TISBURY MA IMPERVIOUS COVER DISCONNECTION (ICD) PROJECT: AN INTEGRATED STORMWATER MANAGEMENT APPROACH FOR PROMOTING URBAN COMMUNITY SUSTAINABILITY AND RESILIENCE

A TECHNICAL DIRECT ASSISTANCE PROJECT FUNDED BY THE U.S. EPA SOUTHERN NEW ENGLAND PROGRAM (SNEP)

TASK 0 WORK PLAN (FINAL)

1ST DRAFT OCT 2, 2018
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Prepared for:

U.S. EPA Region 1 **Tisbury MA** **Martha's Vineyard Commission**

Prepared by:

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1 PROJECT UNDERSTANDING

The goal of this project is to identify and quantifiably-assess and quantify opportunities for the disconnection of impervious cover (IC) within a geographically-constrained urbanized New England community located near the southern New England coastline. The community, the Town of Tisbury (Town), has requested assistance from the United States Environmental Protection Agency (EPA) to address chronic (even acute) flooding and the generally poor transmission of stormwater runoff related to and resulting from IC. An equally important project goal is building an understanding and capacity for integrating green infrastructure (GI) and other stormwater control measures (SCM) into municipal land use decision making. This collaborative project will achieve innovative and cost-effective management of stormwater for a broad range of management objectives (e.g., volumetric control (flooding); reuse, resilience and sustainability; control of pollutants and protection of sensitive surface waters).

Considering the apparent increasing frequency and magnitude of storm events such as the recent hurricane Florence, and the increasing fragility and scarcity of the nation's water resources, the Project Team will strive to develop and present a conceptual 'blueprint' for the management of stormwater and stormwater infrastructure that may help the Town of Tisbury achieve resilience and sustainability into the foreseeable future. To do so, the Project Team recognizes it will need to convey an appreciation for stormwater such that the Town's public constituency may begin to recognize stormwater and stormwater management as a high priority land use objective. Because municipal action in New England is achieved by way of Town Meetings and the actions of its Boards and Committees, and which entails a legislative processes that includes development and amendment of a Master Plan, the Project will require meaningful and thoughtful engagement with the Town, its Department of Public Works (DPW) and other Boards and Committees (as appropriate) to develop approaches the Town staff acknowledge and trust will best address its stormwater management objectives. To address existing stormwater-related deficiencies, including chronic (if not acute) flooding of downtown Tisbury and the emerging water quality impairments of Lagoon Pond, we anticipate the aforementioned 'blueprint' will incorporate a wide array of approaches including the disconnection of impervious cover within the urbanized areas of Tisbury, the integration of green infrastructure (GI) where practicable, as well as other stormwater infrastructure approaches. The Project contemplates a hierarchical approach predicated on the physical control of stormwater which we believe will lead to opportunities for future infrastructure projects for both flooding and water quality. Such opportunities will need to be prioritized in terms of scale, scope, cost and time so that the Town may properly consider such in a most convenient manner that accords with its budget and decision-making processes. As mentioned, we anticipate that the raising of public awareness within the Tisbury constituency of the need and benefits for stormwater and stormwater-related infrastructure improvements will be dispositive for attaining stormwater improvements into and throughout the municipality – and it will be incumbent on the Project Team to convey the information and results developed by this project in such clear and concise terms as to facilitate such appreciation by the public. Lastly, the work achieved here may serve as an important template to be transferred to other New England communities that share similar stormwater management needs.

The following sections provide our team's approach to completing the tasks outlined in the Performance Work Statement (PWS) and the key staff proposed to provide project management and technical leadership.

2 DRAFT WORK PLAN

The following draft Work Plan and methodology will serve as the starting point for discussion related to task expectations, deliverables, staffing, and schedule.

Task 0: Work Plan, Budget and Schedule

This document serves as our draft work plan and it outlines our approach and staffing for each task included in the PWS. Our proposed level of effort and schedule for key milestones and deliverables are provided at the end of this section.

Task Lead: Khalid Alvi and Mick DeGraeve
Key Support Staff: James Houle
Schedule: The final work plan will be delivered to EPA within 1 week of receiving comments from EPA.
Deliverable(s): Draft work plan (this deliverable); Final work plan, including level of effort, final schedule, and deliverables

Task 1: Prepare Quality Assurance Project Plan (QAPP)

Our team will develop a draft QAPP that addresses all aspects of this project no later than October 12, 2018. The QAPP will be based on the QAPP provided by EPA for Phase 2 Mystic River Watershed Eutrophication Analysis, with updates and additions as appropriate. A final QAPP will be delivered within 1 week of receiving EPA comments on the draft. Any QAPP revisions that become necessary as the project progresses will also be developed and delivered to EPA for review and approval.

Task Lead: Mick DeGraeve and Khalid Alvi
Key Support Staff: James Houle
Schedule: The draft QAPP will be delivered to EPA no later than October 12, 2018 and a final QAPP will be delivered within 5 days of receiving EPA comments on the draft.
Deliverable: Draft and final QAPP's

Task 2: Project Management and Administration

The following highlights our approach to completing the subtasks identified in the PWS.

Subtask 2A. Kickoff Meeting

The GLEC team will initiate the planning for a short kickoff call the week of October 1 to make team introductions, briefly discuss the project, ask any initial questions, and start the planning for the kickoff meeting. We will work with EPA to determine the attendees and we will make every attempt to schedule the kickoff meeting no later than October 26, 2018. The kickoff meeting will provide a critical opportunity for coordination and information sharing with the EPA Project Team. Prior to the meeting, we will deliver the Task 0 work plan draft (this document) and the Task 1 draft QAPP for EPA's review. Our team will have compiled additional information and will come to the meeting prepared to actively participate in project-related details. Attendees from our team will include the Mick DeGraeve, Khalid Alvi, and James Houle. We will take notes for the duration of the meeting and will develop a meeting summary for distribution to the meeting attendees and any others as directed by EPA.

