ATTACHMENT 1

EPA Region 1 Blanket Purchase Agreement, BPA-68HE0118A0001-0003

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PERFORMANCE WORK STATEMENT

FDC Phase 2 Task Order A: FDC Application Modeling (FDC2A)

PERIOD OF PERFORMANCE 10/1/21 – 9/30/22

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I. OBJECTIVE AND PURPOSE

This work scope represents a continuation – a second phase - of EPA's flow duration curve (FDC) project entitled, *Holistic Watershed Management for Existing and Future Land Use Development Activities: Opportunities for Action for Local Decision Makers: Phase 1 – Modeling and Development of Flow Duration Curves (FDC1 Project).* This second phase FDC project will employ two separate but related task orders. **This is FDC2 Task Order A: FDC Application Modeling (FDC2A).**

The objective of this phase (FDC2) is to apply the results of the first phase (FDC1) to second and third order headwater stream segments of the Taunton River Watershed to understand the impacts of, and potential approaches for managing impervious cover (**IC**). Specifically, the efficacy of using FDC will be demonstrated by modeling differences between watershed / subwatershed development scenarios, including a pre-development forest condition, the current built state, future development conditions, a scenario that incorporates the State of Massachusetts' stormwater standards and a number of potential managment scenarios that considers potential climate change and future land development conditions.

The results of applying the FDC at a watershed / subwatershed scale will next be employed to illustrate the effect of land use decision making at the site scale. Application at the site scale will facilitate consideration and development of possible next-generation local regulatory options (i.e., municipal bylaws / ordinances that address stormwater (SW) management and site development activities) to inform local decision makers on land use decision making, particularly with respect to new development and/or redevelopment (**nD/rD**). Quantifying hydrologic, water quality and other impacts, as well as the benefits of potential management solutions (in part by applying the FDC and continuous modeling simulation approaches at the site scale) will facilitate municipal practitioner appreciation of how nD/rD impacts water quality, flooding frequency and duration, channel stability, ecohydrological function, and hydrogeomorphology.

Quantifying impacts of lost and altered watershed functions, as well as applying the FDC and continuous modeling simulation approaches at the site-scale will demonstrate impervious cover (IC) conversion impacts and the necessity of robust SW management as well as the value of next-generation nD/rD management practices – or as termed here, Conservation Development (**CD**) practices.[1] As contemplated here, CD practices promote conservation of site-scale ecology to help ensure preservation of pre-development-like hydrology, hydrogeology, pollutant export and ecological diversity and vitality. Such practices are anticipated to include, among others, a de-emphasis of impervious cover (IC) (e.g., primarily access roads, driveways, parking lots and rooftops), and increased reliance on low impact development (**LID**) practices that emphasize next-generation site design and green infrastructure (**GI**) management practices (e.g., dispersed hydrologic controls and soil management practices), architecture (e.g., green roofs, LID) and landscape architecture. Additionally, CD practices can emphasize the value of permeable vegetated land cover including opportunities for local agriculture uses to increase sustainability of local food systems and the use of forest canopy and landscape architecture to promote evapotranspiration for hydrologic benefits and to offset the "heat island effect" that results from excessive IC.

This project is about envisioning a different future of watershed management. Practitioners will be asked to compare and consider likely scenarios ranging from inaction (status quo policies) to actions that incorporate flooding risks, stream-channel stability, increased pollutant export and reduced base flows. Phase 2 then is very much about *communicating* the results so that practitioners can *appreciate* the impact of nD/rD on the future of their watersheds. Ideally, practitioners would be able to glean the future of a watershed managed for optimal sustainability and resilience, compared to one that acquiesces, or continues to facilitate by inertia, the phenomenon of "urban sprawl".

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[1] It is interesting to consider a 1975 report funded by EPA's Office of Research and Development (ORD) proposed an "ecologically responsible land use decision-making system for local, regional and . . . state governments." The fundamental premise of this methodology was "*environmentally responsible land use planning and control must be based on valid ecological information combined with enlightened and informed public opinion*." [Emphasis in original]. USEPA, A Land Use Decision Methodology for Environmental Control, EPA-600/5-75-008, available at https://nepsis.epa.gov.

FDC Phase 2 will employ two separate but related task orders: (a) FDC application modeling and (b) development of a toolbox to include next-generation bylaws/ordinances, state-of-the-art approaches and techniques for architecture and landscape architecture, principles for site-scale design that help to conserve/preserve ecology and hydrology (e.g., site design and soil management approaches to promote better geospatial distribution of nD/rD site runoff, preservation of natural vegetated areas, etc.). Each task order will include specific tasks to disseminate and promote the technical transfer of overall project findings, including the development of a technical support document (TSD) and a webinar.

II. SCOPE OF WORK

In brief, this project will employ results of FDC Phase I hydrologic and watershed management modeling for developing future land use managment strategies designed to protect water resources from future watershed development activities. This following scope of work is predicated on developing flow duration curves for the headwaters and/or other low-order stream systems of the Taunton River watershed.[2] Much of the development of these FDCs is currently, or recently occurred, in the first phase of this work, FDC1 Project. For this task order, and consistent with the discussion above, the Contractor shall apply the FDC developed in FDC1 to a variety of watershed-scale and site-scale scenarios to demonstrate the practical efficacy of the FDC in evaluating impacts and benefits of management solutions. At the watershed scale, application of the FDC will be employed for one of the FDC1 subwatershed areas to demonstrate differences in hydrological response and condition for existing and future climatic conditions between historical (i.e., minimal development and/or complete forested cover), current (i.e., partially developed), and future (i.e., more fully developed with increased IC cover based on growth projections) scenarios. At the site-scale, the FDC1 Hydrologic Response Unit (HRU) modeling results and FDC will be applied to demonstrate the impact of development practices by comparing realistic land use development and watershed management scenarios to scenarios that incorporate both conventional development approaches with and without robust SW management and next-generation CD practices. One goal of site-scale application will be to examine the effectiveness of existing State stormwater regulations in managing and offsetting IC-related impacts for conventional nD/rD approaches. To this end, the project shall evaluate a wide range of potential watershed-scale and site-scale management measures for both restoration and protection of water resources including incorporation of GI Stormwater Control Measures (SCMs) to minimize hydrologic connectedness of IC, de-emphasis and/or removal of existing IC, and potential next-generation CD practices that can be realistically simulated.

