Exhibit A

Scope of Services

Following is the scope of services for this project

Phase I

Task 1 – Phase I Public Engagement

Objective: Understand the community issues to be addressed throughout model development, calibration, and finally recommendation of improvements derived from stormwater model analysis. Gain a realization of the specific concerns in different areas throughout the city to help focus the model, as needed, in these areas.

Through Task 1, CDM Smith aims to develop and involve a representative public advisory group in the project. The advisory group will help plan and implement a general public engagement strategy to inform watershed groups of the purpose and scope of the project. This communication will help provide information to the technical team on how the modeling work needs to be completed to be successful. The public engagement strategy will be comprised of the following elements:

a. **Kickoff and prepare public engagement strategy.** The initial kickoff meeting with project stakeholders will refine the project critical success factors, and prove useful in developing the strategy for identifying and addressing public observations and concerns. We propose the use of residential and commercial focus groups to understand issues relative to stormwater level of service and geographical issues. This task will refine the number and type of groups that are to be consulted, and the definition of goals for each interaction.

b. **Manage website and other media.** CDM Smith will work with City staff and the Advisory Committee of affiliated experts to design website content, residential mailings/communications, various presentations, informational handouts, press releases, meeting summaries, and other materials as a means of public engagement. This information will be developed to communicate the location of known problems, and to define recommended solutions.

c. **Assemble stormwater advisory group.** We will develop a representative public advisory group to help plan and implement a general public engagement strategy to inform watershed groups of the purpose and scope of the project. This group will likely include City staff, HRWC staff, and Washtenaw County staff, as well as other groups. The group will be maintained throughout the life of the project from goal definition, calibration review, selections of focus areas and issues, and presentation of results to the community.

d. **Define focus groups.** We will define targeted focus groups that will include residential groupings in selected neighborhoods, commercial groups that may include the DDA, Main Street Area Association, and the Chamber of Commerce, and developer groups who are interacting with the regulatory needs of stormwater management. Each focus group will have concerns unique to their situation, and to their geography.

e. **Meet with focus groups.** CDM Smith will reach out to candidates to populate these different focus groups. At the focus group meetings, we will provide these groups with information about our general objectives and project activities to stimulate a discussion about their issues with stormwater control and management, and elements of work that they would like to see incorporated into project outputs. Developer focus groups will help our team to understand

emerging trends in new development, and how this construction will be served by the stormwater drainage system. While the stormwater advisory group (task 1.d) will be convened right at the start of the project, work with the focus groups will not take place until the preliminary model calibration is complete.

f. **Provide general public outreach.** Providing information on the project is important for those people interested in stormwater. To fill this need, we will post project objectives and activities, status of the work, and contact information for planned meetings, as well as general project information and staff managing the work on a project web site. We will update this information as activities and tasks are completed, and keep the information up-to-date and engaging.

g. **Document public engagement activities.** The project team will summarize the results of each focus group and public meeting in a set of minutes for distribution within the project stakeholder group. At the end of the phase, the minutes will be summarized in a Phase I Technical Memorandum.

Task 2 – Preliminary Model Calibration/Validation

Objective: Utilize the existing model and collected data to perform a preliminary calibration of the model. This model will be validated using independent storm events to review the model performance. Part of this work will incorporate new asset information into the model, and develop the scenarios needed by the InfoSWMM scenario manager to perform simulations of the calibration events.

Task 2 is a major analysis task using the available flow and rainfall data collected in 2007. This work will provide the foundation for subsequent flow and rainfall data collection, and will establish modeling protocols. It is critical that stormwater issues identified through public input are incorporated into the modeling work. Detailed activities included in this task follow:

a. **Update the model.** CDM Smith will review the current model and provide revisions based on changes in imperviousness from the Stormwater Utility updates. We will incorporate changes to the network, such as larger pipes, relief drains, culvert changes, and new or revised stormwater basins controls. CDM Smith will incorporate new city development into the model so that it represents the impervious values for the sub-basins and integrate the current state of the FDD program into the model. As described earlier, we will use InfoSWMM 2D to simulate the behavior of the surface drainage system when the underground drainage system cannot convey all flows. For this scope of work, we assume that 10% of model drainage area will be updated to utilize the InfoSWMM 2D extension. Areas with 2D capability will include all areas where FEMA map comparisons are needed, as well as known surface flooding areas such as Churchill Downs, Lansdowne, Pauline/Dartmoor, and Orchard Hills.