It is assumed that the kickoff meeting will be held in the EPA Region 1 offices in Boston MA and that meeting space will be provided by EPA.

Key Staff: Mick DeGraeve, Khalid Alvi, and James Houle
Schedule: A kickoff call will be scheduled by October 5; a kickoff meeting will be scheduled to occur (key attendee schedules permitting) by October 26, 2018.
Deliverable: Kickoff meeting summary will be provided within 1 week of the meeting.

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

We will schedule and participate in monthly progress calls to keep the EPA Project Team apprised on progress of all tasks as well as planned activities during the next month. We will coordinate with EPA on the best approach to scheduling and notifying attendees of call details in advance of the call. Working with EPA, we will develop an agenda for each call but will also leave time on each call to discuss topics of interest to the EPA Project Team. Each call will be attended, at a minimum, by the Khalid Alvi and James Houle. Call notes, with action items, will be distributed via email to project team members within 3 days of the call.

In addition to the monthly calls, our team will present the results of the project on a 1-hour webinar. Our team will prepare all materials in advance of the webinar, with sufficient time for EPA review. It is assumed that EPA will provide the license for the webinar and that we will be responsible for the outreach, scheduling, and development of materials.

Key Staff: Mick DeGraeve, Khalid Alvi, James Houle, and Ryan Murphy
Schedule: Monthly progress calls and call summary notes; post-project webinar (end of project, date to be determined in consultation with EPA)
Deliverable(s): Monthly calls; monthly call notes (distributed via email); draft and final webinar materials; delivery of webinar.

Task 3: Municipal Coordination Meeting

An important component of this project will be meeting with, engaging, and the sharing of information with municipal officials and representatives from the Town. Our goal will be to communicate the project details while encouraging dialog that ensures that local knowledge, understanding of the issues, preferences, and concerns are heard and incorporated into this project at an early stage.

We will work with EPA to schedule the meeting no later than November 29, 2018 (we will attempt to schedule prior to the Thanksgiving holiday). We will develop a draft agenda for EPA review and comment. We will prepare all presentation materials and will lead the meeting. The agenda will include all the topics listed in the PWS, as well as others identified during the kickoff meeting or subsequent conversations with EPA and Town representatives.

Our team will ensure that information from documents provided by EPA, as well as other documents obtained provided prior to the meeting, will be incorporated as appropriate into the meeting presentation materials.

Our team's presentation will be led by James Houle, with support from Khalid Alvi. Dr. Houle and Mr. Alvi will efficiently present the project plans and expertly address any questions of comments related to the technical aspects of this project. We assume the meeting will be held in the Town in space provided by the Town. We assume a projector will be available, but will plan on providing one as well. We will also take notes for the duration of the meeting and will prepare a meeting summary to be distributed via email after the meeting.

Task Lead: James Houle
Key Support Staff: Khalid Alvi and Ryan Murphy
Schedule: Prepare meeting materials at least 1 week prior to meeting and revise based on EPA comments; provide EPA with electronic copies of all materials by meeting date; schedule the meeting no later than November 29, 2018; prepare and distribute meeting notes within 1 week of meeting;
Deliverable(s): Draft and final meeting materials; draft and final meeting agenda; meeting summary

Task 4: Stormwater Management Assessment for the Town of Tisbury, MA

The following highlights our approach to completing the Task 4 subtasks identified in the PWS.

Subtask 4A. Watershed Characterizations through Geographic Information System (GIS) Spatial Data Analyses

This subtask will be led by Mr. Alvi, who has extensive experience processing GIS data to support modeling efforts, including specific analyses tailored to the requirements of the Opti-Tool. Mr. Alvi will be supported by Dr. Dale White and Mr. Ryan Murphy, who have developed numerous GIS and spatial data analysis tools in support of modeling studies throughout the US. Our technical approach for this subtask will follow these steps:

- Compile and review available GIS data and identify any data gaps
- Develop an approach for conducting the GIS analysis for developing spatial hydrologic response units (HRU), a combination of land use type, soil infiltration capacity, and land cover slope, to characterize the watershed conditions. The HRUs will represent the primary building blocks for developing the rainfall-runoff response timeseries and to identify the unique areas that generate high flow rates and/or pollutant loadings in the watershed.
- Develop an approach for conducting the GIS analysis for identifying potential broad-based SCM management categories and locally suitable infiltration and filtration practices that align with the project goals. The approach will be based on the site suitability criteria (land cover, land use, soil, slope, groundwater depth) used in the Opti-Tool Buzzard Bay watershed case study. Our team will refine the criteria if needed, including exploring the GI opportunities on municipal properties only and/or exclusion of hazardous waste location(s).
- Work closely with the EPA and municipality staff to review and finalize the draft approaches developed under this task.
- Perform the GIS analyses following the approved approaches and ensuring that the output of this spatial analysis will support the EPA Region 1 Opti-Tool for quantifying SW runoff volume, high flow rates and pollutant loads according to IC and pervious cover from various land uses within the municipality. We will work with the Task Order Contracting Officer Representatives (TOCORs) and project team to identify and include any additional spatial data that could be used to better inform the Opti-tool analysis such as sub-drainage areas to sensitive surface waters.

