**Objective:** The Contractor will update the section on [Stormwater re-use and rainwater harvesting](http://stormwater.pca.state.mn.us/index.php/Stormwater_re-use_and_rainwater_harvesting) in the Minnesota Stormwater Manual (Manual). This work includes providing updates to existing information, providing new information for incorporation into the Manual, and providing updated and new visual information (e.g. photos, schematic drawings, graphs, plans and cross-sections, etc.).

In providing this information the Contractor will review other manuals and documents, including but not limited to [North Carolina](http://portal.ncdenr.org/c/document_library/get_file?uuid=6dd12217-25f5-4703-b7d1-dc81fb51ab3b&groupId=38334), [Virginia](http://www.vdh.state.va.us/EnvironmentalHealth/ONSITE/gmp/documents/2011/pdf/GMP_154.pdf), [Virginia](http://www.vwrrc.vt.edu/swc/april_22_2010_update/DCR_BMP_Spec_No_6_RAINWATER_HARVESTING_Final_Draft_v1-8_04132010.htm), [Bellingham Washington](https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Bellingham_Rainwater%20harvesting%20manual.pdf), [Texas](https://www.twdb.texas.gov/innovativewater/rainwater/docs.asp), [Arizona](http://ag.arizona.edu/pubs/water/az1052/harvest.html), [Hawaii](http://www.ctahr.hawaii.edu/oc/freepubs/pdf/rm-12.pdf), [Georgia](http://www.dca.ga.gov/development/ConstructionCodes/programs/documents/GARainWaterGdlns.040209.pdf), the [Mississippi Watershed Management Organization](http://www.eorinc.com/documents/EOR-StormwaterHarvesting.pdf), California (various documents), [Florida](http://www.dep.state.fl.us/legal/rules/surfacewater/62-346/AH-ENGINEERING.pdf), and the [Metropolitan Council](http://www.metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Guidance-Planning-Tools.aspx). The Contractor will also review recent literature, including peer-reviewed literature, and consult with active researchers as appropriate for the topics discussed below.

**Task A.** Work with the PM to organize a technical team that will meet to discuss the tasks described in this scope of work, review and comment on MPCA-approved draft reports, and meet at a later date, agreed upon by the Contractor and PM, to discuss progress of the work described in this scope of work. The Contractor will work with the PM to arrange an initial meeting in which the review team will discuss the scope of work with the Contractor, PM and other MPCA staff. The Contractor will work with the PM to arrange a second meeting at an agreed upon time to discuss the progress of the work. This meeting will likely occur after drafts have been prepared and reviewed by the team for the majority of the tasks described in this scope of work.

**Task B.** Submit a report that provides an overview of stormwater harvest and use. The report will include but not be limited to the following information.

* Definitions and terminology. It is the intent to establish consistent and accurate terminology in the Manual. The Contractor will identify existing terms in the literature and create a table or list of terms defining and clarifying the various terms. The Contractor will provide a recommended term or set of terms for stormwater harvest and use. Upon approval by the PM, this terminology will be applied consistently to all tasks described in this Scope of Work.
* A list and description of types of harvest and reuse systems, including but not limited to above- and below-ground cisterns, wet detention ponds, rain barrels, and stormwater channels. Categorize these uses as indoor, outdoor, or indoor/outdoor and differentiate, if applicable, regulatory oversight for these.
* Uses of harvested stormwater runoff, including but not limited to urban irrigation, residential toilet flushing, vehicle washing, municipal fire-fighting, street cleaning, dust control, and industrial cooling towers. Describe advantages and/or limitations of each of these uses and divide the uses into those with restricted or unrestricted public access (e.g. a park is unrestricted).
* For the different types and uses identified above, discuss the applicability of the practice to different settings, considering factors such as soil, geology, slope, and land use. Include a discussion of potential application in different development and redevelopment conditions, including ultra-urban settings.
* Benefits of stormwater harvest and use, including but not limited to reductions in stormwater runoff volume and pollutant loading to surface receiving waters; beneficial uses of harvested stormwater, such as irrigation or indoor use; benefits for vegetation; cost considerations; reducing requirements for other stormwater management practices; attenuation of peak flows; and water conservation. As appropriate, associate benefits with the different types and potential uses identified above.
* Limitations, including but not limited to cost considerations, existing legal considerations, water quality concerns depending on intended use, storage or supply limitations, and cold climate concerns. As appropriate, associate benefits with the different types and potential uses identified above.
* Provide pictures, schematics, or other images as appropriate.