   As a percentage of the total watershed area excluding the Huron River water surface:

   - FEMA 100-year floodplain = 2.5%
   - FEMA 100-year floodplain with adjacent 300-foot buffer = 6.0%
   - Known surface flooding areas = 4.5%
   - Total area with InfoSWMM 2D capability = 10.5%

   The InfoSWMM 2D analysis will be most valuable for simulating intense events, and will help to identify the extent of problem areas in the overall system. For the largest events, 2D capability will be included for up to 15% of the City watershed area to capture all areas that are within 10' of

elevation of the 100-year floodplain. In addition, some sub-basins will include trapezoidal conveyance channels to simulate flow from upstream areas to downstream surface flooding areas included in the 2D model.

Further model updates will be made to account for Footing Drain Disconnection (FDD) Program impacts. FDD Program efforts have resulted in increases in sump pump discharges into the stormwater system, which will be directly handled in the model setup. However, the calibration must be performed using a scenario of the conditions of the system at the time the monitoring was performed. Separate scenarios will be developed for current and future conditions, including the number and location of the sump pump discharges that are present at the time of the monitoring.

b. **Provide field verification.** Based on feedback from City staff, there may be model data that will need to be verified with field surveying. Field verification will be provided when the CDM Smith modeling staff identifies questionable data (including poorly sloped pipe sections or other inconsistencies) or as a quality assurance check. The majority of invert verification work will be completed based on the existing rim elevations obtained by GPS, since this is accurate to within 2 inches. If a GPS elevation is not available or if the rim elevation has changed, field crews will follow the survey procedures used by City crews to obtain accurate invert elevations. CDM Smith field crews will identify the highest point on the rim, and use Total Station survey equipment to reference the rim elevation to a City bench mark. Invert measurements will be obtained using a survey rod and declinometer. This scope of work assumes that up to 60 invert elevations will be verified using existing rim elevation data, and up to 10 invert elevations will be verified using Total Station surveying.

c. **Review model inlet points.** CDM Smith will review the stormwater drainage system flow entry points based on current information. The grouped sets of catch basins or inlets will be revised to estimate the composite inlet size and associated inverts. We will also develop these inlet locations based on the associated surface storage that can be incorporated into the model framework. The model inlets will also be modified to directly include the storm response from the FDD sump pump system. This will allow development of statistics on the additional volume and depth caused by the foundation drain flows removed from the sanitary system.

d. **Perform model calibration simulations.** Model calibration is an iterative process. First the project team will perform model simulations for selected smaller intensity events to make adjustment to the impervious areas that contribute the majority of flow, and for more intense events, when the pervious areas also contribute. Simulations for four different events from the available detailed flow monitoring work are anticipated given the available rainfall and flow data. However, there is also a long term record of flow available at the discharge from the Malletts Creek and Allen Creek gauges, which will be used for additional peak intensity and large volume events. Additional radar rainfall information will be gathered to allow a complete simulation for these events.

e. **Calibrate hydraulic model parameters.** The simulation output will be used to calibrate runoff factors for two small and two large storms. We will adjust the conveyance system factors of pipe and channel roughness, and review the mechanics of surface and detention basin storage to properly simulate flow timing. The calibration process will also include limitations of inlet capacity within areas of the collection system that show these limits in the flow data. The flow data will also be reviewed for season to see if inlets may be blocked during these calibration events. While

performing this work, sensitivity reviews will be performed to understand the additional flow and rainfall data that would be helpful to prepare a better model.

f. **Provide model validation simulations.** Following the calibration of the hydraulic and hydrologic model parameters, CDM Smith will examine two storms for validation of model performance to check model operation without adjustment of modeling parameters. Statistics on performance, such as difference in peak flow at selected locations and total volume produced for each event, will be generated. As noted above, the validation will also examine the model performance using the Malletts Creek and Allen Creek gauges. The validation work will include all significant events that occur during the available rainfall record to test the robustness of the model calibration.