Note that because this work scope will occur with a contemporaneous and complementary task order for development of next-generation nD/rD CD practices (FDC2B), the Contractor will likely need to coordinate as appropriate with the Contractor for FDC2B (assuming FDC2A and FDC2B are awarded to different Contractors).

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[2] A brief discussion outlining the flow duration curve (FDC) and its use for describing impacts and benefits of watershed management approaches is reproduced from FDC1 Project as an **Appendix** to this work scope.

The FDC2A Application Modeling shall build upon the modeling work being conducted in FDC1. The FDC1 modeling work includes the development and calibration of detail watershed hydrologic and stream hydraulic models for the Wading River watershed located within the Taunton River watershed. These models are being applied to three sub-watersheds within the Wading River that have varying levels of development and associated IC. Continuous simulation HRU models have been developed to represent distinct land use and land cover categories (e.g., commercial impervious, permeable forested Hydrologic Soil Group B (HSGB), etc.) to generate hourly time-series of flow and nutrient loads. HRU mapping has been conducted for the entire Taunton watershed, which will allow for the development of municipal-wide summaries of land use, land cover, total IC, hydrologic components (e.g., runoff, recharge, ET) and stormwater runoff source nutrient loads (not attenuated) planned for in this TO. Finally, the Opti-Tool is being applied in FDC1 to simulate management scenarios for existing development conditions under existing climate and future climatic conditions. Opti-Tool simulates the cumulative performance of a variety of SCMs (e.g., infiltration practices) for a specified climatic period. Opti-Tool is being used to optimize sub-watershed-wide retrofit management solutions that will minimize the difference between predevelopment and current development condition FDCs. The results of these optimization analyses are expected to provide insight into developing strategic retrofit management programs.

Under this TO, watershed-scale modeling applications using the Opti-Tool shall be accomplished for **one** of the three pilot sub-watersheds analyzed in FDC1 to evaluate several conventional and CD management scenarios for existing and future climatic and development conditions. Also, Opti-Tool shall be applied at the site-development project scale for several typical development scenarios involving conventional and CD approaches. This site development scale modeling work shall require coordination with the Contractor for FDC2B that shall be responsible for developing the site-scale project scenarios. The site scale modeling shall provide comparative quantified estimates of hydrologic conditions (e.g., annual runoff, recharge, etc) and nutrient export for site conditions for predevelopment, conventional development, and CD alternatives with differing levels of SW management designed to meet specific performance standards. Runoff duration curves for the various site-scale scenarios shall also be developed to illustrate IC impacts and the benefits of possible mitigation strategies associated with alternative CD and SW management approaches.

Task 0: Work Plan, Budget and Schedule

The Contractor shall prepare a detailed work plan and budget response to the following work scope describing its proposed approach to completing all the tasks in this PWS. Its response shall include a description of all assumptions and contingencies made by the Contractor, a proposed schedule including a list of deliverables with due dates, an estimated budget, and special reporting requirements (if any). The Contractor's response will include a description of proposed staff and the number of hours and labor classifications proposed for each task.

Task 0 Deliverables

The Work Plan, Budget and Schedule is due within three (3) weeks of Task Order (**TO**) award.

Task 1: Prepare Quality Assurance Project Plan (QAPP)

EPA policy requires that an approved Quality Assurance Project Plan be developed in advance for work that involves the collection, generation, evaluation, analysis or use (e.g., modeling) of secondary environmental data for environmental decision making. The QAPP defines and documents how specific data generation and collection activities shall be planned, implemented, and assessed. This Task Order will apply results of FDC Phase I to simulate a variety of land use and retrofit management scenarios to demonstrate the use and effect of FDC for next-generation sustainable and resilient watershed management. The Contractor shall develop a QAPP for all activities that involve the application of existing environmental information and data (prior modeling results), as well as for applying Opti-Tool.

As a template, the Contractor will revise the existing QAPP for the prior FDC1 Project, entitled Holistic Watershed Management for Existing and Future Land Use Development Activities: Opportunities for Action for Local Decision Makers: Phase 1 – Modeling and Development of Flow Duration Curves (FDC 1 Project), Quality Assurance Project Plan; Task 1, Version 1.2, dated January 12, 2021. This QAPP is available on the FDC1 Project website at https://www.epa.gov/snep/holistic-watershed-management-existing-and-future-land-use-development-activities-opportunities .

Task 1 Deliverables

- draft QAPP (at the time of submitting the Work Plan).
- final QAPP (within 5 business days after receiving comments on the draft QAPP)

Task 2: Project Management and Administration

This task includes Subtasks related to administration, management and coordination of the project.

Mark Voorhees and Michelle Vuto (Stormwater Permitting), **Ray Cody** (Surface Water Branch, NPS Unit) and **Sara Burns** of The Nature Conservancy (TND) will serve as the EPA Project Team (**Project Team**) and/or Project Technical Leads (PTL) for this project (**"the Project"**). In addition, **Ray Cody** will serve as the Task Order (TO) Contracting Officer Representative (**TOCOR**) and **Steven Winnett** will serve as the Alternate TOCOR (**Alt. TOCOR**). Except as provided (e.g., invoicing, contract-related correspondence), the Contractor shall direct all draft and final deliverables to the EPA Project Team and copy (i.e., cc) the TOCOR and Alt. TOCOR.

