MINNEHAHA CREEK WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

Meeting: Board of Managers
Meeting date: 2/26/2026
Agenda Item #: 11.2
Board Action Item

Title:	Authorization for 2D Watershed Model Build Contract Scope Adjustment and Extension
Resolution number:	26-027
Prepared by:	Name: Brian Beck Phone: 952-471-8306 bbeck @minnehahacreek.org
Reviewed by:	Name/Title: Chuck Holtman, Smith Partners
Recommended action:	Authorize the District Administrator to execute a contract amendment with HDR for additional services to complete the watershed-wide 2D model build, calibration, and documentation for climate planning.
Schedule:	April 30th, 2026: End of Project
Budget considerations:	Fund name and code: 5-5008-4320-001 Fund budget: $738,000 Bolton and Menk LCCMR Expenditures: $79,536.89 HDR LCCMR Budget: $611,500 HDR LCCMR Expenditures: $584,349.08 Requested amount of funding: $28,000
Past Board action:	

Res #: 24-012	Title: Awarding Contract for 2D Watershed Model for Climate Planning
Res #: 22-038	Title: Authorization to Submit Proposal to LCCMR for Development of 2D Watershed Model

CLIMATE CONTEXT

Climate change is measurably changing the distribution, frequency, and intensity of rainfall in Minnesota. Between 2013 and 2019, the MCWD experienced the wettest seven years ever recorded. Over the past 10 years, Minnesota has experienced both record flood conditions and statewide drought that has negatively impacted aquatic ecology, stressed stormwater infrastructure, and cost billions in property damage. To successfully adapt to the increasingly volatile extremes in weather, MCWD and communities must be able to identify what landscape interventions are needed, where they are needed, and how much investment is needed.

The first stage of the MCWD's Climate Action Framework is to "Understand and Predict" the impacts of climate change using new data sets and modeling to forecast scenarios, evaluate vulnerabilities, and make decisions about adaptation strategies. These data will create a foundation for MCWD to engage with partner agencies in climate conversations and develop actionable plans for resilience at a system and community scale.

2D WATERSHED MODEL BUILD

MCWD was awarded a $738,000 Legislative-Citizen Commission on Minnesota Resources (LCCMR) grant to support development of a watershed-wide 2D model for climate planning and related technical work. As part of that effort, the Board of Managers previously authorized Bolton & Menk to complete foundational data collection and model input development work, including stream channel and infrastructure-related data needed to support model construction for an amount of $79,536.89.

On February 22, 2024, the Board of Managers authorized a contract with HDR for the development of the watershed-wide 2D model for climate planning, in an amount not to exceed $611,560. Since project initiation, MCWD and HDR have worked collaboratively through a shared decision-making process to define the model build approach, resolve data and scripting challenges, and advance the watershed-wide model toward completion.

During project implementation, MCWD and HDR encountered unforeseen complexities related to dataset readiness, script development, and the level of coordination needed to build a watershed-wide model from diverse municipal inputs. As this work progressed, staff and HDR also needed to more deeply understand how the model would ultimately support MCWD's climate planning objectives.

MCWD and HDR have collaboratively identified the remaining scope, budget, and tasks necessary to complete the model. Over the next several weeks, MCWD staff will continue coordinating with HDR to finalize model development and prepare the completed model for handoff to the Policy Planning Department for climate scenario evaluation as part of the watershed management planning process.

The requested contract amendment amount of $28,000 is within the remaining balance of the $738,000 LCCMR grant supporting this project. After accounting for prior project expenditures of $79,536.89 by Bolton and Menk and the previously authorized HDR contract amount of $611,560, the project retains an estimated $46,903.11 in available grant funding. District staff recommends that $28,000 of the currently unallocated LCCMR grant funds be allocated to HDR to complete the 2D Watershed Model, which would increase the engineering contract's not to exceed budget from $611,560 to $639,560. This amendment remains within the overall LCCMR grant budget and is intended to complete the remaining HDR scope needed to deliver the model for MCWD's climate planning work, while leaving $18,903.11 in LCCMR funds available for the broader project work plan.

Supporting documents (list attachments):

- Attachment 1: HDR Original Scope and Budget
- Attachment 2: HDR Proposed Scope and Budget Adjustment Overview

MINNEHAHA CREEK
WATERSHED DISTRICT
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RESOLUTION

Resolution number: 26-027

Title: Authorization to Amend HDR Contract for Watershed-Wide 2D Model for Climate Planning

WHEREAS, climate change is measurably changing the distribution, frequency, and intensity of rainfall in Minnesota; and

WHEREAS, a key pillar in Minnehaha Creek Watershed District's (District) Climate action framework is to understand and predict the impacts of climate change using new data analytical and planning tools;

WHEREAS, to support this strategy, the District has identified the need to develop a watershed-wide two-dimensional (2D) model that incorporates high-resolution stormwater infrastructure and land surface data to improve its ability to inform current and future water resource management decisions in the face of climate change;