g. **Summarize hydraulic model results.** CDM Smith will document model development, flow monitoring, data review, model calibration, and model validation activities. The outputs from this task will be the preliminary model calibration/validation technical memorandum. Statistics prepared under other activities will be used to provide statistics on the level of confidence in each model parameter, including imperviousness, pervious soil response factors, and hydraulic routing through the overland flow and pipe system. This memorandum will define additional metering and rainfall monitoring needs in terms of geographical, or type of land use where existing data is inadequate to provide model confidence. If the preliminary calibration is believed to be comprehensive, a recommendation of no more data collection is possible.

h. **Design storm scenarios.** The project team will create a scenario management structure within InfoSWMM. The planned scenarios will represent model assets in place and the calibration and validation rainfall record that will be used for the calibration and validation runs. Additional scenarios will be prepared that represent the system configuration when additional flow monitoring was performed, and future conditions. Rainfall information for these additional scenarios will be added once additional flow monitoring has been completed. Each of these scenarios will incorporate the state of the FDD system for estimating the flows generated by sump pumps in each of the model sub-basins. A minimum of standard design storm scenarios will be defined for use in evaluating system performance once the calibration activities are completed.

Task 3 – Data Collection

Objective: Develop a monitoring plan from collection of additional flow and rainfall data that is needed to improve upon the preliminary calibration of the model. Implement the flow and rainfall monitoring plan by investigating potential metering locations, and deploy and maintain the equipment that will collect additional data needed to refine the model calibration. Prepare a cost-benefit analysis of the option of City-owned flow monitoring equipment, and upgrades to the rainfall monitoring system.

Task 3 gathers additional flow data for locations in the city that would benefit from more detailed flow data, and addresses areas in the city that may have experienced changes in performance from the installation of new stormwater controls. If the preliminary calibration and use of the long-term Malletts Creek and Allen Creek data shows good model performance, this task could be considered an optional activity. The following activities are detailed below:

a. **Determine new flow metering locations.** If additional flow monitoring is determined to be helpful for refining model calibration, the data needs will be evaluated under this activity. We will develop a strategy for locating up to 16 proposed flow meters, including specifying location, performing field investigations on the suitability of the proposed locations, and developing plans for installation. The project team will tailor the monitoring plan and meter locations according to

geographical and land use needs identified by City staff and the advisory committee input. These metering locations may be selected to evaluate key neighborhood observations and allow for potential comparative flow metering analysis with upcoming Capital Improvement Plan (CIP) projects.

b. **Gather new flow and rain data.** The CDM Smith team will deploy flow meters and rain gauges in the locations recommended in the previous activity, perform every other week data collection and maintenance, and remove the meters at the end of the monitoring period. This task includes review of collected flow data immediately after it is collected to determine whether additional meter maintenance is required. This review will include correlation to the other meters, and the long term meters for the Malletts Creek and Allen Creek outlets. If the data review shows loss of data, or other maintenance issues, a field crew will be deployed to correct the issue and minimize loss of information. We have included costs based on seven months of flow and rainfall monitoring to include spring, summer and fall periods in the calibration effort. If an extended monitoring period is required, monthly metering costs will be $1,200 per location. For locations that require traffic control for monthly calibration and maintenance checks, the cost will be $1, 500 per location. These monthly unit costs include extending the rainfall data collection and data processing, but they do not include additional radar rainfall data analysis.

c. **Perform rainfall and flow analysis.** Collected rainfall data will be combined with flow data to review system response according to the different land uses present in the city. Since we will be collecting spatial rainfall data using Doppler analysis that incorporates the rain gauges for ground control, this will provide much improved estimates of rainfall volumes and the distribution of rainfall throughout the tributary area, helping with subsequent calibration tasks. To improve the value of data collection, we would propose to perform these analyses while data collection is underway to determine if adjustments to the monitoring approach might be needed.