**Task C.** Submit a report that provides guidance on design elements for stormwater harvest and use systems. The report shall include the following information.

* Assessing site feasibility, including consideration of buffers, setbacks, proximity to structural and water features, soils, pollution sources, site slopes, site access and effects of regulations on assessing each of these.
* Factors to consider and methods for sizing a system, including the intended use for the system and sizing equations as necessary for the user to make the sizing calculations. Include two or more example calculations. If the sizing methodology requires use of a calculator or other tool, include links to that tool and references for the tool (e.g. [North Carolina State](https://www.bae.ncsu.edu/topic/waterharvesting/model.html), [Virginia](http://www.vwrrc.vt.edu/swc/NonProprietaryBMPs.html), Minimal Impact Design Standards (MIDS) calculator).
* A summary of current legal and regulatory considerations in designing, constructing and implementing a harvest and use system. Include a discussion of applicable Federal, State and local codes and regulations, including plumbing codes. Discuss the role of different agencies with respect to legal and regulatory considerations. Include a discussion of water quality considerations as they relate to human health and a summary of applicable water quality standards. Include a summary of water quality standards used in other states, such as California. Develop a flowchart or other guidance to assist designers of harvest and use systems and ensure they are considering and meeting all applicable requirements. Work with the PM to determine if a gap analysis is needed.
* Develop a list of recommended or required entities to involve in designing a harvest and use system, as well as a description of their role and level of involvement.
* Provide a discussion of the components comprising a harvest and use system, including applicability, cost, advantages, and disadvantages of each component. The components to be discussed include but are not limited to the following.
  + Catchment surface, including metals, clay/concrete, asphalt, wood shingle/tar/gravel, and slate
  + Gutters and downspouts, including the type of material, sizing methods and calculations, and installation methods
  + Removal of debris from the runoff, including leaf screens, first-flush diverters, roof washers, and pre-tank filters. Include a list of types, if appropriate, and specifications for each of these.
  + Storage tanks, including size, type (material), specifications (opaque, non-toxic, screened for mosquitoes, cleaning access for certain uses), siting (close to supply and distribution), above- or below-ground tanks, and tank inlets
  + Delivery systems, including gravity-fed and pumped
  + Treatment/purification needs and methods, including the need for these depending on the intended use
* Overflow and backup systems
* Signage
* Provide a discussion of regulatory requirements or recommendations pertaining to licensure and expertise for designers.
* Provide recommendations to the PM for design documentation needed to receive regulatory credits for volume and pollutant reductions (see Task L).
* Provide a discussion of how safety measures, manufacturer requirements, pretreatment, and testing protocols should be addressed in system design.
* Develop design sequences based on information collected for this task.
* Provide pictures, schematics, or other images as appropriate. Include tables comparing the characteristics of different options for each component, as appropriate.

**Task D.** Develop a construction sequence that includes a discussion of, but not limited to, the following.

* Factors to consider in excavation and installation of footings and pads, including equations for calculating depth of footings and size and thickness of pads. Include a discussion of legal requirements if applicable and of material specifications.
* Cistern placement and factors affecting placement, including a discussion of confined space entry.
* Installation of the system components in sequential order in which they are constructed.
* Filling the storage device (e.g. cistern).
* Installation of downstream BMP or receiving area, if applicable.
* Construction inspection upon completion of the above steps.
* Provide pictures, schematics, or other images as appropriate. Include tables comparing the characteristics of different options for each component, as appropriate.

**Task E.** Prepare a report that provides guidelines and recommended procedures for operation, maintenance, and monitoring of stormwater harvest and use systems, including but not limited to the following.