Invoicing, generally

Provisions for invoicing are generally set forth in the GSA Contract and/or the BPA. To the extent the following is not inconsistent with either, then to ensure timely administration, invoices shall be submitted promptly within the first or second week of each calendar month. Invoices shall be directed to the TOCOR. The TOCOR will distribute as appropriate to the Project Team Leader and/or the Project Team for review and consideration, as appropriate. Invoices shall, among other things, summarize the Contractor's work for the billing month, project anticipated work for the next billing period(s), identify and anticipate any problems that may impact the project or its schedule, and specify and identify the billable hours and other direct costs on a Task and Subtask basis. In its response to this PWS, the Contractor may add one or more specific Subtasks or line items under this Task for its general administration of the project.

In addition, to ensure timely processing of invoices, the Contractor shall copy the TOCOR on invoice submittals (by email as *.pdf) and any and all correspondence to the EPA Servicing Center (presumably, Research Triangle Park (RTP) Financing Center at RTPReceiving@epa.gov) and the subject line or body of such email submittals shall include the following pertinent information:

- Project Name (in this case, "FDC2A")
- Contract No. (i.e., BPA-68HE0118A0001-003)
- Order No.
- Billing/Invoice No.
- Billing Period
- Total Amount Billed for the Billing Period

Deliverables, generally

Provisions for Deliverables are generally set forth in the GSA Contract and/or the BPA. To the extent the following is not inconsistent with either, EPA intends to provide any and all formal reports produced under this contract for public dissemination, in whole or in derivative documents, as appropriate. The Contractor shall always provide draft versions of any spreadsheets, calculations or reports. EPA and its stakeholders may review and comment on draft deliverables / submittals. If so, then the Contractor shall incorporate any such comments into a final version(s). For communiques and reports, the Contractor shall use standard computer software (e.g., Adobe Acrobat, MS Word, MS Excel, MS PowerPoint). All other software (e.g., computer models) must utilize publicly available non-proprietary code. In addition, software application files, if delivered to the Government, must conform with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794(d)).[3] Refer to http://www.section508.gov/.

Subtask 2A. Kickoff Meeting

The Contractor shall initiate a project kick-off meeting with the project team at EPA's Region 1 Boston office located at 5 Post Office Square, Suite 100, Boston, MA 02109-3912. Due to the continuing Covid-19 pandemic, it is assumed this meeting will use a videoconference application. Currently, EPA has a license and uses Microsoft Teams™ for videoconferencing. Teams should be

[3] In 1998, Congress amended the Rehabilitation Act of 1973 to require Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities. The law applies to all Federal agencies when they develop, procure, maintain, or use electronic and information technology. Under Section 508, agencies must give disabled employees and members of the public access to information that is comparable to access available to others.

considered the primary or default videoconferencing platform. Alternative platforms / applications may be employed (e.g., ZOOM™) on an as-needed case-by-case basis and consistent with EPA policy dated April 4, 2020, entitled “Revised - Guidance on Use of Third-Party Virtual Platforms”.

As it is uncertain Covid-19 travel restrictions will continue into and through the POP for this TO, the Contractor may provide a separate line item as a contingency for one (1) to two (2) in-person meeting(s) and assume travel, lodging (if applicable), logistics and coordination for managerial and technical personnel. Under an assumption the task order award includes the in-person meeting contingency, and it becomes reasonably clear during the course of the task order these funds will not be expended, the budget line item may be re-allocated by the TOCOR using Technical Direction.

For the Kickoff Meeting, EPA will make available any additional technical references not already provided herein, or other supplemental data or information that may assist the Contractor.

A week following this meeting, the Contractor shall summarize its understanding of the project kick-off meeting (e.g., action items; scheduling adjustments) and transmit these by email to the COR.

Subtask 2A Deliverables

- Kickoff meeting within one (1) month of Task Order Award.
- Kickoff meeting summary (incl. action items, scheduling adjustments, etc.) within one (1) week of kickoff meeting.

Subtask 2B. Conference Calls, Meetings and Project Team Support

Following the Kickoff Meeting, the Contractor shall provide for monthly video or teleconference calls (as needed) to keep the project team updated as to the status of the project. These calls may utilize EPA’s teleconferencing facilities and EPA can provide video/teleconferencing details in advance of each call. The Contractor shall briefly summarize its understanding of each call (e.g., action items; scheduling adjustments) and/or meeting and transmit these by email to the TOCOR.

It is possible that drafts of any given deliverable may require time and level of effort (**LOE**) for EPA review and/or same for facilitating such review of the drafts by others. The Contractor shall include reasonable provisions for incorporating such review into the development of final deliverables.

Assuming FDC2A and 2B are awarded to different Contractors, it will be important for the Contractors to coordinate for TSC Meetings (Task 3), for development of webinars and for coordination in regards to the development of watershed and site-scale FDC application simulations / scenarios and the presentation of results thereof. Based on its understanding of the work scope provided below, the Contractor shall provide a separate line item cost for *inter* FDC2A/2B task order coordination.

Subtask 2B Deliverables

- Monthly Conference Calls
- Monthly Conference Call Summaries
- Reasonable provisions for incorporating EPA and/or stakeholder review and input, if any
- Inter FDC2A/2B task order coordination

Task 3: Technical Steering Committee (TSC) Meetings

Phase I of the FDC Project included a separate Task (FDC1 Task 3) dedicated to the formation and management of a Technical Steering Committee (TSC). The TSC for FDC1 is comprised of members with expertise related to watershed and hydrologic stream flow modeling; geology and hydrogeology; stream ecology; fluvial geomorphology; green infrastructure and stormwater management; land use planning; and landscape architecture. The purpose of the TSC has been to provide guidance and feedback to the Project Team throughout the Project, which has been accomplished via a series of TSC Meetings where TSC members and other project participants can discuss and vet opinions on drafts of key technical deliverables. The TSC panel has been well attended - and based on the interest and importance of the Project, EPA is interested in continuation of a TSC for this phase of the Project.