d. **Upgrade the rain gauges.** Project team members will calibrate and provide maintenance checks on the three existing rain gauges operated by the Systems Planning Unit. We will review the condition of the tipping bucket gauges, and determine if replacement of the units, or components such as reed relays, are needed to provide the expected reliability. Since these units are nearly 10 years old, the budget for this task includes costs to replace the existing gauges and data recorders with new heated rain gauges and Telog data recorders. If the City chooses to replace all three gauges, the existing equipment will be salvaged and provided to the City for use as spare parts for the new rain gauge network. We will also upgrade the Leslie Park and Wastewater Treatment Plant rain gauges to ensure they are documenting information in a format that is compatible with the Telog Enterprise system. We will evaluate whether the Leslie Park gauge can maintain the existing data logging system used to monitor other parameters such as wind and temperature, while also providing data to the Telog enterprise system. This task also includes an optional cost of $10,500 for the installation of two new rain gauges. Equipment for the new rain gauges will be consistent with the upgraded existing gauges and locations will be determined based on input from City staff. It is assumed that the communications systems for all rain gauges will be equipped with land-line modems. In total, this task includes 7 upgraded or new rain gauges. The task budget is based on CDM Smith providing seven identical gauges and data loggers, with up to 3 older gauges and data loggers available as spare parts.

e. **Review City Meter Ownership.** CDM Smith will review the cost of ownership of a small number of flow meters, and identify the potential benefit to the City. These benefits will include monitoring areas of interest immediately following flooding events, and special studies prior to construction of

new stormwater controls where the flows are not well understood. CDM Smith will prepare a memorandum documenting this evaluation, and will include recommended metering equipment and options for installation and maintenance. An optional cost allowance of $30,000 for the purchase of 2 flow meters has been included in this scope of work. The invoiced cost for metering equipment will be based on actual equipment costs at the time of purchase.

f. **Large Event Data Gathering.** CDM Smith will develop a monitoring network of key locations throughout the City of Ann Arbor watersheds to capture rainfall and flooding elevations that result from the large events. A first step is to identify the locations where flooding is expected during overland flow events, determine landmark features in the field that will be used as gauges, and determine the elevations at these landmark. We will work with the HRWC and the City of Ann Arbor to develop a group of volunteers that will monitor these locations during and just after events to establish the high water marks during specific events. Included within this group will be volunteers who maintain their own volumetric or recording rainfall monitoring devices. CDM Smith will provide two training sessions for this volunteer group, and maintain contact with the group during the project term to provide updates on results of the work, and to keep the volunteers engaged in the process. CDM Smith staff will visit selected locations after 2 events to correlate volunteer peak level observations with high water debris on the landmark features or nearby features. We have included budget to establish up to 40 locations throughout the city for this large event monitoring system. Following major rain events (two assumed during the project period), CDM Smith will compile volunteer observations and other field data into a summary report.

Task 4 – Final Model Calibration/Validation

Objective: Utilize the preliminary calibrated model and newly collected flow and rainfall data, along with additional radar rainfall information, to provide final model calibration and validation. Incorporate these calibration runs into the InfoSWMM scenario manager.

Task 4 will provide a refinement of the preliminary calibration of model parameters performed under Task 2. It is hoped that the extended monitoring period will provide a better range of monitored events with which to perform this work. The detailed task activities are as follows:

a. **Perform model calibration simulations.** We will repeat the model calibration process using smaller events to refine the impervious area calibration for selected areas, providing more detail on the hydrologic parameters. We will also use the more intense storm events to refine the soil parameters for the pervious areas.

b. **Calibrate hydraulic model parameters.** We will revise and improve the calibration of the runoff parameters and make adjustments to conveyance system pipe and channel roughness based on this new calibration data. We will also review the mechanics of surface and detention basin storage to improve the flow timing where this data is available. A minimum of four smaller storms and four large storms will be employed for the final calibration work.

c. **Provide model validation simulations.** Following calibration revision for hydraulic and hydrologic model parameters, we will examine a longer term flow record using the Malletts Creek and Allen Creek flow meter, and all of the installed flow meters for four additional events to validate model performance.

d. **Summarize hydraulic model results.** CDM Smith will document model development, flow monitoring, data review, model calibration, and model validation activities. A part of this work will

be to develop overall rainfall-runoff statistics for different areas within the city, and generate these relationships by land use. Estimates of the percentage of flow generated from surface and FDD sources will be summarized by sub-basin and larger composite areas. This information will be documented in a final calibration/validation technical memorandum. A summary of this final calibration, findings, and recommendations, will be used in communications with the public on model progress.