WHEREAS, in June 2022, the Board of Managers authorized staff to submit a proposal for $738,000 to the Legislative-Citizen Commission on Minnesota Resources (LCCMR) to develop a watershed-wide model;

WHEREAS, in August of 2022, the LCCMR recommended funding the project entitled "Leveraging Innovations in Data Analytics for Project Implementation" in the amount of $738,000, and in May of 2023 the Minnesota legislature approved funding in that amount;

WHEREAS, in February 2024 the Board of Managers approved a contract with HDR for the Development of a 2D watershed Model for climate planning in an amount not to exceed $611,560;

WHEREAS, Bolton and Menk, during the watershed-wide model input refinement process, identified significant gaps in the culvert dataset, which are critical for accurate model development;

WHEREAS, since project initiation, MCWD and HDR have worked collaboratively through a shared decision-making process to define the model build approach, resolve data and scripting challenges, and advance the watershed-wide model toward completion;

WHEREAS, the requested HDR contract amendment amount of $28,000 is within the remaining balance of the $738,000 LCCMR grant, and after accounting for prior Bolton & Menk expenditures of $79,536.89 and the previously authorized HDR contract amount of $611,560, the project retains an estimated $46,903.11 in available grant funding.

NOW, THEREFORE, BE IT RESOLVED that the Minnehaha Creek Watershed District Board of Managers authorizes the District Administrator, on advice of legal counsel, to execute an amendment to the HDR contract for the watershed-wide 2D model for climate planning to incorporate the remaining scope of work necessary to complete model development, calibration, and documentation; and

BE IT FURTHER RESOLVED that the Board of Managers authorizes an increase to the HDR contract amount in an amount not to exceed $28,000, funded through the existing LCCMR grant budget for the watershed-wide 2D model project.

Resolution Number 26-027 was moved by Manager _____, seconded by Manager _____. Motion to adopt the resolution ___ ayes, ___ nays, ___abstentions. Date: 2/26/2026

_____ Date: _____
Secretary

AGREEMENT BETWEEN
MINNEHAHA CREEK WATERSHED DISTRICT and
HDR Engineering, Inc.

2-D Watershed-Wide Model

This agreement is entered into by the Minnehaha Creek Watershed District, a public body with powers set forth at Minnesota Statutes chapters 103B and 103D (MCWD), and HDR Engineering, Inc., a Minnesota corporation (CONSULTANT). In consideration of the terms and conditions set forth herein and the mutual exchange of consideration, the sufficiency of which hereby is acknowledged, MCWD and CONSULTANT agree as follows:

1. Scope of Work

CONSULTANT will perform the work described in the April 10, 2024; Scope of Services attached as Exhibit A (the Services). Exhibit A is incorporated into this agreement and its terms and schedules are binding on CONSULTANT as a term hereof. MCWD, at its discretion, in writing may at any time suspend work or amend the Services to delete any task or portion thereof. Authorized work by CONSULTANT on a task deleted or modified by MCWD will be compensated in accordance with paragraphs 5 and 6. Time is of the essence in the performance of the Services.

The work is supported by a grant of the Legislative-Citizen Commission on Minnesota Resources under the Environment and Natural Resources Trust Fund. The grant agreement and attachments (together, "Grant Agreement") are incorporated into this agreement. CONSULTANT will cooperate with MCWD as necessary for MCWD to fulfill the terms of the grant agreement.

2. Independent Contractor

CONSULTANT is an independent contractor under this agreement. CONSULTANT will select the means, method and manner of performing the Services. Nothing herein contained is intended or is to be construed to constitute CONSULTANT as the agent, representative or employee of MCWD in any manner. Personnel performing the Services on behalf of CONSULTANT will not be considered employees of MCWD and will not be entitled to any compensation, rights or benefits of any kind from MCWD.

3. Subcontract and Assignment

CONSULTANT will not assign, subcontract or transfer any obligation or interest in this agreement or any of the Services without the written consent of MCWD and pursuant to any conditions included in that consent. MCWD consent to any subcontracting does not relieve CONSULTANT of its responsibility to perform the Services or any part thereof, nor in any respect its duty of care, insurance obligations, or duty to hold harmless, defend and indemnify under this agreement.

4. Duty of Care; Indemnification

CONSULTANT will perform the Services with due care and in accordance with national standards of professional care, customarily exercised by members of CONSULTANT's profession practicing at the same time ("Professional Standard of Care"). CONSULTANT will hold harmless and indemnify MCWD, its board members, employees and agents, from any and all actions, costs

(including reasonable attorney fees), damages and liabilities of any nature arising from CONSULTANT's breach of the Professional Standard of Care, and will defend, hold harmless, and indemnify MCWD, its board members, employees and agents from any and all actions, costs, damages and liabilities of any nature arising from CONSULTANT's negligent or otherwise wrongful act or omission, or breach of a specific contractual duty other than the Professional Standard of Care. For any claim subject to this paragraph by an employee of CONSULTANT, the indemnification obligation is not limited by a limitation on the amount or type of damages, compensation or benefits payable by or for CONSULTANT under workers' compensation acts, disability acts or other employee benefit acts.