* A summary of routine maintenance practices such as monitoring, cleaning and repair, filter changes, system draining, disinfecting, and leak repair
* A list of components and operations requiring inspection
* Inspection procedures for system components and system operations identified in Task D.
* Frequency of inspection for system components and system operations identified in Task D.
* Reporting of inspection results, including the format for reporting. Develop an inspection form or identify and modify as needed an existing inspection form from the literature.
* Develop an operation and maintenance log that summarizes stormwater volume harvested, stormwater volume irrigated or otherwise used, observations of the stormwater harvesting system operation, a list of parts that were replaced, dates on which the stormwater harvesting and irrigation (or other use systems) were inspected and maintenance activities conducted
* A summary of practices to be implemented when shutting down a system for winter or restarting the system in spring.
* Provide pictures, schematics, or other images as appropriate.

**Task F.** Submit a report providing a detailed summary of water quality considerations for harvest and use systems. Include a discussion of the water quality of source water (e.g. rooftop runoff, stormwater pond effluent, etc.) and a comparison with water quality requirements for the intended use (see Task B). Discuss potential implications of the quality of runoff water on the harvest and use system and the need for pretreatment and options for pretreatment. Water quality constituents to be considered include but are not limited to bacteria, nitrogen (nitrate, ammonia, total nitrogen), phosphorus, TSS, metals, hydrocarbons, and chlorides. Include a discussion of seasonality (e.g. chlorides) or other sources of variability as appropriate. To the extent practical, present information for individual metals and hydrocarbon groups. Identify existing guidelines in other documents and summarize these in tabular form. Include a discussion of methods for reducing or minimizing exposure, such as use of signage and fencing. Include references for all information. Note the Minnesota Stormwater Manual contains this type of information and should be used as a starting point in completing this task.

**Task G.** Provide a general discussion of environmental concerns for different types of harvest and use systems, including but not limited to risk of and impact from toxic spills, mosquito breeding, exposure concerns, and contaminated pond sediments. Discuss general design, construction and other approaches to minimizing or eliminating these concerns.

**Task H.** Submit a report summarizing costs for harvest and reuse systems, including costs for land acquisition, materials, operation, installation, and maintenance, including repair. Identify cost calculators available in the public domain and discuss the applicability, advantages and limitations of each calculator. Include links to the cost calculators. Identify financial incentives that may be available to designers, builders and owners of harvest/reuse systems (e.g. [State Revolving Fund](http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/watershed-approach/clean-water-revolving-fund.html), [Clean Water Fund](http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/clean-water-fund/index.html)).

**Task I.** Submit a report summarizing available stormwater harvest and use calculators or models that are in the public domain (note they may be identified by other terms, such as rainwater calculators). Briefly describe each calculator, including a summary of required inputs, output information generated by the calculator, calculation methodology, and a brief summary of advantages and limitations of each. Include links and references to each calculator. The MIDS calculator will be included as one of the calculators. The Contractor will work with the PM to identify 4 to 6 (or fewer if limited) calculators and scenarios to run. The MPCA will complete the scenario runs and the Contractor will review the results of the scenario runs and provide recommendations to the PM as needed.

**Task J.** Provide a recommendation to the PM and technical review team for a calculation methodology for volume and pollutant credits to be used in the MIDS calculator, including the option of retaining the current methodology. In developing this recommendation, the Contractor will review initial modeling conducted by Barr Engineering as part of the MIDS project (see [link](http://stormwater.pca.state.mn.us/index.php/Stormwater_re-use_and_rainwater_harvesting#Stormwater_reuse_for_irrigation_-_preliminary_modeling_analysis)) and include that as an option for incorporating rainwater harvest and reuse into the MIDS calculator. Include the rationale for the recommendation, considering factors such as likely accuracy of the methodology, ease of use considering both user accessibility and required data inputs, need for additional modeling or calibration prior to incorporation into the MIDS Calculator, and range of applicability (e.g. can the methodology be used for most harvest and use systems).

**Objective 1 Deliverables:** Contractor will provide the MPCA technical memos that provide information on stormwater harvesting and use. Contractor will make changes as needed based on MPCA review and provide final documentation and provide all deliverables in electronic format. Contractor will also attend two meetings with the technical team.