Subtask Lead: Khalid Alvi
Key Support Staff: Dale White and Ryan Murphy
Schedule: Prepare draft technical memorandum by November 1, 2018 and revise within 1 week of receiving EPA comments; perform GIS analysis within 3 weeks of finalizing the technical memorandum
Deliverable(s): Draft and final technical memorandum in electronic format; results of GIS analysis in an Excel compatible spreadsheet

Subtask 4B. Opti-Tool Analyses for Quantifying Stormwater Runoff Volume, High-Flow Rates and Pollutant Loadings from Watershed Source Areas

This subtask involves setting-up the Opti-Tool and developing/updating the rainfall-runoff response timeseries (flow and water quality) from the selected (up to 20-year) period for each HRU category identified in subtask 4A. Our technical approach for this subtask will follow these steps:

- Download the regionally applicable long-term hourly precipitation record for the selected period of assessment (up to 20 years) following the guidelines provided in the Opti-Tool installation package. Review the timeseries data and fill in the missing data for continuous hourly rainfall. If we find significant missing data, our team will bring it to the attention of EPA Project Team and will propose a methodology for filling the data gaps.

- Update the boundary condition rainfall data in HRU-SWMM models provided in the Opti-Tool package and extend the HRU timeseries of hourly runoff and pollutant loads to cover the selected period of assessment.
- Review and identify the additional HRUs needed (output from subtask 4A) to more fully evaluate high runoff flow rate contributions from steeper surface slopes within the municipal drainage areas. The existing HRU categories in Opti-Tool do not differentiate the slope and default to an average slope for long term planning purpose.
- Develop the HRU-SWMM models to accommodate new HRU categories (if the EPA Project Team decides to expand the number of HRUs). Our team will develop the hourly timeseries of flow and pollutant loads for the selected period of analysis. Opti-Tool HRU timeseries were previously calibrated to the stormwater event mean concentrations on the impervious land cover and verified to the long-term average annual loading rates for each major land use source used in small MS4 Massachusetts permit document. Our team will use the Opti-Tool calibrated HRU-SWMM models and extend the precipitation data to the selected period of analysis for this project.
- Apply the EPA Region 1 Opti-Tool for a planning level analysis of cumulative stormwater runoff volume, high runoff flow rates, and pollutant loads for total nitrogen (TN) according to impervious and pervious cover from various land uses within the municipality.
- ~~Coordinate with the EPA Project Team to develop impervious cover runoff high flow rate metric(s) to assist in evaluating contributions of high runoff rates that contribute to flooding and eventually for evaluating SCM reduction benefits.~~
- Summarize the Opti-Tool analysis results for runoff flow volume and TN average annual load at HRU source level and municipal drainage areas in a technical memorandum. The results will be presented in a format that facilitates the municipality's understanding of the relative contributions of runoff source areas within the Town that specifically contribute to flooding, excessive pollutant loading, and reduction of groundwater recharge. ~~The technical memo will also describe the proposed methodology for high runoff flow rate metric(s) to be used to evaluate both source contributions and reduction benefits associated with SCM categories.~~

Subtask Lead: Khalid Alvi
Key Support Staff: Ryan Murphy
Schedule: Prepare draft technical memorandum by December 15, 2018 and revise within 1 week of receiving EPA comments; summarize results of Opti-Tool analysis in a spreadsheet within 1 week of finalizing the technical memorandum
Deliverable(s): Draft and final technical memorandum in electronic format; results of Opti-Tool analysis in an Excel compatible spreadsheet

Subtask 4C. ~~Develop High Runoff Flow Rate Metric(s)~~ Opti-Tool Application for Two Pilot Drainage Areas (Outfall #2 and #7) to Evaluate Source Area Contributions and GI SCM Reduction Benefits

~~This subtask is the execution of the methodology developed under the subtask 4B. The main outcome of this subtask is to develop the long term cumulative performance curves for estimating the high runoff flow rate reduction from the major categories of SCMs available in Opti-Tool. Our technical approach for this subtask will follow the following steps:~~

- ~~Develop the high runoff flow rate metric(s) based on the methodology proposed under subtask 4B. The metric(s) will be developed in a way that provides a straightforward means for evaluating source area contributions and reduction benefits associated with SCM with varying design capacities.~~

- ~~Setup Opti-Tool model and run scenarios representing a wide range of storage capacities for major SCMs (infiltration and filtration practices) available in Opti-Tool.~~
- ~~Process the Opti-Tool results to generate cumulative performance curves showing the percent reduction of high runoff flow rate metric(s) against a variety of design storage capacities.~~
- ~~Describe the methodology used to develop the metric(s) and provide the results of the reduction estimates in a technical memorandum. The results will be presented in a readily useable format for practitioners to evaluate high flow rate reduction benefits of SCMs.~~

The scope of this subtask has been revised to develop a proof-of-concept comparison which quantifies the benefits of GI SCM within the drainage areas of two outfall locations (#2 and #7). The comparison will evaluate the impact of source area contribution (i.e., runoff and pollutant load) and GI SCM reduction benefits at those outfall locations using the Opti-Tool. The main outcome of this subtask is to provide a comparison of flow volume and TN load delivered at the two selected outfall locations before and after the implementation of GI SCM opportunities. Our technical approach for this subtask will follow the following steps:

- Delineate the contributing drainage areas to the two selected outfall locations using the parcel boundaries, LiDAR elevation data, and elevation contour maps. The sub-catchment boundaries will also be delineated to each catch basin located within the two selected outfall drainage boundaries.
- Calculate the HRU area distribution (developed under subtask 4A) within each sub-catchment and estimate the average annual flow volume and TN load contribution from source areas using the HRU timeseries generated by using the local rainfall data (developed under subtask 4B).
- Establish the baseline condition in Opti-Tool by representing the storm drainage system (i.e., catch basins, storm drain pipes, outfall) and linking the HRU timeseries for flow and TN as boundary condition.
- Develop GI SCM management scenarios in Opti-Tool using the GI SCM screening results from the GIS analysis (under subtask 4A) without any field verification. The actual project areas for the implementation of GI SCM opportunities will be further evaluated through field investigation under subtask 4E.
- Run scenarios and process the Opti-Tool results to quantify the difference between the baseline condition and GI SCM scenarios to estimate the average annual reductions to flow volume and TN load due to the implementation of selected GI SCM opportunities in the upstream drainage areas.
- Describe the methodology and provide the results of the reduction estimates in a technical memorandum. The results will be presented in a readily useable format for practitioners to evaluate reduction benefits of GI SCMs.