Task 5 – Documentation

Objective: Provide comprehensive documentation of the model update and calibration process for future reference. Summarize useful statistics that will be helpful for characterizing different land use and geographical areas within the City.

Task 5 provides a summary of the different work activities developed under Phase I. Previously, these different tasks have detailed the work in technical memoranda, which will be summarized under this task. Detailed task activities include:

a. **Deliver project model and documentation.** CDM Smith will provide interim model deliverables to the City at key milestones to allow review and QA/QC of the model system. The final stormwater drainage system models will be transmitted to the City of Ann Arbor on DVD or portable hard drive. These models will be provided in InfoSWMM format, with the scenarios properly input and organized using the agreed upon structure. Extraneous scenarios that are not needed to provide documentation of the individual calibration simulations, and the assets used for each simulation, will not be included in the transmittal. Internal documentation and a more detailed table will be provided to summarize these scenarios.

b. **Deliver project data files and documentation.** CDM Smith will provide the remaining support files; including collected facility data, flow meter installation, maintenance, and flow data; rainfall data for individual gauges, and the radar rainfall data as ArcGIS time-series coverages; database used to define the FDD flows depending on the calibration period; GIS support coverages; and other support data used to develop the calibrated model. This information will be organized in an appropriate file structure and provided to the City of Ann Arbor on DVD or portable hard drive. The data will include internal documented contents and file location.

c. **Prepare draft report.** The CDM Smith project team will draft a report presenting the public engagement process, the modeling update, the preliminary calibration process, the collection of new flow and rainfall data, and the final calibration process. The structure of this report will include the technical memoranda prepared under each of the prior tasks, and will include a summary of the processes, findings, and recommendations in report format. Copies of the draft report will be submitted electronically and in paper format.

d. **Gather report comments.** After a review period, the CDM Smith project team will meet with City of Ann Arbor staff and other stakeholders to review report contents, discuss comments, define approaches to resolve concerns, and prepare a plan for addressing them. Two to three weeks will be allotted for draft report review with an additional three weeks reserved to update the report.

e. **Prepare final report.** CDM Smith will incorporate resolution of comments from City of Ann Arbor staff into a final report. This final report will include copies of the individual technical memoranda from the individual tasks in the appendices and will be provided in both electronic and paper format.

Task 6 – Procedures

Objective: Provide support to the City of Ann Arbor staff that will routinely use the model to evaluate developer requests for service, and for City staff who evaluate planned change in the street drainage system. To address future changes in design storms as climate change occurs, provide a process for modifying the model to evaluate these new standards.

Task 6 represents a toolkit for the Ann Arbor staff to reduce the time needed to address common tasks. To help streamline these tasks, the following activities are recommended:

a. **Deliver model update procedures.** Project staff will prepare example scenarios of the application of different best management practices (BMPs) and low impact development (LID) strategies. This task will document the steps needed to incorporate these system changes and additions into the model framework. Procedures will include steps for designing upgrades to the system capacity based on the addition of flows from new development. As noted earlier, we will use the InfoSWMM Designer module to size these improvements. This module reduces the effort of making manual model changes, but rather the module will recommend pipe sizing changes, and parameter changes to incorporate different BMP and LID changes. The procedures for each application will be provided in this task technical memorandum.

b. **Deliver design storm update procedures.** As the climate changes, the City needs to modify the standard design storm scenarios within InfoSWMM. CDM Smith will provide a procedure for developing new hyetographs for incorporation into the existing storm scenario manager. This process will be documented in the task technical memorandum.

Task 7 –Training

Objective: Develop training materials and provide both general and detailed training for the newly developed modeling tools. Provide training on equipment, if provided by the project.