5. Compensation

MCWD will compensate CONSULTANT for the Services on an hourly basis and reimburse for direct costs in accordance with Exhibit A. Invoices will be submitted monthly for work performed during the preceding month, and must conform to the requirements of the Grants Reimbursement Manual that are a part of the Grant Agreement. Payment for undisputed work will be due within 30 days of receipt of invoice. Direct costs not specified in Exhibit A will not be reimbursed except with prior written approval of the MCWD administrator.

The total payment for each task will not exceed the amount specified for that task in Exhibit A. The total payment for the Services will not exceed $611,560.00. Total payment in each respect means all sums to be paid whatsoever, including but not limited to fees and reimbursement of direct costs, whether specified in this agreement or subsequently authorized by the administrator.

CONSULTANT will maintain all records pertaining to fees or costs incurred in connection with the Services for six years from the date of completion of the Services. CONSULTANT agrees that any authorized MCWD representative, the state auditor or the grant auditor may have access to and the right to examine, audit and copy any such records during normal business hours.

6. Termination; Continuation of Obligations

This agreement is effective when fully executed by the parties and will remain in force until September 30, 2025 unless earlier terminated as set forth herein.

MCWD may terminate this agreement at its convenience, by a written termination notice stating specifically what prior authorized or additional tasks or services it requires CONSULTANT to complete. CONSULTANT will receive full compensation for all authorized work performed, except that CONSULTANT will not be compensated for any part performance of a specified task or service if termination is due to CONSULTANT's breach of this agreement.

Insurance obligations; duty of care; obligations to defend, indemnify and hold harmless; duty to cooperate in assignment of intellectual property; and document-retention requirements will survive the completion of the Services and the term of this agreement.

7. No Waiver

The failure of either party to insist on the strict performance by the other party of any provision or obligation under this agreement, or to exercise any option, remedy or right herein, will not waive or relinquish such party's rights in the future to insist on strict performance of any provision,

condition or obligation, all of which will remain in full force and affect. The waiver of either party on one or more occasion of any provision or obligation of this agreement will not be construed as a waiver of any subsequent breach of the same provision or obligation, and the consent or approval by either party to or of any act by the other requiring consent or approval will not render unnecessary such party's consent or approval to any subsequent similar act by the other.

Notwithstanding any other term of this agreement, MCWD waives no immunity in tort. This agreement creates no right in and waives no immunity, defense or liability limit with respect to any third party.

8. Insurance

At all times during the term of this Agreement, CONSULTANT will have and keep in force the following insurance coverages:

A. General: $1.5 million, each occurrence and aggregate, covering CONSULTANT's ongoing operations on an occurrence basis.

B. Professional liability: $1.5 million each claim and aggregate. Any deductible will be CONSULTANT's sole responsibility and may not exceed $100,000. Coverage may be on a claims-made basis, in which case CONSULTANT must maintain the policy for, or obtain extended reporting period coverage extending, at least three (3) years from completion of the Services.

C. Automobile liability: $1.5 million combined single limit each occurrence coverage for bodily injury and property damage covering all vehicles on an occurrence basis.

D. Workers' compensation: in accordance with legal requirements applicable to CONSULTANT.

CONSULTANT will not commence work until it has filed with MCWD a certificate of insurance clearly evidencing the required coverages and naming MCWD as an additional insured for general liability, along with a copy of the additional insured endorsement establishing coverage for CONSULTANT's ongoing operations as primary coverage on a noncontributory basis. The certificate will name MCWD as a holder and will state that MCWD will receive written notice before cancellation, nonrenewal or a change in the limit of any described policy under the same terms as CONSULTANT.

9. Compliance With Laws

CONSULTANT will comply with the laws and requirements of all federal, state, local and other governmental units in connection with performing the Services and will procure all licenses, permits and other rights necessary to perform the Services.

In performing the Services, CONSULTANT will ensure that no person is excluded from full employment rights or participation in or the benefits of any program, service or activity on the ground of race, color, creed, religion, age, sex, disability, marital status, sexual orientation, public assistance status or national origin; and no person who is protected by applicable federal or state

laws, rules or regulations against discrimination otherwise will be subjected to discrimination. Specifically but not exclusively, CONSULTANT will conform to the requirements of the Grant Agreement, §21 ("Non-Discrimination Requirements"), as applicable.

10. Data and Information

As between MCWD and CONSULTANT, all data and information obtained or generated by CONSULTANT in performing the Services, including documents in hard and electronic copy, software, and all other forms in which the data and information are contained, documented or memorialized (together, here and in sections 11 and 12, the "Materials"), are the property of MCWD. CONSULTANT hereby assigns and transfers to MCWD all right, title and interest in: (a) its copyright, if any, in the Materials; any registrations and copyright applications relating to the Materials; and any copyright renewals and extensions; (b) all works based on, derived from or incorporating the Materials; and (c) all income, royalties, damages, claims and payments now or hereafter due or payable with respect thereto, and all causes of action in law or equity for past, present or future infringement based on the copyrights. CONSULTANT agrees to execute all papers and to perform such other proper acts as MCWD may deem necessary to secure for MCWD or its assignee the rights herein assigned. Intellectual property rights of the parties under this agreement further are subject to the rights of the State as set forth in the Grant Agreement.