Subtask Lead: Khalid Alvi
Key Support Staff: Ryan Murphy
Schedule: Prepare draft technical memorandum by ~~February 1, 2019~~ February 22, 2019 and revise within 1 week of receiving EPA comments
Deliverable(s): Draft and final technical memorandum in electronic format

Subtask 4D. Develop Planning Level GI SCM Performance Curves for Estimating Cumulative Reductions in SW-Related Indicator Bacteria

This subtask involves developing HRU-SWMM models for predicting the indicator bacteria loads from the impervious land cover and estimating the cumulative load reductions from the available SCMs in Opti-Tool using the readily available performance information on the indicator bacteria (e.g., international BMP database). Our technical approach for this subtask will follow these steps:

- Perform literature review (journal publications, conference papers, international BMP database, etc.) to obtain readily available information on the build-up, wash-off, and BMP removal efficiency for indicator bacteria. Our team will work closely with the EPA Project Team to ensure available local information are incorporated in this analysis.
- Develop a methodology for predicting the indicator bacteria load from the impervious land cover using the build-up and wash-off parameters identified through the literature review. We will use the existing HRU-SWMM models available in Opti-Tool package as a template to build the indicator bacteria model and will use the regionally representative rainfall hourly data for the selected period, same as in subtask 4B.
- Develop a methodology to provide planning level estimates of long-term cumulative reductions in stormwater related indicator bacteria by SCMs with varying design capacities. The methodology will be consistent with the previous work done by Mr. Alvi in developing the performance curves for other pollutants that are available in the Opti-Tool.
- Develop a technical memorandum detailing the above-mentioned methodologies for developing HRU timeseries and BMP performance curves for the indicator bacteria.
- Setup and run HRU-SWMM model for the impervious land cover using the methodology described in the approved technical memorandum. The output from the SWMM model will be processed to convert the HRU timeseries format to be compatible with the format needed for Opti-Tool model using the SWMM2Opti-Tool utility available in Opti-Tool package.
- Setup Opti-Tool/SUSTAIN model for indicator bacteria and run scenarios representing a wide range of storage capacity for the SCMs (infiltration and filtration practices) available in Opti-Tool.
- Process the Opti-Tool/SUSTAIN results to develop the planning level SCM performance curves for estimating long-term cumulative load reductions in stormwater related indicator bacteria. Our team will work closely with the EPA Project Team to ensure all the input assumptions and the outcome of this subtask is appropriately documented and published with the performance curves. It is anticipated that the performance curves will reflect the reduction of indicator bacteria mass and not necessarily reduction to the effluent concentration.

Subtask Lead: Khalid Alvi and Dustin Bambic
Key Support Staff: Ryan Murphy, James Houle, Mick DeGraeve
Schedule: Prepare draft technical memorandum by December 15, 2018 and revise within 1 week of receiving EPA comments; develop SCM performance curves of cumulative reductions estimates for indicator bacteria by February 15, 2019.
Deliverable(s): Draft and final technical memorandum in electronic format; the SCM performance curves of cumulative reductions estimates for indicator bacteria in an Excel compatible spreadsheet.

Subtask 4E. Identify Green Infrastructure Stormwater Control Opportunities and Potential Management Strategies for Tisbury

This critical subtask serves as the foundation for identification of potential management strategies for the Town. The main objective of this subtask is to identify the feasible and practical solutions for disconnecting the stormwater related impervious cover that causes the potential flooding and water quality problems. The success of this subtask will hinge on the commitment to a collaborative effort between the technical experts, the regulators, and the municipal personnel. Through this subtask, our team will identify SCM categories and potential strategies that the municipality considers to be acceptable for further evaluation. We will also work with the Town to understand local operation and maintenance capacity to ensure that SCM retrofits are compatible with the local maintenance culture. Our technical approach for this subtask will follow these steps:

- Coordinate with the TOCOR to schedule a meeting with Town municipal officials. It is anticipated that TOCOR will work with the Town personnel to secure the meeting place.
- Prepare the meeting material using the potential SCMs identified in the GIS analysis (subtask 4A) and hot spot areas identified through runoff source area characterization (subtask 4B). In discussions with municipal officials, identify broad processed-based SCM categories (e.g., infiltration, filtration, impervious cover removal, etc.) that work best for the local conditions. The outcome from subtasks 4A and 4B will highlight the available opportunities of SCMs and hot spot areas in the Town where those SCMs will be suitable for addressing the Town's water resource needs/objectives. For the meeting, our team will prepare a series of brief information sheets on potential SCM categories and strategies for consideration that cite real-world examples.
- Participate and present the meeting material with Town municipal officials. Our team will be prepared to address the technical and economic feasibility of potential SCM retrofit categories and strategies being discussed, as well as provide ranges of estimates of associated cumulative runoff reduction benefits that could potentially be achieved. We will estimate the cumulative reduction benefits for runoff volume and pollutant loads using EPA Region 1's performance curves (*https://www.unh.edu/unhsc/sites/default/files/media/ms4_permit_nomographs_sheet_final.pdf*). Our subtask leads have first-hand-knowledge and experience in developing and using these SCMs performance curves and nomographs.
- Introduce numerous examples of relatively "low-tech" SCM retrofits that would partially, or in disconnect impervious cover runoff. The concept of outright removal of impervious cover will be explored with the Town. Emphasis will be on straightforward transferrable SCM concepts that achieve the overall planning goals noted above, minimize maintenance requirements, and can be most cost-effectively implemented by local municipal departments with minimal outside support. Dr. Houle has relevant regional experience supporting similar projects, including working with the City of Dover, NH (Berry Brook) under a collaborative effort, to develop innovative and customized designs that met the local needs. Our team will present innovative SCMs examples at the meeting to demonstrate the feasibility, performance, low cost, and maintenance of such controls.
- Develop meeting notes and a list of the SCM opportunities and strategies identified at the meeting for further evaluation.

