Item 6H.
BCWMC 8-20-15

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Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Company
Subject: Item 6H – Receive Information on Tasks Related to XP-SWMM Phase 2 Project
BCWMC August 20, 2015 Meeting Agenda
Date: August 12, 2015
Project: 23/27-0051 2015

6H Receive Information on Tasks Related to XP-SWMM Phase 2 Project

Recommendations

- Information only

The BCWMC approved the XP-SWMM Phase 2 work at their April 16, 2015 meeting and requested a Scope of Work from the Engineer at their July 16, 2015 meeting.

Scope of Work for the XP-SWMM Model (Phase 2)

Proper calibration of the XP-SWMM model using acceptable parameters requires enhancing the current XP-SWMM model by further subdividing the watershed divides, incorporating upstream storage in ponds and wetlands, and including the associated storm sewer data. The Phase 2 of the XP-SWMM modeling includes the following tasks:

- **Subdivision of watersheds:** The current XP-SWMM model contains 55 watersheds (from the original HEC-1 model). We will subdivide the watersheds for the BCWMC into approximately 890 watersheds (consistent with the watersheds in the BCWMC P8 water quality model). The table below summarizes the approximate number of watersheds expected in the various portions of the BCWMC. The subdivided watersheds are typically to the scale of the various ponds, wetlands, and other BMPs within the watershed. Major changes to the subwatersheds used for the P8 model development are not expected. However, minor changes to subwatershed divides may be required in select locations within the XP-SWMM model to better address the needs of hydrologic and hydraulic modeling (rather than water quality modeling) and to reflect any new data obtained during this process (e.g. storm sewer information, as-built drawings, topography).

Table 1 Phase 2 XP-SWMM Model Subwatershed Summary

Major Watershed	Approximate Number of Subwatersheds
Plymouth Creek (including Parkers Lake)	260
Medicine Lake	120
North Branch Bassett Creek	100
Main Stem Bassett Creek (Medicine Lake to North Branch)	250
Main Stem Bassett Creek (North Branch to Tunnel)	160
Total	**890**

- **Developing revised watershed hydrology inputs:** We will need to calculate the hydrology inputs for the subdivided watersheds. We will utilize the revised USDA SSURGO soils data (as available) to develop infiltration parameters based on the assigned hydrologic soil groups. For unclassified soil types, we will assume a soil type similar to adjacent classified soils. Subwatershed imperviousness will be based on the 2011 University of Minnesota Twin Cities metro area land cover/imperviousness data set. Subwatershed slopes will be developed based on the MnDNR 2011 LiDAR dataset. The initial subwatershed widths will be developed based on the subwatershed areas and the longest flowpaths.
- **Modeling of storm sewer & outlet structures:** The current XP-SWMM model does not model any of the existing storm sewer within the watershed and only includes channel cross-sections and bridge or culvert crossings along Bassett Creek. As part of Phase 2, we will incorporate information for storm sewer that convey flows between each of the modeled ponds (based on data provided by the member cities). However, we will not be modeling storm sewer systems within each of the subwatersheds. For any gaps in the required storm sewer or outlet data (e.g. pipe size, material, and upstream and downstream inverts), we assumed that the member cities will provide the information as necessary (e.g. record drawings, storm sewer data). If this information is not available from the cities, we will make assumptions based on the best available information (e.g. P8 model, storm sewer GIS data).
- **Integrating detailed storage within the watershed:** As previously mentioned the watersheds in the current XP-SWMM model are fairly large and only include storage along the Bassett Creek system. By refining the scale of the watersheds, we will incorporate the

storage associated with each of the modeled ponds, wetlands, and other BMPs within the watershed, upstream of the Bassett Creek system. We will develop the flood storage utilizing the Minnesota Department of Natural Resources (MnDNR) 2011 LiDAR data. For storage in the Bassett Creek channel, we will utilize the same cross section information as used in the current (Phase 1) XP-SWMM model.