MCWD may immediately inspect, copy or take possession of any Materials on written request to CONSULTANT. On termination of the agreement, CONSULTANT may maintain a copy of some or all of the Materials except for any Materials designated by MCWD as confidential or non-public under applicable law, a copy of which may be maintained by CONSULTANT only pursuant to written agreement with MCWD specifying terms.

11. Data Practices; Confidentiality

If CONSULTANT receives a request for data pursuant to the Data Practices Act, Minnesota Statutes chapter 13 (DPA), that may encompass data (as that term is defined in the DPA) CONSULTANT possesses or has created as a result of this agreement, it will inform MCWD immediately and transmit a copy of the request. If the request is addressed to MCWD, CONSULTANT will not provide any information or documents, but will direct the inquiry to MCWD. If the request is addressed to CONSULTANT, CONSULTANT will be responsible to determine whether it is legally required to respond to the request and otherwise what its legal obligations are but, before replying, will: (a) notify and consult with MCWD and its legal counsel; and (b) under the terms of the Grant Agreement, await any instructions from the State. Nothing in the preceding sentence supersedes CONSULTANT's obligations under this agreement with respect to protection of MCWD data, property rights in data or confidentiality. Nothing in this section constitutes a determination that CONSULTANT is performing a governmental function within the meaning of Minnesota Statutes section 13.05, subdivision 11, or otherwise expands the applicability of the DPA beyond its scope under governing law.

CONSULTANT agrees that it will not disclose and will hold in confidence any and all proprietary Materials owned or possessed by MCWD and so denominated by MCWD. CONSULTANT will not use any such Materials for any purpose other than performance of the Services without MCWD written consent. This restriction does not apply to Materials already possessed by CONSULTANT or that CONSULTANT received on a non-confidential basis from MCWD or another party.

Consistent with the terms of sections 10 through 12 regarding use and protection of confidential and proprietary information, and regarding the intellectual property rights of the State, CONSULTANT retains a nonexclusive license to use the Materials and may publish or use the Materials in its professional activities. Any CONSULTANT duty of care under this agreement does not extend to any party other than MCWD or to any use of the Materials by MCWD other than for the purpose(s) for which CONSULTANT is compensated under this agreement. In any publication or public communication pertaining to its work under this agreement, CONSULTANT will acknowledge the financial support of the Minnesota Environment and Natural Resources Trust Fund as required by the Grant Agreement, §15.

12. MCWD Property

All property furnished to or for the use of CONSULTANT or a subcontractor by MCWD and not fully used in the performance of the Services, including but not limited to equipment, supplies, and Materials, will remain the property of MCWD and returned to MCWD at the conclusion of the performance of the Services, or sooner if requested by MCWD. CONSULTANT further agrees that any proprietary Materials are the exclusive property of MCWD and will assert no right, title or interest in the Materials. CONSULTANT will not disseminate, transfer or dispose of any proprietary Materials to any other person or entity unless specifically authorized in writing by MCWD.

Any property including but not limited to Materials supplied to CONSULTANT by MCWD or deriving from MCWD is supplied to and accepted by CONSULTANT as without representation or warranty including but not limited to a warranty of fitness, merchantability, accuracy or completeness. However, CONSULTANT's duty of professional care under paragraph 4, above, does not extend to Materials provided to CONSULTANT by MCWD or any portion of the Services that is inaccurate or incomplete as the result of CONSULTANT's reasonable reliance on those Materials.

13. Notices

Any written communication required under this agreement to be provided in writing will be directed to the other party as follows:

To MCWD:

Administrator
Minnehaha Creek Watershed District
15320 Minnetonka Boulevard
Minnetonka, MN 55345

To CONSULTANT:

Christine Wiegert
HDR Engineering, Inc.
1601 Utica Ave S, Suite 600
Saint Louis Park, MN 55416

Either of the above individuals may in writing designate another individual to receive communications under this agreement.

14. Choice of Law; Venue

This agreement will be construed under and governed by the laws of the State of Minnesota. Venue for any action will lie in Hennepin County, except that venue in Ramsey County is permitted where the action properly is consolidated with an adjudication under the Grant Agreement.

15. Whole Agreement

The entire agreement between the two parties is contained herein and this agreement supersedes all oral agreements and negotiations relating to the subject matter hereof. Any modification of this agreement is valid only when reduced to writing as an amendment to the agreement and signed by the parties hereto. MCWD may amend this agreement only by action of the Board of Managers acting as a body.

IN WITNESS WHEREOF, intending to be legally bound, the parties hereto execute and deliver this agreement.