Subtask Lead: Khalid Alvi and James Houle
Key Support Staff: Ryan Murphy
Schedule: Prepare meeting materials at least 1 week prior to meeting and revise based on EPA comments; provide EPA with electronic copies of all materials by meeting date; prepare and distribute meeting notes within 1 week of meeting
Deliverable(s): Draft and final meeting materials (e.g., presentation and brief information sheets) in electronic format; a list of the SCM opportunities and strategies identified at the meeting for further evaluation in electronic format

Subtask 4F. Conduct Field Investigations to Further Evaluate Community GI SCM Opportunities and Strategies

Our team will work side-by-side with the community to identify stormwater related problem areas within the community, as well as identifying other specific stormwater management opportunities that exist within the community. Also, using information from the GIS/Opti-Tool analysis and with significant input from the community, our team will try to identify and prioritize typical types of stormwater management opportunities that may arise over the long-term (e.g., roof top disconnection/rain barrel and rain garden programs; redevelopment, roadway projects, urban renewal, etc.).

Under this subtask, our team will conduct up to 10 days of field investigations to further explore GI SCM retrofit project opportunities and prioritize opportunities for further evaluation. These investigations would be for specific project opportunities but could also identify typical generic types of GI SCMs and potential programmatic projects (e.g., rooftop disconnection) that could be carried out in the long-term by the municipality, in part by raising awareness within the community through participation from municipal staff. Ideally, this work would be carried out collaboratively with engaged municipal staff that have the responsibility and authority to implement, operate and maintain stormwater management infrastructure to ensure that GI SCM retrofits are compatible with end user maintenance culture. Dr. Houle will lead this subtask with support from Mr. Alvi.

Subtask Lead: James Houle
Key Support Staff: Khalid Alvi and Ryan Murphy
Schedule: Prepare a draft informational brochure within 2 weeks of the first scheduled date for conducting field investigation; finalize the informational brochure before conducting field investigations; conduct and complete field investigations by June 1, 2019; prepare a draft technical memorandum by June 15, 2019; finalize the technical memorandum within 1 week of receiving comments from the TOCOR.
Deliverable(s): Draft and final informational brochure in electronic format; draft and final technical memorandum in electronic format.

Subtask 4G. Develop GI SCM Conceptual Designs

Our team will work closely with the Town to develop up to 6 conceptual designs that will highlight the range of opportunities where GI SCM retrofit projects could be implemented. This work will target simple, low cost SCMs that staff are comfortable with and which could be feasibly applied singularly or more widely as dispersed GI SCMs to address the three-identified high priority problem flooding areas and other SW management objectives throughout the community. It is expected that the conceptual designs will include low tech and adaptable GI SCMs to partially or wholly (e.g., IC removal) disconnect IC runoff that will be feasible, readily implementable (pending final design) and acceptable to the community. The feasibility of implementing the GI SCMs identified in the conceptual designs will be determined based on the field investigations and other readily available information (e.g., maps of topography and utilities, etc.). To the extent practicable, efforts will be made to develop conceptual designs that include the most promising GI SCM types (applied in varying and typical settings) determined to be acceptable to the municipality and that also serve as examples/templates for future municipal work. Dr. Houle will lead this task with support from Mr. Alvi.

Subtask Lead: James Houle
Key Support Staff: Khalid Alvi and Ryan Murphy
Schedule: Prepare up to 6 draft conceptual designs for SCMs (combination of project specific and generic SCMs) by July 15, 2019 and finalize the conceptual designs within 1 week of receiving comments from the TOCOR.
Deliverable(s): Up to 6 conceptual designs for SCMs (combination of project specific and generic SCMs) in electronic format.

Subtask 4H. Quantify Benefits for Municipal Long-Term GI SCMs Implementation Strategies

This subtask takes the outcome from all the previous subtasks and prioritizes/optimizes the selected potential SCMs at the watershed scale (Town of Tisbury). The previous tasks focus on the individual SCMs that are suitable to the local conditions and are easy to maintain by the local municipal staff. Under this subtask, our team will work closely with the TOCORs, EPA Project Team and the Town to develop 'big-picture' long-term SCM management strategies to accomplish impervious cover disconnection and to achieve water resource objectives (flooding, water quality, urban community farming and affordable foods, urban aesthetics and safety, green jobs, smart growth land use planning, greening community, etc.).

At a watershed scale, the problem becomes more complex in finding how many SCMs, what sizes, and where to place them to get the maximum management benefits (flow and/or water quality) at the minimum cost. The number of possible combinations of such SCMs at watershed scale could be in billions or trillions and best professional judgement may never pick the optimal combination. Tools like Opti-Tool in the hands of experienced modelers with experience formulating the problem are powerful tools for running large possible iterations to find an optimal solution. Our technical approach for this subtask will follow these steps:

- Setup Opti-Tool using the conceptual designs developed under subtask 4G for the selected types of SCMs through field investigations under subtask 4F.
- Represent the SCMs at the major source category level (e.g., urbanized residential, commercial, municipal streets, buildings, etc.) in Opti-Tool.
- Run Opti-Tool to generate cost-effectiveness curves for high flow rate reduction, flow volume reduction, and pollutant load reduction for a mix of optimized sizes of SCMs at the major source category level in the Town. Opti-Tool results can be used to quantify the cumulative reduction benefits that could be achieved at various levels of implementation of potential SCM retrofit strategies over the long term.
- Work closely with the Project Team and municipal officials to identify a solution from the cost-effectiveness curves (e.g., knee of the curve) that provides the municipality's long-term water resource objectives.
- Document the recommended long-term SCM retrofit strategies and the expected stormwater runoff-related reduction benefits associated with these strategies in a technical memorandum.