Training of City of Ann Arbor staff is critical for continued model use and maintenance of the underlying GIS system. City staff must understand the different tools and procedures developed by the project that can be used for evaluating proposed city developments. The following detailed activities are included in this task:

a. **Develop training materials.** CDM Smith will develop model training materials consisting of model input files, operating instructions, details on model auxiliary files, and instructions for updating land use-based model parameters. Materials will include detailed instructions for upgrading the system to reflect changes in the FDD program, so that this is largely automated and can be performed annually. Training materials will also include a training presentation for new staff requiring general familiarization to the model system, or for detailed users of the provided system. These training materials will be transmitted to the City of Ann Arbor on DVD or portable hard drive in a properly organized file structure, with documentation on the included training materials.

b. **Perform general training.** CDM Smith project team members will host two four-hour training sessions for interested staff from the City of Ann Arbor, Washtenaw County, or other approved parties. Training will outline the steps, procedures, and methods for the application of model tasks relevant to attendee use, including developer requests for service, analysis of specific design storm or historical storm events, and application of the model for future growth in undeveloped areas.

c. **Perform detailed training.** CDM Smith will host a two-day training session for two City staff members at either City of Ann Arbor or CDM Smith offices to review model elements, modeling tools and support functions, and modeling procedures developed in earlier tasks. The lesson will examine the developed modeling scenarios, teach strategies for creating additional model scenarios from existing ones, and production of supporting map functions. This training will also include review of the InfoSWMM 2D model used to evaluate overland flow and interaction with the underground drainage system, and the InfoSWMM Designer module which is used for gaining additional capacity by upsizing or the addition of relief sewers.

   At key modeling milestones, CDM Smith will provide informal hands-on model training to 1 or 2 City staff members. These interim training sessions will be intended to help the City understand the procedures to update the model, scenario management, make calibration adjustments, change design storms, change FDD hydrographs, and use InfoSWMM 2D to determine surface flooding elevations.

d. **Perform rain gauge training.** CDM Smith will provide training for City staff at either the CDM Smith or City of Ann Arbor offices on the steps needed to install, maintain, program, and download data from the modified rain gauges.

Phase II

Task 8 – Phase II Public Engagement

Objective: Continue information sharing and public education while deficiencies in the existing system are identified, and recommended solutions are developed.

During Phase II, public engagement will be redirected from information gathering to providing modeling results that identify deficiencies and recommended improvements to interested parties. This effort will include dissemination of material at public meetings and via project website.

a. **Facilitate public meetings.** CDM Smith will design and facilitate five public meetings within the City of Ann Arbor designed to share the findings and implications of the stormwater modeling project, and to welcome residents' questions, suggestions, and concerns. We suggest that this process include one meeting per ward, unless adjustments to this plan are indicated during Phase I of the project. City Council members will be invited to "co-host" the meetings in their wards, welcoming participants and providing opening remarks, and/or taking on other meeting roles according to their preference. City Council members will be briefed on findings and outcomes of stormwater modeling and public engagement elements throughout the project, and will be well-positioned to answer constituent questions and concerns.

b. **Initiating and maintaining additional media.** The CDM Smith project team proposes the following unconventional methods for the City of Ann Arbor's consideration, as a means for educating the public on the stormwater modeling findings:

   - In partnership with the Washtenaw County Water Resources Commissioner's Office, the University of Michigan, the Huron River Watershed Council, the Great Lakes Environmental Law Center, the Ann Arbor Public Library, and other local experts, the CDM Smith team could support development of a series of moderated panel discussions thematically devoted to Water to be held at the Ann Arbor Public Library. A draft list of potential topics could include: Water Law (history/overview and recent legislative actions);

Water and Development (ranging from a historical consideration of the way proximity to waterways influences the built landscape, up through present-day redevelopment issues, including projects such as Argo Cascades); Water Systems (describing the path that water travels from river to tap and back); and Stormwater. Stormwater would include an overview of stormwater systems, the evolution of stormwater management philosophy (from nuisance to resource), and the findings and implications of the stormwater modeling study.