CONSULTANT

By Christine Wiegert (Apr 11, 2024 14:26 CDT) Date: 04/11/2024

Its Sr. Vice President

Approved as to Form and Execution

Chuck Holtman (Apr 15, 2024 17:18 CDT)

MCWD Attorney

MINNEHAHA CREEK WATERSHED DISTRICT

By James Wisker (Apr 16, 2024 21:24 CDT) Date: 04/16/2024

Its

Exhibit A
Scope of Services

Developing a 2D Watershed-wide Model

Scope of Work

April 10, 2024

Introduction

This scope of services describes the work activities that will be performed for the development of a 2D watershed model with the Minnehaha Creek Watershed District (MCWD or District).

This project will build off of previous efforts by the District including the Pilot 2D Model Project, the 2D Model Data Standardization Project, and the Model Input Refinement Project. Through these previously completed efforts, the District has developed an automated framework and a baseline Python script package, which together will serve to process stormwater infrastructure datasets, address critical data gaps for the watershed-wide climate model, and unify each municipal/agency dataset within the watershed into a single, standardized geodatabase.

The services provided as part of this contract include identification, aggregation, and processing of the input data required for a StormWise model. Python scripts previously developed by the District will serve as a basis for data processing. Where automation is not practical, HDR will develop repeatable workflows to process data. A limited amount of field verification or survey will be performed to better characterize critical features. Through a series of workshops, a model development approach will be determined and executed in two phases. A preliminary model build will be executed to identify gaps and challenges in model construction followed by a final build and calibration of the model. The result of these tasks will be a calibrated watershed-wide 2D StormWise model built in collaboration with the District. This project will leverage learnings from the District's past modeling projects to build a watershed-wide model that can help answer critical questions surrounding climate change adaptation for MCWD.

Upper and Lower Watersheds and model limits are as shown in the attached map. As defined in the request for proposal, the roles of MCWD and HDR are as follows:

1. Data Processing and Python Scripting: HDR will lead data review and data processing to produce baseline datasets that will be used in the watershed models.
2. Upper Watershed Model Development: MCWD staff will lead the development of the Upper Watershed model that will be reviewed by HDR.
3. Lower Watershed Model Development: HDR will lead the development of the Lower Watershed model.
4. Data Collection: HDR will lead field data collection and MCWD staff will support field data collection where necessary.

The project schedule is attached. It is anticipated that MCWD will follow a similar schedule for the model build tasks to allow the HDR and MCWD team to work in tandem and collaborate on

the detailed approach. In addition to the workshops listed in the scope of services, HDR anticipates the following project development meetings during the project schedule:

- Technical approach meetings
  - Biweekly
  - MCWD technical staff
  - Up to (2) HDR team members, including the Technical Project Manager
  - 30 minutes
- Project advancement meetings
  - Monthly
  - MCWD project management staff
  - Up to (2) HDR team members, including the Project Manager
  - 30 minutes

Detailed Scope of Services

Task 1: Data Discovery and Data Review

HDR will lead a data discovery and review task to build upon the District's work to date. The approach will identify modeling inputs, aggregate available datasets, and advance additional processing steps required for compatibility with the intent of identifying critical data gaps that could impact a preliminary model build.

Task 1A: Data Discovery

- HDR will collect and organize data provided by MCWD into a data registry and include a summary of metadata such as dates updated, collection methods, and source.
- HDR will perform a review of the data provided by the District. Data review will include the Upper and Lower Watersheds. These data are assumed to include data sources provided in the request for proposal, data used for pilot study build, data collected to address gaps identified in the pilot model build, and other data owned or previously collected by the District.
- As necessary for model input, HDR will identify and aggregate additional data required for a successful model build, and establish methods for pre-processing datasets into model-ready inputs. Additional datasets are shown in Figure 1 below or may include limited other sources.

Task 1B: Data Review Documentation

- HDR will schedule a meeting with MCWD to build consensus around a draft list of data reviewed, critical issues, and explanation of identified gaps and how these gaps could be filled prior to establishment of the initial watershed model.
- Upon agreement with the methods discussed at the meeting, HDR will document the data discovery process in a technical memo.

Task 1: Deliverables

- Data Discovery and Review Technical Memorandum that includes:
    - A summary of data needs for a successful StormWise model build including potential limitations to preliminary model results based on data gaps.
    - Areas of data necessary for the preliminary model build where there are specific gaps or erroneous data.
    - A description of the issues or gaps within the datasets and why they need to be filled prior to preliminary model development.
    - Recommended non-publicly available data sources, methods, or assumptions that could be used to fill the data gaps or erroneous data.
- Data Register:
    - Data to be used for the initial model build, data assumptions and metadata.
    - This register will be updated at each major milestone throughout the project lifecycle.

Task 1: Assumptions

- Task 1 does not include StormWise modeling or model-related deliverables.
- Up to one (1) round of unified comments on the Data Discovery and Data Approach Technical Memo will be addressed.
- Identification of critical data gaps will include review of datasets for compatibility with StormWise and not detailed review of individual elements or verification of data accuracy (included in Task 6).
- Prioritization for filling of data gaps identified in Task 1 will occur in Task 6.