Accordingly, the Contractor shall provision for TSC participation in FDC2A and assume preparation for and participation in up to two (2) TSC meetings; each meeting being approximately two (2) hours in length. To offset redundancy and facilitate economy of TSC member availability and participation, the TSC Meetings will be coordinated with the FDC2B Project. EPA envisions the agenda for each TSC meeting would be adjusted and/or tailored to the subject matter as a function of priority or need, or simply adjusted pro rata based on time. For instance, it may be that for a given TSC Meeting, Project FDC2A is ready to receive TSC input but that FDC2B is not; in this case, priority of TSC time would be given to FDC2A. EPA R1 shall be primarily responsible for convening the TSC and coordinating between FDC2A and FDC2B; the Contractor shall coordinate in kind as needed, including coordination with the FDC2B Contractor (assuming the award for FDC2B is to a different Contractor).

Consistent with FDC1, the Contractor shall assume TSC Meetings will be convened virtually using a videoconference platform as discussed above. However, in the event pandemic conditions improve which allow for in-person meetings, one option may be to convene one or more of these meetings at the University of Massachusetts, Amherst, MA (UMass Amherst). Consistent with the discussion of travel provided above under Subtask 2A, the Contractor may provide separate line item contingency for such travel for this task. Again, not unlike Subtask 2A above, under an assumption the task order award includes an in-person meeting contingency, and it becomes reasonably clear during the course of the task order these funds will not be expended, the budget line item may be re-allocated by the TOCOR using Technical Direction. R1 anticipates convening the TSC meetings at the following project milestones to facilitate receiving timely TSC input prior to key project decision points:

- TSC Meeting 1: Completion of draft Work Plan
- TSC Meeting 2: Completion of draft Project Report

The TOCOR will be primarily responsible for convening the TSC.

Task 4: Develop Future Land Cover Data for Taunton River Sub-Watershed Modeling and Hydrologic Response Unit Analyses

The objective of this task is for the Contractor to develop data projections representing potential future land cover characteristics in the Taunton River watershed associated with projections of future growth and associated land development in the distant future (e.g., year 2060). The contractor shall review existing information related to projections of future growth and land development in the Taunton watershed (to be provided by EPA R1) and shall propose to the Project Team an approach for generating estimates of future land cover and associated IC that will be suitable to support detailed hydrologic and flow routing modeling analyses and FDC development for one of the three Phase 1 sub-watersheds in the Wading River subwatershed of the Taunton Watershed (e.g., Upper Hodges Brook). The Contractor shall interpret the future land use projections assuming conventional development approaches (i.e., "business as usual") would occur and estimate associated typical percent IC coverage for the projected new development conditions. Additionally, the future development estimates shall be suitable for providing future growth condition Hydrologic Response Unit (HRU) modeling source estimates (not attenuated) and unabated (no controls) for the entire Taunton River watershed assuming conventional development conditions.

Upon receiving approval of the proposed approach from the Project Team, the Contractor shall develop the necessary data layers to support the detailed hydrologic watershed modeling of the pilot sub-watershed area within the Wading River and the future-growth HRU analysis of the entire Taunton River watershed. Estimates of future land development conditions in New England including the Taunton watershed have been developed and are available here:

https://newenglandlandscapes.org/?map=1&lat=44.0000&lon=-70.0000&zoom=7&leftScenario=rt&rightScenario=cc&leftYear=2010&rightYear=2060

and
https://view.publitas.com/p222-2239/voices-from-the-land/page/1

The Contractor shall prepare a **Technical Memorandum (TM)** that documents the approach taken and provides comparative results between existing and projected future land cover conditions including future estimates of IC (assuming conventional development patterns) and estimates of unattenuated average annual runoff volume yields, groundwater recharge and nutrient load export for both existing and future climatic conditions. The Contractor shall submit a draft TM to the TOCOR. The Contractor shall finalize the TM and provide a summary or otherwise incorporate responses to all comments within 10 business days from the date of receiving comments from the TOCOR. The TOCOR will be responsible for obtaining input from the TSC.

Task 4 Deliverables

- Draft Task 4 TM
- Final Task 4 TM

Task 5: Opti-Tool Enhancements: Green Roofs and Temporary Runoff Storage with IC Disconnection

The objective of this task is for the Contractor to incorporate two new green infrastructure stormwater control measures (GI SCM) into Opti-Tool for Phase 2 management alternative analyses. The Contractor shall configure the Opti-Tool to simulate 1) green roof technologies and 2) the use of temporary runoff storage combined with IC disconnection. EPA R1 shall research and provide information on current green roof technology designs to the Contractor. The Contractor shall create a SCM design template for simulating long-term continuous performance of runoff and nutrient load reductions. The Contractor shall select appropriate default model parameters for simulating green roof technologies in SUSTAIN based on published research and best professional judgement. The Contractor shall also include the SCM option of temporary runoff storage (e.g., cistern) combined with partial IC disconnection or direct use of stored water. The IC disconnection option shall allow for partial hydrologic IC disconnection based on the ratio of IC drainage area to receiving pervious area (PA) as is currently represented in the current MA and NH MS4 permits (Appendix F Attachment 3). The Contractor may propose for approval by the TOCOR an alternative modeling approach for temporary storage and partial IC disconnection. EPA will provide the Contractor with unit cost information for the two new GI SCMs to be included in the Opti-Tool enhancements.

The Contractor shall prepare a **Technical Memorandum** (**TM**) detailing the work conducted under Task 5 including documentation of and supporting information for the enhancements made to Opti-Tool to simulate green roof technologies and temporary storage with varying partial IC disconnection or other direct use of stored runoff. Additionally, the Contractor shall provide the enhanced Opti-tool (Version 2.1) and updated user's manual (if necessary). The Contractor shall submit a draft Task 5 TM to the TOCOR. The Contractor shall finalize the Task 5 TM and provide a summary of the response to all comments within 10 business days from the date of receiving comments from the TOCOR. The TOCOR will be responsible for obtaining input from the TSC. The Contractor shall deliver the enhanced Opti-Tool (version 2.1) and updated User's Manual (if necessary) upon completion of Task 5.