Subtask Lead: Khalid Alvi
Key Support Staff: Ryan Murphy and James Houle
Schedule: Prepare a draft technical memorandum by August 15, 2019 and finalize the technical memorandum within 1 week of receiving comments from the TOCOR.
Deliverable(s): A draft and final technical memorandum in electronic format.

Subtask 4I. Develop Streamlined Technical Support Document to Quantify Benefits of GI SCMs for IC Disconnection

Working with municipal staff, our team will develop technical support documents that will assist the community in applying a best hierarchical conceptual approach for IC disconnection and quantifying the pollutant and runoff volumetric reductions for each land use 'type' (e.g., urbanized residential, municipal (streets, buildings, lots). In addition to identifying the best of the conceptual designs opportunities the technical support documents will use the Region's cumulative performance curves, the new method for quantifying peak flow reductions to be developed as part of this project, and the Region's cost estimates to assist with long term planning approaches. Dr. Houle will lead this task with support from Mr. Alvi.

Subtask Lead: James Houle
Key Support Staff: Khalid Alvi and Ryan Murphy
Schedule: Prepare a draft technical support document by August 15, 2019 and finalize the document within 1 week of receiving comments from the TOCOR.
Deliverable(s): A draft and final technical support document in electronic format.

Subtask 4J. Final Project Meeting and Final Project Report

The outcome of this subtask will be a final report that documents the results from all the subtasks and to present/discuss the final findings in a meeting with the municipal officials at the Town. Our technical approach for this subtask will follow these steps:

- Coordinate with TOCOR to schedule a meeting with municipal officials at the Town of Tisbury. It is anticipated that TOCOR will work with the Town personnel to secure the meeting place.
- Prepare the meeting material to recap the project goals and outcome from this project.
- Participate and present the results of the analyses conducted under previous subtasks and to discuss project findings. Our team will also present the draft technical support document for quantifying SCM benefits developed under subtask 4I.
- Compile all technical memorandums developed under each subtask in a draft final report that describes the process undertaken to achieve project objectives, project work, findings and recommendations. The draft final report will also include the discussions and input received during the final project meeting.

Subtask Lead: Khalid Alvi and James Houle
Key Support Staff: Ryan Murphy
Schedule: Prepare meeting materials at least 1 week prior to meeting and revise based on EPA comments; provide EPA with electronic copies of all materials by meeting date; prepare draft final report including the feedback received from the meeting by September 15, 2019; finalize the report by September 27, 2019.
Deliverable(s): Draft and final meeting materials in electronic format; draft and final report in electronic format.

Task 5: Develop Streamlined Technical Support Document for Developing Long-Term Community SCM IC Disconnection Strategies

Our team will work with the municipality to identify their specific technical support needs and develop a scope of a Technical Support Document that meets their needs. This may be in the form of a simple report summarizing the work conducted to present what may be the best and most cost-effective opportunities for SCM implementation.

Our team will develop a brief (2-4 pages) streamlined technical support document (TSD) under this subtask. The first part of the TSD will provide an overview of the project elements and the overall collaborative process undertaken between the municipality and the project team; lessons learned; and recommendations for improving the process. The second part of the TSD will provide the municipality with needed technical information to best select and quantify the benefits of a range of SCMs identified as feasible throughout the project. Similar TSDs are currently being developed for principle innovations of the Berry Brook Project. Numerous communities throughout the region have requested these TSDs to advance implementation efforts in other surrounding communities. These templates will be further developed and tailored as deliverables for this project.

Task Lead: James Houle
Key Support Staff: Khalid Alvi and Ryan Murphy
Schedule: Prepare a draft technical support document by September 15, 2019 and finalize the document by September 27, 2019.
Deliverable(s): A draft and final technical support document in electronic format.

Schedule

Table 1 presents the proposed schedule key activities and deliverables for this project. We will revise this schedule as appropriate after receiving comments from EPA on this draft work plan, as well as any information obtained during the kickoff meeting.

Table 1. Proposed Task and Deliverable Schedule

Project Elements/Sub-Tasks	Delivery Dates											
	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
Task 0: Work Plan, Budget, and Schedule												
Draft work plan, budget, and schedule	12-Oct											
Final work plan, budget, and schedule	•											
Task 1: Prepare Quality Assurance Project Plan												
Prepare draft QAPP	12-Oct											
Final QAPP	•											
Task 2: Project Management and Administration												
Kickoff call	4-Oct											
Kickoff meeting and summary	24-Oct											
Monthly progress calls and summaries												
Develop and present post-project webinar												15-Sep*
Task 3: Municipal Coordination Meeting												
Prepare meeting material, including the agenda		21-Nov*										
Participate in municipal coordination meeting, including preparation of materials		29-Nov*										
Prepare meeting notes			6-Dec*									
Task 4												
4A: Watershed Characterizations through GIS												
Draft technical approach memo		1-Nov										
Final technical approach memo		•										
GIS analysis results		28-Nov*										
4B: Opti-Tool Analysis for SW Volume, High Flow Rates, and Pollutant Loading												
Draft technical memo			15-Dec									
Final technical memo and Opti-Tool analysis results in Excel			•									
4C: High Runoff Flow Rate Metrics												
Draft technical memo					1-Feb							
Final technical memo					•							
4D: Develop Planning Level SCM Performance Curves												
Draft technical memo			15-Dec									
Final technical memo			•									
SCM performance curves in electronic format					15-Feb							
4E: Identify GI SW Control Opportunities and Management Strategies												
Develop meeing materials						1-Mar						
Attend and participate in meeting						7-Mar*						
List of SCM opportunities and strategies identified in meeting						15-Mar*						
4F: Conduct Field Investigations												
Draft informational brochure							15-Apr*					
Final informational brochure							29-Apr*					
Conduct and complete field investigations									1-Jun			
Draft technical memo									15-Jun			
Final technical memo									•			
4G: Develop SCM Conceptual Designs												
Draft conceptual designs in electronic format										15-Jul		
Final conceptual designs in electronic format										•		
4H: Quantify Benefits for Long-Term SCM Implementation Strategies												
Draft technical memo											15-Aug	
Final technical memo											•	
4I: Develop Streamlined Technical Support Document (TSD)												
Draft TSD											15-Aug	
Final TSD											•	
4J: Final Project Meeing and Final Report												
Participate in final project meeting											30-Aug*	
Submit draft final project report												15-Sep
Submit final project report												27-Sep
Task 5: Develop Streamlined TSD for Developing Long-Term SCM IC Disconnection Strategies												
Draft TSD												15-Sep
Final TSD												27-Sep

