ph.D., P.E., Professor Emeritus, University of Minnesota (Senior Advisor). John 40+ years of academic experience in the Department of Civil, Environmental and Geo-Engineering at the St. Anthony Falls Laboratory. His research develops new technology for stormwater treatment practices. He has led 108 research projects on performance of hydrodynamic separators, metal/phosphorus retention, infiltration, and climate change.

Project Management Strategy

Angela Gallardo will serve as the Project Lead for the project and primary point of contact. Nigel Pickering will serve as the Project Manager for the project and for the Geosyntec tasks. There will be bi-weekly internal meetings for the project team, monthly meetings with the Ecology Grants Manager, and bi-annual meetings with the TAC. The project will begin with an initial kick-off workshop with the team leads, Ecology, and the TAC to:

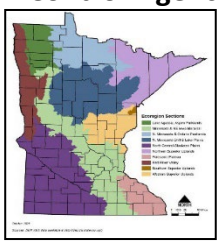
- Confirm the vision and goals for this study
- Overview of the project tasks and deliverables
- Identify studies and data to include in the project search
- Define communication protocols and process for reviewing deliverables
- Set project milestone deadlines and future meetings
- Confirm plan for coordination with the TAC

The team will utilize proven internal controls to ensure a streamlined delivery of on-budget and on- schedule tasks throughout the project. Angela will use King County's accounting system to track her staff's expenses and Geosyntec's billing. Geosyntec will use its BST® software for project accounting and management. Geosyntec will employ its QA/QC policies that are used on every project and deliverable and will ensure compliance with the QAPP. Geosyntec has extensive experience managing large data sets across multi-disciplinary teams.

The team will utilize standardized templates for collecting data to ensure consistency across all team members. We will create a Microsoft® Teams® folder that provides our team, the Ecology's Grant Manager and the TAC common access to the collected information and project deliverables. We will use a comment/response table to track incoming comments and related responses.

Past Projects

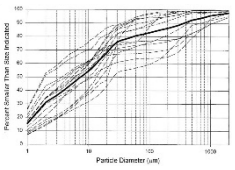
SW DESIGN - Development of Stormwater Pretreatment Guidance, Minnesota Pollution Control Agency (MPCA). Geosyntec was tasked by the MPCA to gather data on water quality benefits and maintenance needs for pretreatment systems like vegetated filter strips, hydrodynamic separators, underground settling devices, swales, and forebays for incorporation into the Minnesota Stormwater Manual (SWM). The SWM is used by stormwater practitioners to meet stormwater regulatory requirements and determining pollutant and stormwater volume reductions associated with implementation of different stormwater management practices.



SW DESIGN - Stormwater Engineering Design, City of South Burlington, Vermont. Geosyntec was part of a multidisciplinary team retained to prepare the notices of Intent, engineering feasibility analysis reports, and engineering design. The team confirmed the impervious area covered under the General Permit, then evaluated remediation options. For sites with existing stormwater BMPs, Geosyntec evaluated if they met state standards. Proposed upgrades included impervious reduction, disconnection, and simple retrofits. For new BMPs, we combined projects when feasible to leverage economies of scale. Geosyntec also estimated BMP pollutant loads, construction cost estimates, and O&M manuals for each site.

SW MONITORING/WinSLAMM MODEL - Sediment Recontamination Studies, Multiple Locations. Geosyntec was the director of several SERDP projects to evaluate the risks of recontamination of sediment cleanup sites from ongoing stormwater discharges. The project included development of stormwater monitoring plans, autosampler installation/programming, collection of stormwater samples, data analysis/reporting, review of WinSLAMM modeling, and development of a spreadsheet tool with guidance to quantify site-specific recontamination risk.

WinSLAMM MODEL - Stormwater Engineering Design Review, Confidential Client, Multiple Sites. Geosyntec was engaged to conduct a review of proposed stormwater engineering designs for multiple sites. Rica Enriquez led the evaluation of the WinSLAMM model used for the stormwater designs, the capacity to manage stormwater runoff and mitigate pollutants, the feasibility of implementing the proposed infrastructure, and the cost estimates. Geosyntec identified errors in the data, limitations of the model, deficiencies in the proposed designs, and inflated cost estimates.