Task 5 Deliverables

- Draft Task 5 TM
- Final Task 5 TM

Task 6: Modeling Analyses for Projected Future Land Development Conditions at Sub-watershed and Site-Development Project Scales; responsibilities of and coordination between FDC2A and FDC2B Project Teams

The Objective of this task is to conduct modeling simulations using the Phase 1 calibrated models including Opti-Tool to assess impacts and benefits associated with projected future watershed development conditions and various management alternatives at both the sub-watershed and site-development project scales. The modeling analyses shall be performed for both existing and projected future climatic conditions.

EPA envisions that up to three (3) future climatic scenarios shall be selected from the Phase 1 future climate analysis for the Phase 2 FDC2A/FDC2B modeling analyses. Optimized sub-watershed management opportunities shall be developed using the enhanced Opti-Tool (Task 5) and provided to the FDC2B Project Team. EPA expects that outputs from both the Phase 1 and 2 subwatershed modeling analyses shall be used by the FDC2B Project Team to inform:

1) the FDC2B Municipal Partners of IC conversion impacts and management opportunities; and

2) the development of alternative levels of local regulatory (i.e., bylaw) control for addressing potential water resource and watershed health impacts associated with future new and redevelopment activities.

All alternative management scenarios to be evaluated by the FDC2A Contractor through conducting subwatershed and site-development scale modeling simulations will be developed by the FDC2B project team.

EPA anticipates that the management alternative scenarios to be evaluated for both the sub-watershed and site-development project scales shall be consistent such that the results of the sub-watershed modeling simulations would represent the net level of control for the entire subwatershed, assuming the specified level of control for the site-scale would be applied to all potential new and redevelopment activities that would be subject to the alternative control requirements.

This modeling work for this task is divided into two modeling Subtasks (6A and 6B) described below and a third Subtask, 6C, that specifies the Final Report deliverable for FDC2A. Note: work under Subtasks 6A and 6B are not sequential but are likely to occur simultaneous in an iterative manner.

Inter Project Coordination; Generalized Inter Project Data Flow; Example

EPA anticipates close coordination among the FDC2A, FDC2B and EPA R1 teams will be necessary for achieving overall objectives of the two projects and more specifically for carrying out work under this task. The EPA R1 Project Team will have the lead role for facilitating inter-project coordination between the FDC2A and FDC2B project teams. Close inter-project coordination will be important for the success of both projects including providing baseline information to characterize impacts and benefits of management opportunities (FDC2A to FDC2B), informing the development of management alternatives (FDC2B to FDC2A) and numerous conceptual site-development scale scenarios (FDC2A to FDC2B) that shall be modelled as specified under this task. As a general rule, EPA anticipates the following sequence of modeling simulations for Task 6 including key transitions of information sharing / outputs between FDC2A and FDC2B:

Baseline Subwatershed Modeling

FDC2A conducts Subwatershed Optimization Simulation Outputs and provides this output to FDC2B.

'Alternative 1'

FDC2B then develops and provides 'Alternative 1' level of control (LOC) Concept Site Development Plans (e.g., As-Built Plans) to FDC2A for modeling.

FDC2A conducts further modeling simulations for Alternative 1 concept Site Development Plans **and** Alternative 1 Subwatershed Modeling Simulations. FDC2A provides modeling outputs to FDC2B.

'Alternative 2'

FDC2B then develops and provides 'Alternative 2' LOC concept Site Development Plans to FDC2A for modeling.

FDC2A conducts modeling simulations for Alternative 2 concept Site Development Plans **and** Alternative 2 Subwatershed Modeling Simulations.

Example: The initial subwatershed modeling analysis and optimization simulations will be performed independent of local regulatory control alternative scenarios and the output shall be used by the FDC2B project to inform their Municipal Partners of impacts and management opportunities from a watershed perspective.

The FDC2B project team shall use this information to begin a dialogue with the FDC2B municipal partners about possible alternative local regulatory control scenarios focused on SW management and conservation development practices to be evaluated for new and redevelopment activities. The FDC2B project team shall then create a series of conceptual site-development project plans that incorporate the necessary site design elements and SW management to comply with the alternative local regulatory requirements being evaluated.

These conceptual site-designs shall in turn be used by the FDC2A project Team to:

1) simulate site conditions to quantify impacts and benefits of management practices; and

2) develop implementation rules to conduct subwatershed modeling simulations that represent a specific alternative level of local regulatory control for future development activities. It is likely the results of the site plan and the subwatershed modeling simulations for the first alternative (i.e., 'Alternative 1') analyzed will be used to inform the development of the next alternative level of local regulatory control to be evaluated.

Subtask 6A: Sub-watershed Modeling and Alternative Management Analysis for Project Future Land Use Conditions

The objective of this Subtask is to simulate alternative watershed management scenarios for the selected Phase 1 study sub-watershed area tributary to the Wading River for projected future land use development conditions under both existing and future climatic conditions. The Contractor shall carry out the sub-watershed SW/hydrologic management modeling approach as described in the Task 0 Work Plan. Work under this Subtask will likely include the following work elements for both existing and future climatic conditions:

- GIS Analysis. Update Phase 1 GIS SW management analyses to identify potentially effective stormwater management opportunities including Phase 1 GI SCMs and the two new GI SCMs (green roofs and storage with IC disconnection) to be incorporated into Opti-Tool under Task 6 of this TO. The GIS analysis shall be suitable for projected future land use development conditions assuming conventional development patterns (i.e., "business as usual") occur in the selected sub-watersheds in preparation for performing EPA R1's Opti-Tool stormwater management optimization simulations and model simulations that evaluate alternative local SW management regulatory requirements.