- **Ensuring consistent vertical datums**: In using the current model, we have identified that select portions of the current model are not in the same vertical datum as the rest of the model. The majority of the current model was developed in NAVD88; however, portions of the larger model (e.g. DeCola Ponds area, Sweeney Lake area, and Wirth Lake area, which were developed as part of separate modeling efforts and provided to the BCWMC for use in the Phase 1 model development) are in NGVD29. The difference between these vertical datums is 0.18 feet and will require adjustments in the pipe inverts, overflows, and storage curves to maintain consistency in the Bassett Creek watershed.
- **Incorporating Atlas 14 precipitation data:** The current XP-SWMM model was developed prior to the release of the Atlas 14 precipitation data. We will revise the current XP-SWMM model to incorporate the Atlas 14 precipitation depths and the MN MSE3 storm distribution (replacement of "Type 2" storm distribution; developed by the Natural Resource Conservation Service (NRCS) and approved in early 2015) for the 100-year storm event and capture any "lost water" associated with this event and make sure all water is routed appropriately in the model. After calibration (discussed below), the calibrated model will be rerun utilizing the 100-year event to predict the expected 100-year flood elevations.
- **Flow monitoring & model calibration:** Phase 2 also includes additional flow monitoring and calibration at select locations in the watershed. For several years, the Three Rivers Park District has collected flow monitoring data at two locations along Plymouth Creek for the City of Plymouth. We assumed that the City of Plymouth will provide the flow monitoring data for Plymouth Creek. We installed a flow monitoring station on the North Branch of Bassett Creek to collect data for a 3 month period in 2015. We will also utilize the WOMP station flow data and the Wisconsin Avenue control structure flow data, along with any data logger water surface elevations at Medicine Lake (if available). For each monitoring location, we will calibrate to one smaller, lower intensity storm event and one larger, more intense storm event. Once calibrated, we will run the model for one additional storm event to validate the calibration. By utilizing flow monitoring data at locations throughout the watershed and incorporating the changes outlined above, we expect the modeled runoff rates to the creek system to more realistically represent actual conditions, resulting in an acceptable calibration.

- **Develop a modeling methodology report:** To summarize the modeling and calibration efforts, a brief modeling methodology report will be developed outlining the modeling process and results. We will develop tables summarizing the modeling results (100-year flood elevation tables) and figures showing the calibration plots and 100-year inundation mapping (including subwatersheds and modeled storm sewer).

Uses of the Updated Model (Phase 2)

With the changes summarized above, the Phase 2 XP-SWMM model could be used to determine (and compare) absolute water surface elevations and flow rates. The revised model results could be beneficial to the BCWMC and member cities for revising the BCWMC's jurisdictional flood elevations and the results could also be submitted to FEMA for possible use in future Hennepin County flood insurance rate maps. The model could also be useful to the member cities to assess flood elevations at other ponds or wetlands throughout the watershed. By refining and recalibrating the XP-SWMM model, the BCWMC will be more able to share the model with other units of government for use on public projects (e.g. Blue Line LRT). The updated model can also be used by the BCWMC and/or the member cities to evaluate the impacts of proposed projects on flood levels. It will also be important to periodically revisit and update the XP-SWMM model as conditions change and new hydrologic and hydraulic data is developed.

Cost Estimate and Schedule for Phase 2 Modeling

The BCWMC authorized completion of the Phase 2 modeling effort during the 2015 and 2016 fiscal year. The following table shows the estimated year, budget, and approximate schedule for the Phase 2 modeling to be completed in stages, moving from upstream to downstream in the watershed.

Table 2 Phase 2 XP-SWMM Modeling Schedule and Budget

Year	Study Area	Budget[1]	Approximate Time to Complete
2015 (through January 31, 2016)	Detailed Modeling, Plymouth Creek Watershed	$54,000	Six Months
	Flow Monitoring, Plymouth Creek	$0	Completed[2]
	Detailed Modeling, Medicine Lake Direct Watershed	$40,000	Four Months
	Three Months Flow Monitoring, North Branch Bassett Creek	$9,000	Three Months
2015 Total		**$103,000**	
2016 (through January 31, 2017)	Detailed Modeling, North Branch Bassett Creek	$39,000	Four Months
	Detailed Modeling, Bassett Creek Main Stem – Medicine Lake to Confluence with North Branch	$54,000	Five Months
	Detailed Modeling, Bassett Creek Main Stem – Downstream of the Confluence with North Branch (Including Sweeney Branch)	$49,000	Four Months
	Final Modeling Methodology Report	$16,000	Three Months
2016 Total		**$158,000**	
Phase 2 – Total		**$261,000**	

[1]Budget is based on 2015 dollars

[2]Utilize historic flow data along Plymouth Creek from Three Rivers Park District, collected for City of Plymouth