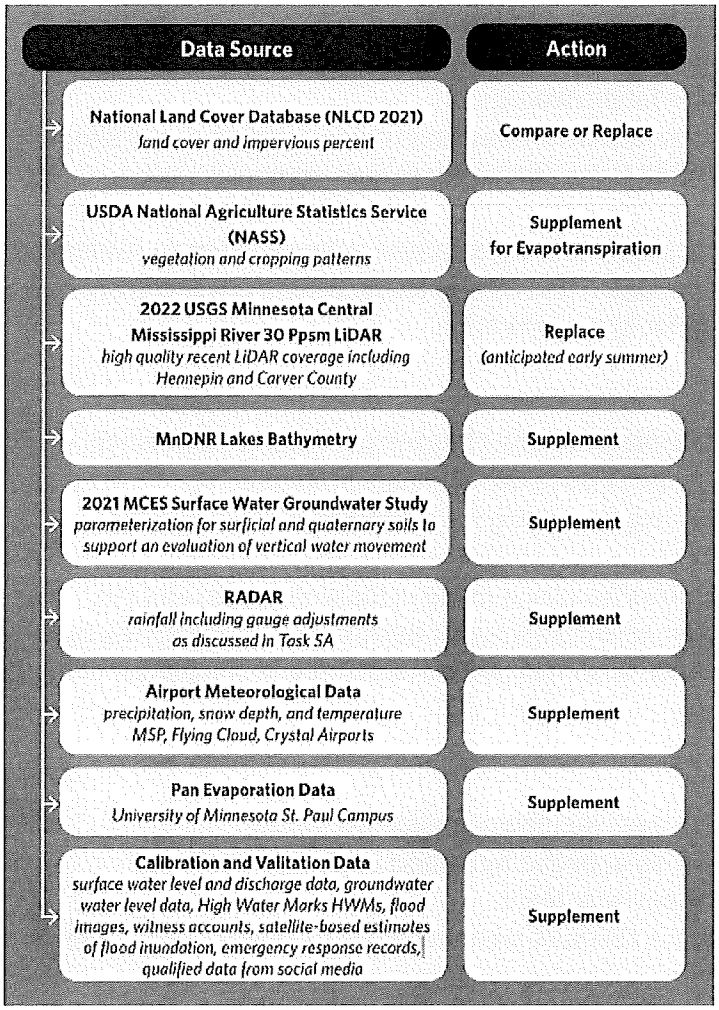


Figure 1. Anticipated additional data sources

Task 2: Model Build Approach

This task includes four (4) in-person project team workshops to discuss and reach consensus on items critical to the development of a model. At the outset of this task HDR will document the discussions and advance the development of guidance documentation for the model build.

- HDR will generate preliminary workshop themes including an anticipated discussion agenda. Refinement of the theme, conversation items, and key decision points will be coordinated with the District as part of task initiation.
- Anticipated workshop themes and approximate timing include:
    - Goal Setting and Prioritization: 2 months after Notice to Proceed (NTP)
    - Surface Water Model Build: 3 months after NTP
    - Groundwater Model Build: 4 months after NTP
    - Calibration, Validation, Scenario Management, and Model Maintenance: 5 months after NTP

- Prior to each workshop, HDR will coordinate with the District and their advisory team on items to be discussed as part of the workshop. A powerpoint presentation and agenda will be developed to provide context for the workshop.
- HDR will facilitate the discussion and document decisions made during the workshops. Workshop summaries will be provided to the District for review, comment, and refinement.
- Workshop summaries will be formalized into a set of guidance documentation. Guidance documents will be formatted to be updated and refined as the project advances and will be submitted at project completion for future reference.

Task 2: Deliverables

- Workshop agenda with stated goals provided one (1) week prior to each workshop.
- Up to four (4) in-person workshops, each up to two (2) hours in length.
- Workshop summaries for each meeting describing the decisions made during the meetings.
- A guidance document that summarizes decisions made in the workshops, and the proposed model approach will begin development after the first workshop and will be hosted in a shared location. Guidance document will be formalized at completion of the project.

Task 2: Assumptions

- HDR anticipates up to five (5) HDR team members at each workshop.
- HDR anticipates the workshops will be attended by District staff, HDR staff, and members of the District's technical advisory team.
- HDR anticipates coordination with the District's technical advisory team prior to, during, and after each workshop.
- Up to one (1) round of unified comments on each workshop summary.
- Active comments or refinements will occur to the guidance documentation as it is developed. A draft final version of the guidance documentation will be provided for review along with the Draft Modeling Report for the Lower Watershed as part of Task 7. Up to one (1) round of formal unified comments on the draft final guidance documentation.

Task 3: Non-Pipe Stormwater Dataset

Currently, many of the storage features within the watershed are poorly documented. Given that it is cost prohibitive to collect detailed field data for each storage feature, a framework for prioritization will identify which features are significant. HDR will develop standardized methodologies to characterize features, focusing efforts on those with more hydrologic significance, resulting in a more comprehensive spatial database of storage features across the watershed.