- Utilize Creative Change Educational Solutions (CCES), a local non-profit devoted to integrating sustainability concepts into school curricula. If the City were amenable to the idea, CCES could be engaged to develop a children's educational series that would complement the panel discussions described above, thereby educating the next generation of Ann Arbor residents on water issues, especially stormwater. The series could be developed in partnership with the Ann Arbor Hands On Museum and/or the Leslie Science and Nature Center, either of which could serve as the venue for the series.

Task 9 –Deficiency Analysis & Recommendations

Objective: Utilize the final calibrated model to determine the location of deficiencies in the stormwater drainage system throughout the City of Ann Arbor. Based on results, look at potential options for mitigating deficiencies through improvements in the areas of concern.

The calibrated model will be primarily used to identify areas of concern, and correlate these findings with the problem areas defined in the public engagement phase of the project. We will undertake the following steps to understand the location of areas of concern in the stormwater drainage system, and develop improvements necessary to mitigate those issues:

a. **Prepare simulations.** CDM Smith will review the design storm scenarios created in Phase I with City staff and the Advisory committee before performing the deficiency analysis. We expect that the design storm simulations will include the 100%, 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% probability storms. It is likely that the 20% probability design storm will be considered in areas where a 10% probability, 12-hour level of service is not provided. We will consider applying historical storms, such as the June 2000 storm, to understand the unique conditions with storm volume and intensity that caused this event to cause widespread surface flooding. The model will be developed to simulate the impacts of all components of green infrastructure on a sub-basin or citywide basis by modifying the runoff behavior of the subbasins.

b. **Analyze existing condition deficiency.** We will use the design storms to identify deficiencies in the stormwater system using the existing storm water drainage network and land use. This review will include homes with FDD work performed to include the additional flow generated and discharged into the stormwater conveyance system. Identified deficiencies will be compared to the previous stormwater master plan deficiencies and recommendations to identify conveyance limitations in upstream areas that may not have been present in the prior work. As noted previously, surface flooding and the associated street drainage will be considered using the InfoSWMM 2D model and the existing DTM model for the City. Estimates of the amount of surface flooding and depth of flooding will be estimated. These surface flooding locations will be compared to the sanitary manhole locations to determine which structures may present risk of excessive inflow during flooded street events. If desired, additional detail and more detailed elevation data

for street elevations along these identified flow pathways could be added as an optional cost to the project.

c. **Identify necessary improvements.** Following deficiency analysis, CDM Smith will identify and prioritize necessary improvements, which may include conveyance improvements and stormwater BMPs to limit flow entering the system. By incorporating these improvements into the model framework, the project team can prepare simulations to verify that the improvements will correct the associated deficiencies. This work will be performed using the InfoSWMM Design module. For future deficiency analysis, only major recommended improvements will be identified as the timing of development in these areas is unknown. The relative impact of wider application of pervious pavement BMPs will be compared to these recommended improvements.

d. **Analyze future condition deficiency.** The project team will review the recommended system using future land use conditions that represent the expected final development density within the City. These conditions will include final configuration of the FDD removals throughout the city with connected footing drains removed from the sanitary sewer system and directed to the stormwater drainage system. These simulations may include the application of BMPs on an area or citywide basis depending on the expected development standards are used. These simulations will identify areas of concern that may need to be factored into the system recommendations for improvements. In turn, they will allow City staff to review the needed improvements in light of potential future development.

e. **Analyze stormwater management impacts.** CDM Smith will work with City staff to perform optional model analysis of 2 stormwater management scenarios. These scenarios are expected to be prepared so that the effectiveness of the stormwater management practices can be evaluated under different design storm events. CDM Smith will perform the model analysis and include results showing the impacts of the stormwater management practices based on the probability of storm where impacts are seen and whether certain areas of the City could see benefits in flood mitigation. Results will be presented in map format, showing a comparison of flood levels between the base scenario and the stormwater management scenario.

f. **Develop cost analysis.** Improvement costs will be developed at the planning level. CDM Smith will develop a unit cost basis for stormwater improvements, and apply this unit cost to the set of improvements. We will gather information from the stormwater utility project concerning the levels of capital funding that can be supported by that program, and use this data to define a schedule of system improvements. Project staff will develop alternative solutions with a set of draft recommendations for review and comment by City staff prior to final recommendations. The work in this task will be summarized in a technical memorandum that can be used for review of the deficiencies and proposed improvements.