•=within 1 week of receiving comments from EPA
*=tentative, to be finalized in consultation with EPA
As needed, 1 call each month

3 STAFFING

The GLEC team is pleased to provide EPA Region 1 and the Town of Tisbury with an impressive group of scientists and engineers to support this challenging project. The following table provides the details for key consultant team staff and their contact information. Bios for these and other key personnel follow the table.

Key Personnel/Role	Contact Information
Mick DeGraeve, Program Manager	Great Lakes Environmental Center; 739 Hastings Street, Traverse City, MI 49686; 231-941-2230; mick@glec.com
Khalid Alvi, Project Manager/Modeling Lead	Paradigm Environmental, Inc.; 3911 Old Lee Highway, Suite 41E, Fairfax, VA 22030; 703-957-1908; alvi@paradigmh2o.com
James Houle, SCM Lead	UNH Stormwater Center; 35 Colovos Road, University of New Hampshire, Durham, NH 03824; 603-862-1445; james.houle@unh.edu
Ryan Murphy, GIS/Modeling Support (alternate POC for Alvi)	Paradigm Environmental, Inc.; 3911 Old Lee Highway, Suite 41E, Fairfax, VA 22030; 703-957-1908; ryan.murphy@paradigmh2o.com

Mick DeGraeve (Ph.D.), P4 - Program Manager
Ph.D., Aquatic Biology, 1979, University of Wyoming, Laramie, Wyoming
Master of Science, Biology, 1970, Eastern Michigan University, Ypsilanti, Michigan
Bachelor of Science, Biology, 1968, Eastern Michigan University, Ypsilanti, Michigan

Dr. DeGraeve will manage the GLEC Team at the contract level and assure that OEP's needs and expectations are met for this procurement. He is the founder of GLEC, and for the past 45 years has interacted regularly with professionals in a wide range of disciplines, and with representatives of industry, government and academia. Mick's technical aquatic biology/ toxicology professional experience has included managing EPA Office of Water level of effort contracts for GLEC for 20+ years. Over that period, he has had responsibility for the technical and financial oversight of 11 EPA Office of Water contracts; five for the Health and Ecological Criteria Division (HECD), three for the Standards and Health Protection Division (SHPD), one for the Permits Division of the Office of Wastewater Management (OWM), and two for the Office of Ground Water and Drinking Water's (OGWDW) Technical Support Center.

Khalid Alvi (PE), P4 - Senior Project Engineer
Master of Science, Civil and Environmental Engineering, 1999, Asian Institute of Technology, Thailand
Bachelor of Science, Civil Engineering, 1993, University of Engineering and Technology Lahore, Pakistan
Professional Engineer, Virginia No. 0402046509 (since 2010)

Mr. Alvi will be the Project Manager and modeling technical lead for the modeling effort under this task. He has extensive experience in developing the practical solutions for a variety of management objectives (e.g., flow volume reduction or pollutant load reduction target) by identifying the best mix of cost-effective stormwater controls using the state-of-art optimization algorithms at watershed scale. At his previous employer, he was the project manager and technical lead for the development of Opti-Tool, a spreadsheet-based stormwater best management practices optimization tool. The Opti-Tool is designed for use by municipal SW managers and their consultants to assist in developing technically sound and optimized cost-effective SW management plans. The Opti-Tool uses EPA SUSTAIN optimization module as a back-end computational engine to identify the best mix of cost-effective stormwater controls. Mr. has also led the development of SUSTAIN, a System for Urban Stormwater Treatment and Analysis Integration—a decision support system for the EPA's Office of Research and Development to develop, evaluate, optimize, select, and place BMPs based on cost and effectiveness. Mr. Alvi, as a primary developer of EPA Opti-Tool, has unmatched understanding of the underlying BMP modeling algorithms used in the tool. He fully understands the BMP types and design configurations available in the tool. He has demonstrated the application of the Opti-Tool through two case studies, Buzzard Bay watershed located in the Town of Fairhaven, MA and Mystic River watershed (work in progress) located in the city of Medford, MA.

James Houle (Ph.D.), P4 - Senior Project Engineer
Ph.D., Natural Resources and Environmental Studies, 2015, University of New Hampshire, Durham NH
Master of Arts in Sustainable Development, 2003, School for International Training, Brattleboro, VT
Bachelor of Science, 1995, Molecular and Developmental Biology, University of New Hampshire, Durham NH

Dr. Houle will serve as the SCM lead on the project and he will ensure a high level of collaboration and coordination with the Town on the identification and conceptual design of control measures. Dr. Houle is the Program Director for the Stormwater Center. His responsibilities include directing and managing the Stormwater Center's growing body of research projects. Areas of expertise include diffusion of innovative stormwater management solutions, the design and implementation of innovative stormwater control measures including green infrastructure (GI), and low impact development (LID) strategies, planning and implementation, operation and maintenance, and water resource monitoring. Dr. Houle holds a Ph.D. in Natural Resources and Environmental Science and has over twenty years of experience with water quality related issues in New England and is a certified professional in storm water quality (CPSWQ) and a certified professional in erosion and sediment control (CPESC).