Task 3A: Non-pipe Stormwater Dataset Strategy Development

- HDR will develop an approach to identify non-pipe stormwater assets for modeling and data management purposes. The approach will include reviewing the District's existing data and other publicly available GIS data sources identified as part of Task 1. This framework will identify what data gaps currently exist. HDR will focus on non-pipe stormwater features meeting criteria for incorporation into the model as defined in Task 2.
- Methodologies for characterization will be defined by type of asset, whether it be storage assets (i.e. lakes, ponds, wetlands, Best Management Practices (BMPs), etc.) or structures (i.e. outlet control structures, weirs, etc.).
- HDR will work in collaboration with the District to identify a method to organize and represent non-pipe stormwater information in the model. Based on quality of available data, HDR will develop a structure for identifying and tracking data sources and relative level of accuracy to fill data gaps, similar to the following:
    - Leverage data previously characterized by the District or their partners that requires minimal pre-processing prior to implementation into the model. Sources will include the District's existing XP-SWMM model, other non-District owned models, and GIS-based bathymetry data currently held by the District.
    - Pre-processing of developed datasets that cannot be implemented into the model in their current state. For example, third party datasets such as BioBase could be used by the District to supplement bathymetry data.
    - Mining of unformatted digital data such as record drawings, as-builts, or historic aerials. This approach could be followed where available data doesn't cover or sufficiently characterize critical model elements such as structures or historic projects.
    - Automate processes to describe storage features that can be applied across less-critical or difficult to estimate model elements. We anticipate using tools such as the ArcHydro toolkit to determine sinks to be characterized as Pond Control Volumes or applying representative cross-sections to Channel Control Volumes.
- Aggregated data from differing data collection techniques will be unified by using consistent schema such as MetroGIS Stormwater Geodata Project Standard. Standardization will lead to improved quality assurance of the hydraulic dataset, provide a consistent method to collect or import future data as the watershed develops and changes, and support the integration of these datasets into model ready format through automation procedures refined in Task 4.
- HDR will summarize this process in a technical memorandum which will include a list of proposed non-pipe stormwater assets, proposed characterization methods, and relative level of accuracy for review by the District.
- Following memo comment resolution; data collection, data mining, and scripted processing of datasets will be performed as part of Task 3b.

Task 3B: Initial Non-Pipe Stormwater Data Mining and Data Collection

- Each non-pipe stormwater feature anticipated to be modeled will be paired with a proposed data schema defined by one (1) of the data gap methodologies developed in the Task 3a technical memorandum.
- HDR will build on the Task 3A technical memorandum to summarize the non-pipe stormwater feature datasets represented, the data source, and relative level of accuracy based on the data sources used.
- It is understood that upon completion of Task 3 that some features will be represented using data sources that will be sufficient for the initial model build, but may not be characterized well enough to produce accurate results. Features using less accurate methods of representation in the model will be tracked and considered for refinement or data collection as part of Task 6.

Task 3: Deliverables

- Technical memorandum outlining methodologies for digitizing non-pipe stormwater data which includes, at minimum:
    - Methods for locating critical storage and hydraulic control structure data gaps
    - Criteria for when assumptions will be made about storage and hydraulic control structures
    - Strategies for filling critical data gaps in storage and hydraulic control structures
- Technical memorandum summarizing the non-pipe storage and hydraulic control structure datasets produced for the preliminary model build
- Populated geodatabase, in an agreed-upon structure, that contains the newly developed storage data
- Data Register developed as part of Task 1 will be updated to include additional datasets.

Task 3: Assumptions

- Approval of methods developed in Task 3a will be provided prior to commencement of Task 3b.
- Data schema will be agreed upon prior to commencement of Task 3b.
- Up to one (1) round of unified comments from the District will be addressed for each deliverable.
- District will work with watershed partners to collect record drawings or non-digitized data to supplement available GIS data of non-pipe stormwater features.
- HDR will review up to twenty (20) record drawings or non-digitized data features for model representation.
- HDR will review up to twenty (20) previously modeled non-District owned stormwater features
- Field data collection is not included as part of Task 3.
- Data accuracy will be qualitatively characterized as a relative scale between aggregated datasets.

Task 4: Review and Refinement of Programmatic Data Processing Scripts

As part of previous work, the District has developed Python based script packages to translate member community infrastructure data into MGIS and from MGIS into a model ready format. This task will modify these scripts to include the results of Task 3.

Task 4A: Existing Stormwater Infrastructure Script Review

- HDR will review the overarching framework and script packages provided by MCWD to develop an understanding of the tools developed in the previous project.
- HDR will compile questions for further discussion, conduct a script-focused workshop with the District to discuss expected future application of the scripted workflow, and identify opportunities for further script refinement.