Task 10 – Verify FEMA Mapping

Objective: Compare calibrated model results to existing city flood maps to determine whether flood mapping requires adjustment resulting from calibration.

The recently updated FEMA maps contain floodplain and floodway locations established for the Allen, Malletts, Millers, Swift Run, and Traver creeksheds, as well as for the Huron River. This verification effort will provide confirmation that the appropriate modeling work was used to develop these maps. Adjustments to the mapping may be recommended based on results of the stormwater modeling. This task includes the following detailed activities:

a. **Compare FEMA flood maps to InfoSWMM results.** The CDM Smith project team will compare peak flows used in InfoSWMM and the recent FEMA models for the selected flood events (10, 50, 100 and 500-year), and computed water surface elevations between the current FEMA models and the InfoSWMM models. We will overlay the extent of flooding for InfoSWMM and HEC for areas of the City that include flood mapping, and review FEMA regulatory floodway widths for compatibility with InfoSWMM model results. The team will then identify differences in flow, water surface elevation, and floodway width to determine model agreement. We will be working with the InfoSWMM 2D model to perform this comparison of floodplain location.

b. **Assess Model Agreement and Need for Revisions.** Our team will document the validation process results for presentation to City staff. We will establish the level of agreement between the models acceptable to the City in order to finalize the validation process and recommend whether a Letter of Map Revision (LOMR) or Preliminary Map Revision (PMR) is warranted based on validation criteria. Submittal of the application for the LOMR/PMR is not included in the budget supplied in the proposal, but could be provided as an optional task should this work be needed. The work in this task will be provided in a FEMA mapping technical memorandum.

Task 11 – Documentation

Objective: Provide final Phase II documentation to the City.

The following task activities include:

a. **Deliver project model and documentation.** CDM Smith will provide final model deliverables to the City at key milestones to allow review and QA/QC of the model system. The final stormwater drainage system models used for deficiency analysis and review of improvement options will be transmitted to the City of Ann Arbor on DVD or portable hard drive. These models will be provided in InfoSWMM format, with the scenarios properly input and organized using the agreed upon structure. Since much of the work will be performed for surface drainage and flow pathways, these model simulations will be provided in InfoSWMM 2D format. Extraneous scenarios not needed to provide documentation of the individual calibration simulations and the assets used for each simulation will not be included in the transmittal. Internal documentation will be provided, and a more detailed table will be provided to summarize these scenarios.

b. **Deliver project data files and documentation.** CDM Smith will provide the remaining support files, including the deficiency identified, and the final recommended changes to address these deficiencies. GIS support coverages and other support data used to develop the deficiencies and recommended improvements will be provided. This information will be organized in an appropriate file structure and provided to the City of Ann Arbor on DVD or portable hard drive. The data will include internal documented contents and file location.

c. **Prepare draft report.** The CDM Smith project team will draft a report presenting the Phase II public engagement process, the modeling review of deficiencies, and the recommended improvements. The structure of this report will include the technical memoranda prepared under each of the prior tasks, and will include a summary of the processes, findings, and recommendations in report format. Copies of the draft report will be provided electronically and in paper format.

d. **Gather report comments.** After a review period, the CDM Smith project team will meet with City of Ann Arbor staff and other stakeholders to review report contents, discuss comments, define

approaches to resolve these comments, and prepare a plan for addressing them. Two to three weeks will be allotted for draft report review and an addition three weeks will be reserved to update the report.

e. **Prepare final report.** CDM Smith will incorporate resolution of comments from City of Ann Arbor staff into a final report. The final report will include copies of the individual technical memoranda from the individual tasks in the appendices and will be provided in both electronic and paper format.

f. **Provide InfoSWMM model software.** The final model deliverables will be provided with software updates so that the City has the capability to run all aspects of the model. One copy will be provided of InfoSWMM platform, along with the 2D and Designer extensions. Costs for this scope of work are based on current costs with an assumed annual increase for delivery in July 2015. Invoiced costs for this task will be based on actual software costs at the time of purchase.