- Optimize SCM Opportunities. Conduct optimization analyses of GI SCM opportunities in the selected FDC1 pilot sub-watershed area for projected future development conditions assuming conventional development IC amounts. Optimization analyses shall be conducted using EPA's R1 Opti-Tool to restore and protect watershed hydrologic and pollutant attenuation functions (e.g., groundwater recharge, evapotranspiration, pollutant filtering, etc.) using FDC evaluation factors and other metrics for driving optimization analyses (e.g., pollutant load export, runoff yields, etc.) for both existing and future climatic conditions. The purpose of this analyses will be to support the selection of additional alternative management scenarios for further evaluation using cost effectiveness curves and model generated FDC results designed for specific environmental outcomes (e.g., nutrient export, maintain low flows, etc.). EPA assumes that the Contractor shall accomplish up to three optimization simulations for the selected sub-watershed to identify cost-effective scenarios that could address multiple management objectives such as channel stability, low flow conditions and pollutant load export.

- Alternatives Analysis of Local SW and Site-Development Regulatory Requirements. The Contractor shall coordinate with EPA R1 and the FDC2B project team to support selection of up to two (2) alternative management scenarios for modeling and evaluation: 'Alternative 1' and 'Alternative 2'. The two alternate management scenarios shall include a baseline scenario in which MA SW standards would be applied to applicable future new and redevelopment activities. For example, MA's SW standards for new development are currently applicable to projects creating 1 or more acres of IC. The modeling analysis of this scenario will require applying estimates of how much of projected future development activities would be subject to MA SW standards. For this alternative, EPA will, in coordination with MassDEP and FDC2B, develop estimates of future land development activities that would be subject to MA SW standards for the Contractor to use in developing the modeling scenario. The Contractor shall interpret and apply MA SW standards in the sub-watershed modeling of this scenario for two modeling simulations that reflect: 1) focus on SW management practices only for conventional development; and 2) use of GI and emphasis of CD practices to meet MA SW standards. Rules for interpreting these alternative scenarios for modeling purposes shall be based on results of the conceptual site-development project scale alternatives developed under FDC2B.

  The Contractor shall simulate **one** additional alternative scenario for the sub-watershed that would represent more environmentally protective local requirements for new and redevelopment activities. EPA envisions that this alternative will include more stringent on-site SW managment (e.g., increased on-site retention requirements) and potential site design standards that would lead to CD practices. Similar to analyzing the MA SW standards alternative discussed above, the Contractor shall conduct two model simulations for this alternative scenario: 1) focus on SW management practices only for conventional development; and 2) use of GI and emphasis of CD practices to meet specified next-generation local requirements. It is possible that local next-gen CD design standards to be considered for alternative analysis in FDC2B may include use of IC thresholds and allowance of next-gen CD site design standards for new development that would result in minimizing IC impacts (e.g., less IC through narrower roads, underground parking garages, green roofs, use of permeable pavement technologies, smaller parking spaces, less parking, etc.) and designation of on-site conservation areas for offsetting IC impacts. EPA presumes the development of the alternate SW management and site-development local requirement scenarios will be developed under FDC2B following a community engagement process and after receiving input from EPA R1 and the FDC2A project team.

Subtask 6B: Site Development Project Scale Modeling Alternative Analysis

The Contractor shall apply Opti-Tool to evaluate alternatives for **up to three (3) new site-development project-scale scenarios** (e.g., low, medium and high intensity development sites) and **up to three (3) redevelopment scenarios**, totaling 6 potential site development scenarios. The scenarios and management alternatives to be simulated under this Subtask shall be developed by the FDC2B project team in consultation with EPA R1 and provided to the

Contractor. The FDC2A project team shall have the opportunity to coordinate and provide input to the FDC2B team for alternative development and the types of SCMs to be simulated in the various site-development scenarios and alternatives.

The Contractor shall perform modeling simulations for existing and up to three (3) **future climatic conditions for each scenario for the two alternatives discussed in Subtask 6A** to estimate the effectiveness of varying levels of possible local SW management and site-development requirements (i.e., next-gen bylaws). Similar to Subtask 6A, the Contractor shall perform the following two (2) modeling simulations for each alterative scenario for each of the three new site-development scenarios:

1) SW management only assuming conventional development of the site; and
2) site development applying CD practices with GI.

The Contractor shall also simulate **predevelopment conditions for the 3 new site-development scenarios**. In total, it is estimated the Contractor shall perform up to 108 modeling simulations to estimate project site-scale hydrologic and pollutant export conditions. The Contractor shall quantify for each scenario and alternative modeling simulation the resulting hydrologic conditions (e.g., runoff duration curves, average annual runoff volume, average annual recharge to groundwater), pollutant export rates, carbon sequestration, and if plausible, estimates of heat exchange or evaporative cooling. The results of modeling conducted under this Subtask shall be used by the FDC2B project team as part of the municipal engagement process to occur under FDC2B. The Contractor shall coordinate with the EPA R1 Project Team to provide to the FDC2B Project Team a summary of the results for each modeling simulation performed.

Subtask 6C: Final FDC2A Project Report and Project Summary Overview

The Contractor shall prepare a written Final Report that documents all work performed under this TO/Project. EPA presumes this Final Report may be a compendium of the Technical Memorandums produced under the above Tasks/Subtasks but will include an Executive Summary, and a Conclusions and Recommendations Sections. The Recommendations Section should identify areas for further investigation / work along with approximate costs/LOE (although such costs/LOE shall be provided in a separate brief addendum to the Final Report). The Final Report shall also describe how the work conducted under this TO could be applied to support local entities including municipal governments in developing wise water resource management strategies to build resiliency and make progress in restoring/protecting local and regional water resource health through effectively addressing potential impacts associated with future development activities. To this end, the Contractor shall revise, as necessary, long-term management strategies and potential mechanisms that local communities can begin pursuing (e.g., adopting more protective local SW management and site-development requirements for new and redevelopment activities and opportunistic SW management retrofit programs) to be developed during Phase 1.