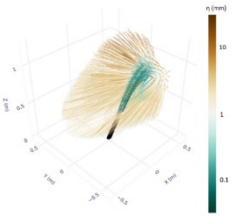
SWMM/HSPF MODEL – Los Peñasquitos Watershed Master Plan, San Diego, California. Geosyntec teamed with other consulting firms to develop a high-resolution Watershed Master Plan (WMP) for the Los Peñasquitos Water Management Area. The WMP included optimized combinations of distributed BMPs, regional multi-use BMPs, and stream rehabilitation and stabilization. These solutions were developed to address sediment loading to the Lagoon, manage bacteria loads, reduce unnatural dry weather flows, and

reduce flooding in the watershed. Geosyntec provided technical direction on flood control and water quality modeling and compiled existing condition and proposed condition models for the entire watershed LSPC (a variant of HSPF) and PCSWMM models.

SWMM/WWHM MODEL – Portland, Oregon. Geosyntec provided modeling support for various projects, using the City's GIS-based modeling framework, and adhering to the City's modeling standards and conventions. Geosyntec provided pre-design analysis and design support modeling for upcoming projects. We also provided high-end modeling expertise for applying the SWMM, WWHM, and Optimizer models. Optimizer allows for simultaneous evaluation of multiple alternatives against multiple design objectives.

SHSAM MODEL- - Assessment of Hydrodynamic Separators for Storm-Water Treatment, Minnesota. John Gulliver's team at the University of Minnesota tested the performance of hydrodynamic separators using full size devices. Six devices were evaluated for suspended sediment removal capability by dosing them with artificial stormwater of a defined particle size distribution and suspended sediment concentration. The captured sediment was removed, dried, sieved, and weighed. Suspended sediment removal efficiency was then related to the dimensionless Péclet number. The team developed an accurate universal approach, now used in SHSAM, for predicting the sediment removal performance of hydrodynamic separators and CBs.

CFD MODEL - Brine Diffuser Shear Mortality Research, West Basin Municipal Water District, California. Geosyntec was retained to study the effects of high-velocity brine discharge on mortality of marine organisms. Al Preston was the leader for a team of experts in fluid mechanics, marine biology, desalination processes, and California Ocean Plan. The team used computational fluid dynamics (CFD) modeling to systematically evaluate the effect of shear and turbulence on mortality of different marine taxa, with the goal of informing and updating the current Ocean Plan regulations. This work was funded by Metropolitan Water District of Southern California and U.S. Bureau of Reclamation.



INTERFACE/TOOL - Data Management System for the Regional Stormwater Monitoring Program, Lake Tahoe. Geosyntec developed the Tahoe Stormwater and BMP Database to enhance the Monitoring Site Management Tool (MSMT). The MST currently provides remote access to equipment and sensors at monitoring sites as well as real-time data visualization and analysis. These two systems constitute the RSWM DMS. Geosyntec developed a web application as a front end for the RSWM DMS that allows users to access annual stormwater quality data reports. Geosyntec also developed data analysis and statistical summaries as well as charts and tables that allow users to visualize and download the data.

INTERFACE/TOOL – Cost Estimation for the National Stormwater Calculator (NSC). Geosyntec was hired to add a cost feature to the NSC. The NSC provides a quick estimate of runoff from a site and evaluates the effectiveness of various low impact development (LID) measures like impervious area disconnection, rainwater harvesting, rain gardens, green roofs, street planters, infiltration basins, and permeable pavement. Geosyntec developed cost estimation procedures and data for LID measures and implemented a cost estimation tool. Dan Pankani implemented the cost component using web technologies to support future

migration to the web. This was accomplished by embedding a web browser in the existing C# desktop application.