Dustin Bambic (PH), P4 - Principal
Master of Science, Civil and Environmental Engineering and Hydrologic Science, 2003, University of California-Davis
Bachelor of Science, Physics and Mathematics, 2000, Western Kentucky University

Dustin has extensive experience in watershed hydrology, pollutant fate and transport, and identification of pollutant sources. His understanding of both the science and policy of Clean Water Act issues has enabled him to lead some of the most challenging water quality projects in the U.S. He has been leading water quality projects in the world's most engineered watershed – the Los Angeles River – for over a decade. He also has nationally-recognized expertise related to the bacteria contamination that causes beach closures and freshwater impairments across the U.S., and has led numerous cutting-edge studies (including microbial source tracking and quantitative microbial risk assessment) to support plans to reduce bacteria levels in stormwater and/or develop alternative water quality objectives.

Ryan Murphy, P4 - Senior Environmental Scientist
Master of Engineering, Environmental & Water Resources Engineering, 2008-2010, Tufts University, Medford, MA
Bachelor of Science, Environmental Policy & Planning, 2005, Virginia Tech, Blacksburg, VA

Mr. Murphy combines an interdisciplinary background in water resources engineering, ecological planning, public policy, and computer science. He has extensive hands-on experience applying advanced computer systems to solve complex water resource and environmental challenges. Mr. Murphy's primary experience is with surface-water, watershed, water quality, and stormwater modeling system including the Hydrologic Simulation Program Fortran (HSPF), Loading Simulation Program - C++ (LSPC), Storm Water Management Model (SWMM), and System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN). He honed this expertise through a combination of project-specific application, active software development, and facilitation of hands-on training workshops as part of several landmark water quality modeling studies and stormwater management plans. Through the application of these modeling systems, Mr. Murphy has become adept at leveraging both the Python and R scripting languages for extraction, transformation, and analysis of large datasets often distributed across multiple platforms (e.g., desktop/server, Windows/Unix). Mr. Murphy has experience recoding some existing USGS software tools and methods (e.g., HySEP) into contemporary scripting languages like Python for customized application. He has actively contributed to significant, publicly funded software projects in which some of his runtime and post-processing utilities are incorporated into releases (e.g., SUSTAIN), and he continues to participate in public open-source initiatives (e.g., QGIS web client). Mr. Murphy champions leveraging open-source frameworks, including the QGIS and Python, for both scientifically focused and publicly funded initiatives, as well as the standard for day-to-day workflow application within Paradigm.

Dale White (Ph.D.), P4 – Aquatic Toxicologist III
Master of Science, Environmental Engineering, 2009, Ohio State University
Ph.D., Physical Geography, 1988 Penn State University
Master of Science, M.S., Physical Geography, 1986, Penn State University
Bachelor of Science, B.S., Environmental Studies, 1983, Slippery Rock University of Pennsylvania

As an environmental engineer and physical geographer with over thirty years of experience, Dale White has focused his career on using stressor-response frameworks and mechanistic and statistical environmental process models, inherently spatially varying, to solve environmental resource problems. He has contributed to developing and communicating advances in understanding water quality issues and watershed management solutions working for both regulatory agencies and academic institutions. He is expert in applying advanced GIS, modeling, and statistical methods in water quality research. Dale is both a licensed professional engineer (Ohio) and a Certified GIS Professional (GISP).

John Riverson, P4 - Principal
Master of Science, Civil and Environmental Engineering, 1999, University of Virginia
Bachelor of Science, Civil and Environmental Engineering, 1997, University of Virginia

John has 18 years of experience developing and applying hydrologic models and conducting supporting data analyses services, with a focus on public-domain models typically used to support water resources management and regulations and subject to peer review (e.g., HSPF, LSPC, SWMM, SWAT, TR-55, CE-QUAL-W2, QUAL2E/2K, SUSTAIN). He has an in-depth understanding of meteorological and hydrological processes and interactions, climate change assessment, watershed and stormwater management, water quality, and pollutant source characterization. John led the development of USEPA's LSPC for 12 years and was responsible for designing system architecture and developing algorithms for most of the core LSPC modules including: (1) high-resolution meteorological data (2) crop-associated irrigation, (3) hydraulic withdrawals and diversions, and (4) the time-variable land use module. John's experience also includes computer programming of customized supporting applications to store, manage, process, and analyze complex data sets. He's proficient at engineering highly-effective graphical and tabular displays for journal/report- and web-based publication media, and has published his work in high-impact peer-reviewed journals (e.g. Water Resources Research, Water Research, Climatic Change). John is regularly sought by different agencies in California to provide third-party review and QA/QC of modeling applications. He is highly regarded for his ability to present highly technical content to a wide-variety of audiences though in-person presentation, webinars, and on-site training workshops.

Jennifer Hansen, P3 – Quality Assurance Officer
M.S., Biology/Conservation Biology, 2002, Central Michigan University, Mt. Pleasant, MI
B.S., Biotechnology, 1990, Ferris State University, Big Rapids, MI

Jennifer is the proposed Quality Assurance Officer and has a diverse background in the biological and biochemical sciences. She has extensive professional experience as a Quality Assurance Specialist, including development and implementation of Quality Assurance Systems, data review and approval, laboratory auditing and approval, and noncompliance investigations. She has extensive professional experience in laboratory and field operations including water quality sampling, testing and reporting.