Municipal practitioner understanding and appreciation is a critical goal of this Project. Results of all modeling simulations shall be presented with the goal of demonstrating IC conversion impacts and potential benefits associated with various management opportunities. In addition to fully documenting the work conducted under this TO, the Contractor shall include summaries of results suitable for lay audiences to understand major project findings related to IC conversion and various mitigation opportunities.

EPA envisions that the Final Report shall include quantified estimates of impacts associated with existing and future watershed development and IC conversion, as well as the potential benefits associated with possible future SW management requirements evaluated in the optimization and alternative management scenarios. The Contractor shall create summary tables and depict on FDCs where appropriate quantitative estimates of long-term cumulative impacts and management benefits for the identified critical streamflow regimes/metrics, SW runoff pollutant load export, groundwater recharge, evapotranspiration, carbon sequestration and heat loss exchange. EPA anticipates that such result summaries shall include HRU source loading and hydrologic yield estimates, for the subwatershed, site development scenarios and select municipalities participating in FDC2B. EPA R1 will work with the Contractor to discuss approaches for conveying results of the FDC analyses for different levels of development and management scenarios (e.g., predevelopment, existing development, future development) to facilitate understanding of impacts and benefits by municipal government officials and an engaged public.

The Contractor shall prepare a **Technical Support Document (TSD)** in the form of a fact sheet to be used as an outreach document that provides a brief project information summary (not to exceed four pages) for efficiently conveying key messages, lessons learned, and valuable water resource management information to watershed management practitioners including local, state and federal government representatives. The TSD / fact sheet shall be developed with the goal to effectively communicate key findings including discussion of relationships between watershed function, land use development and water resource impacts in low-order stream systems and larger down-gradient waters resources (e.g., lakes, coastal waters, aquifers, etc) and evaluated water resource management strategies. The information summaries should be designed with accompanying graphics and tables to clearly convey water resource impacts associated with inadequately managed IC conversion and the potential quantitative benefits of feasible watershed restoration activities/strategies identified in this study.

Task 6 Deliverables

- The Contractor shall provide modeling sub-watershed and site scale results to the TOCOR in an iterative manner to support the FDC2B municipal engagement process as discussed in the task description. In summary, modeling results shall be submitted in the following sequential order in accordance with the following timeline relative to the date of the TO award: 1) Subwatershed Optimization-3 months; 2) Alternative 1 (baseline requirements)-5months; and 3) Alternative 2- 8 months. The results shall be provided in a format to support the FDC2B municipal engagement process.

- The Contractor shall submit a draft Phase 2 **Final Report** to the TOCOR. The Contractor shall finalize the Phase 2 report within 15 business days from the date of receiving comments from the TOCOR. The TOCOR will be responsible for obtaining input from the TSC, if any.

- The Contractor shall submit draft **TSD/fact sheet (**up to 4 pages including figures and tables) to the TOCOR. The Contractor shall finalize the Project Summary Overview within 10 business days from the date of receiving comments from the TOCOR. The TOCOR will be responsible for obtaining input on the outreach materials from the TSC, if any.

Task 7: Phase 2A Project Webinar to SNEP Region

The Contractor shall prepare for and participate in a webinar to present the Phase 2 study results and findings. The Contractor may assume webinar logistics will be provided by the SNEP.

IV. SCHEDULE

The following table provides an estimate of the project schedule. EPA understands that this schedule may change as a result of discussions with the Contractor or with the natural course of the project. In addition, the Contractor may propose modifications or an alteration of this schedule in its response to this PWS. **However, the schedule must presume completion within one year of Task Order (TO) award.**

Deliverables	**Delivery Dates**
Task 0. Workplan, Budget and Schedule	Within three (3) weeks of TO award
Task 1. Prepare QAPP	
• Draft	Same as Task 0: within three (3) weeks of TO award
• Final	Within five (5) business days of receipt of EPA comments
Task 2. Project Management and Administration	
• Subtask 2A Kickoff Mtg	Within one (1) month of TO award
• Subtask 2B Monthly Conference Calls and Summaries	As Needed
Task 3. Technical Steering Committee Meetings	
• Two (2) Meetings	To Be Determined
Task 4: Develop Future Land Cover Data for Taunton River Sub-Watershed Modeling and Hydrologic Response Unit Analyses • Draft Technical Memorandum	Within 6 weeks of TO award

• Final Technical Memorandum	Within one (1) week of receipt of EPA comments
Task 5: Opti-Tool Enhancements: Green Roofs and Temporary Runoff Storage with IC Disconnection • Draft Technical Memorandum • Final Technical Memorandum and updated Opti-Tool	 Within six (2) months of TO award Within one (1) week of receipt of EPA comments
Task 6: Modeling Analyses for Projected Future Land Development Conditions at Sub-watershed and Site-Development Project Scales • Subtask 6A: Modeling Results for Sub-watershed Modeling and Alternative Management Analysis for Project Future Land Use Conditions • Subtask 6B: Modeling Results for Site-Development Project Scale Modeling Alternative Analysis • Subtask 6C: Draft Final FDC2A Project Report and Project Summary Overview • Subtask 6C: Draft Final FDC2A Project Report and Project Summary Overview • Final Report	6A, B and C: To Be Determined. Interim modeling results shall be provided to support the FDC2B Municipal engagement process. EPA estimates timeline from date of TO award to be: 1) Optimization: 3 months 2)Alternative 1: 5 months 3) Alternative 2: 8 months Within ten (10) months of TO award Within two (2) weeks of receipt of EPA comments