INTERFACE/TOOL – Stormwater Heatmap and Decision Support Tool, The Nature Conservancy. Geosyntec, including Christian Nilsen, was hired to develop the Stormwater Heatmap, an interactive mapping tool, report generator, and data repository that quantitatively visualizes hotspots of pollution generation and runoff throughout Washington State's Puget Sound watershed. Users can access 29 data layers including across multiple scales, from large watersheds to local neighborhoods. Using Google's BigQuery, we provide access to large datasets of spatial data, including predicted pollutant loads in hard-to-fund areas. Reports and high-resolution visuals can be downloaded and used for operations, public presentations, and grant-funding applications. This tool will be incorporated into the Nature Conservancy's National Solutions Toolkit.

Project Budget and Schedule

Task Budget

Deliverable	Description	Total
1.i	Final project schedule	$907
1.iii	Six-monthly reports (3)	$15,188*
2.i	Draft & final QAPP	$23,958
3.i	Confirmed list of TAC Members	$4,036
3.ii	TAC meetings (3)	$20,132
4.i	Draft and final technical memorandum on CB data collection	$38,050
4.ii	Draft and final technical memorandum on available PSD data	$27,097
5.i	Draft and final technical memorandum on TSS models	$31,918
5.ii	Draft and final technical memorandum on CB models	$31,183
5.iii	Draft and final technical memorandum on CFD role in CB modeling	$48,155*
6.i	Draft and final CB tool with simple instructions	$51,219
7.i	Draft and final technical report	$15,386
7.ii	Presentation to SWG	$3,728
7.iii	Two-page fact sheet	$6,148
TOTAL		$317,105

*1.ii no charge, 5.iii includes cost of $7,500 for Flow3D

Staff Hours

Name	Position	Role	Hours
Angela Gallardo	Manager	Project Lead	50*

Nigel Pickering	Senior Professional	Project Manager	237
Al Preston	Principal	CFD Modeling Lead	65
Christian Nilsen	Senior Professional	Watershed Modeling Lead	140
Dan Pankani	Senior Professional	Tool Development Lead	155
Rica Enriquez	Project Professional	Model & Data Review Lead	163
Harsh Anurag	Senior Staff Professional	Project Support	347
Hannah Holtzman	Staff Professional	Project Support	192
Technician	Technician II	Project Support	166
Sarah Weinmann	Project Administrator	Project Administration	28
John Gulliver	Consultant	Senior Advisor	75
TOTAL			1,618

*Estimated - no charge

Timeline

Task	Description	Months from Start of Project																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Project Management	*			*			*			*			*			*			*			*		
2	QAPP Development				*																				
3	TAC Formation and Meetings	*	*								*									*				*	
4	Collect and Examine Existing							*			*														
5	Evaluate Catchment and CB													*			*			*					
6	Create a Simple Usable CB Tool																						*		
7	Reports and Communications																							*	*

* = deliverable

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May 31, 2023

Stormwater Action Monitoring (SAM)
Effectiveness Study and Source Identification Projects
Brandi Lubliner | brandi.lubliner@ecy.wa.gov

Subject: Development of a CB Model to Predict Sediment Accumulation and Clean Out Frequency (LOI #6)

Dear Ms. Lubliner:

Geosyntec Consultants, Inc. (Geosyntec) is pleased to provide support to King County's Water Quality Compliance Unit's Managing Supervisor, Ms. Angela Gallardo and her team, for Stormwater Action Monitoring (SAM)'s need for the Development of a Catch Basin Model to Predict Sediment Accumulation and Clean Out Frequency (LOI #6).

Catch basin (CB) modeling allows for more robust understanding of sediment dynamics in CBs with the goal of developing a simple CB model to:

a) Make clean outs more certain,
b) Reduce downstream pollution, and
c) Reduce costs for stormwater permittees.

Geosyntec's expertise in sediment dynamics and CB modeling will allow us to develop a useful and cost-saving tool for MS4 permittees, which will also provide cleaner water to their constituents. We look forward to hearing back from Ms. Gallardo when the SWG has reached a decision.

Sincerely,

Nigel Pickering, Ph.D., P.E.
Senior Engineer
npickering@geosyntec.com
(612) 253-8214

King County

Geosyntec consultants

engineers | scientists | innovators