Task 7: Phase 1 Stormwater/Hydrologic Management Optimization Analyses
 	
• **Final Project Report**
    ○ Draft
 	
    ○ Final
 	
• Task 7 Outreach Materials
    ○ Draft
 	
    ○ Final
	
	Within eleven (11) months of TO award
	
	Before TO expiration
	
	Within eleven (11) months of TO award
	
	Before TO expiration

Task 8: Phase 1 Project Webinar to SNEP Region	Before TO expiration

V. Appendix

PROJECT BACKGROUND

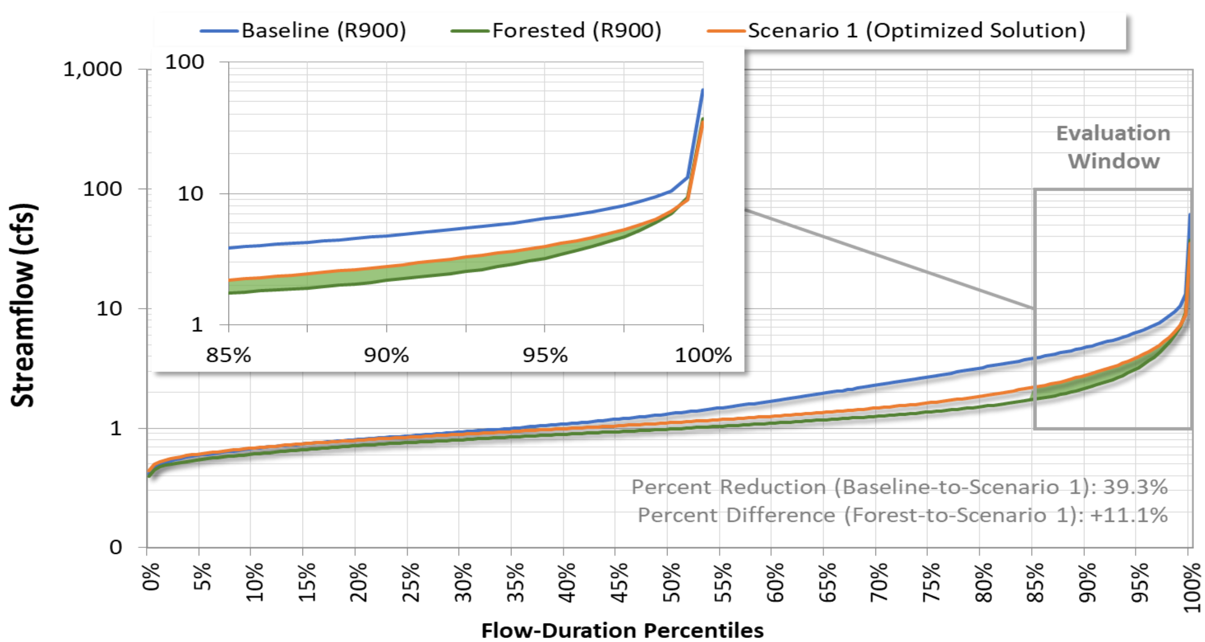
(Reproduced from FDC1 Work Scope)

Conventional development approaches and existing stormwater management standards (where applicable) do not adequately address the full range of hydrologic, water quality and aquatic life impacts associated with human development and impervious cover ("IC"). The weight of evidence is clear that human development and urbanization have had a profound impact on water resources in multiple ways. The paving of vegetated land disrupts the natural hydrologic cycle at a site scale that has ramifications for the larger watershed. Recent research assessing the health and integrity of watersheds indicates that efforts to restore the hydrological and ecological function of our watersheds are not likely to offset the combined impacts of 1) past and future development that expands watershed impervious cover (IC), and 2) changing climate conditions. For instance, "billions of dollars continue to be invested in the physical restoration of urban channels. [However,] post-construction studies generally show . . . [these streams are in fact biologically] unrestored [except where stormwater control measures have been extensively implemented]." (Hawley; 2015). Watershed management needs to consider the magnitude, frequency, and timing of various flow events – and incorporate new insight on the role of lesser permeability soils (e.g., tills) which indicate such soils provide a primary mechanism for maintaining hydrological balance (Boutt; 2017). As human populations continue to grow, and population centers shift in response to changing natural hazards associated with climate change impacts, appropriate guidance on resource protection is a fundamental need for humans and ecological communities. The Flow Duration Curve encapsulates the full spectrum of hydrologic and hydrogeologic balance needed for assessing and preserving the future health of watersheds.

In brief, the FDC describes the frequency and duration of stream flow rates for a given location that occur over a long period. The FDC is a powerful diagnostic tool for evaluating impacts of watershed development and potential benefits of future management alternatives across the full spectrum of in-stream flow regimes:

- **FDCs Quantify Impacts.** FDCs can be used to quantify the impacts (change in frequency and duration) to critical flow regimes (e.g., bank-full flow (i.e., flooding), scouring flows (i.e., channel destabilization), base flow (i.e., aquatic life), high pollutant export flows, etc.) for varying levels of development and IC.

- **FDCs Quantify Benefits.** FDCs can be used to quantify anticipated benefits of alternative development practices and watershed stormwater management alternatives including:
    - relevance of existing stormwater standards;
    - enhanced Low Impact Development approaches;
    - optimized stormwater management solutions emphasizing green infrastructure (stormwater control measures (GI SCM) for both existing and future development conditions; and
    - identifying high-value hydrologic/ecological resource areas in which development should be avoided to maintain natural watershed functions essential for future watershed and water resource resiliency.



The above figure is an example flow duration curve for predevelopment and existing watershed development conditions, as well as an alternative conservation development management solution. The figure provides an example optimized solution for a given subwatershed after incorporating specific development and management practices in order to normalize the FDC towards the natural hydrologic condition of the forested state. Except for the smaller percentage of larger storm events, the optimized solution demonstrates that the watershed can be hydrologically restored, a condition that translates overall into less geomorphic distortions, reduction in flooding events, and improved water quality. Hydrologic normalization is a precursor for ecological health and restoration.