Task 4B: Existing Stormwater Infrastructure Script Refinement

- Based on the review of the script packages and the District workshop performed in Task 4a, HDR will refine the District script packages to incorporate data developed in Task 3 such as storage areas (e.g., wetlands, ponds, and lakes), BMPs, and hydraulic control structures.
- HDR will further refine the District script packages based on specific feedback received from the District following the Task 4a workshop. Refinement includes minor adjustments to script format or processing steps. Multi-step changes to District scripting packages are not anticipated.
- Using the refined script packages, HDR will produce output geodatabase(s) of watershed-wide model-ready datasets based on the model approach defined in Task 2.

Task 4C: Script Documentation

- HDR will produce a brief memorandum documenting the script refinement process as well as any revisions or additions to the script packages.
- HDR will annotate changes inside the existing script files as code comments.
- Where applicable, HDR will also update any documentation provided by the District, reflecting any revisions or additions, to provide a similar level of documentation as the existing script package documentation.

Task 4: Deliverables

- Memo documenting completed review of script packages and a list of questions regarding script inputs, processing, or outputs for discussion with the District.
- Meeting minutes from the workshop with the District including a summary of script refinement opportunities identified for Task 4b.
- Revised package of stormwater infrastructure scripts with associated documentation
- Geodatabase(s) of watershed-wide model-ready datasets based on the model approach defined in Task 2.

- Revised package of stormwater infrastructure scripts with associated documentation.

Task 4: Assumptions

- Holding a script-focused workshop with District to discuss questions related to the script packages, how the tool is currently utilized within Districts overall workflow, and other needs beyond those outlined in Task 4b.
- Script focused workshop will be up to two (2) hours in duration and will include up to four (4) HDR staff.
- The estimated level of effort for potential script refinements will be discussed with MCWD during the Task 4a workshop relative to the level of effort assumed in the fee.
- Up to one (1) round of unified comments on the scripts developed as part of Task 4b will be addressed.

Task 5: Preliminary Model Build

This task includes the initial construction of the lower watershed StormWise model. Here an incremental model development will be used to help identify erroneous data, data gaps, and model run challenges. It is anticipated that a GIS environment will be used for creating and formatting model input data due to the additional tools and ability for multiple users to work in parallel. Scripted preprocessing of datasets, refined in Task 4, will be utilized for the model build. Additional data processing that is not practical to automate will occur and be documented including development of meteorological data, merged bathymetric and LiDAR data, bridge rating curve preprocessing, and the development of overland flow and groundwater flow regions. Technical alignment through an advisory group and working sessions amongst the modelers will occur periodically to navigate challenges and decision points as they arise. Prior to completion of this task, sensitivity simulations will be used to identify impacts of parameter adjustments on watershed response.

Task 5A: Model Build

Task 5a will incrementally develop a GIS and StormWise digital replica of the lower watershed model domain through GIS software, tools, and application of the data management standard. HDR will use the refined scripting from Task 4 to process watershed data into a model-ready format. HDR anticipates that some watershed data may require importing through non-automated, but repeatable processes and will document the steps of the model build and data sources through the guidance document started in Task 2.

This task begins the development of a digital replica. The anticipated data sources and general approach for digital replica data assembly are summarized by the following:

- Stormwater Infrastructure Datasets:
    - Pending the capabilities of scripts developed in Task 4, simplification, connectivity, and topological tools within a GIS environment will be used to prepare watershed data for model integration.
    - Using the scripts refined as part of Task 4, HDR will process the stormwater infrastructure datasets into the digital replica. Data integration into the digital

replica is limited to only those features identified for incorporation in the model as defined in Task 2.

- Meteorological Data Development:
  - Meteorological data will be developed for three (3) flood events (each up to two weeks in duration) and two (2) longer periods (each up to one year in duration) to support calibration and validation. The events will be selected as part of workshops executed in Task 2.
  - Calibration and validation periods will be limited to those with available calibration/validation data at USGS stream gages along Minnehaha Creek and target periods with additional calibration/validation data available.
  - Precipitation, temperature, evapotranspiration, and crop coefficient input datasets will be downloaded from publicly available sources and included in calibration and validation events.
  - One (1) of the precipitation events will be selected to use for test simulations and sensitivity runs.
  - For event only calibration periods, Gage Adjusted RADAR Rainfall (GARR) will be developed using the best publicly available RADAR data.
  - For longer duration simulations spatially uniform meteorological model inputs will be used. High quality meteorological data from airport stations like Minneapolis/St. Paul, Flying Cloud, and Crystal airports are anticipated for use along with suitable District maintained and verified gaging stations.
  - After development, precipitation and evapotranspiration data will be included in the digital replica as a combination of GIS spatial representation linked to a set of time series data.
- Terrain:
  - The LiDAR topographic elevation data identified in Task 1 will be used characterize the watershed model surface.
  - Traditional LiDAR is not capable of penetrating the surface of water features, leaving lakes, ponds, wetlands, and creeks/rivers without adequate representation below the water surface when the LiDAR was captured. These data will be supplemented by publicly available GIS data or GIS data provided by the District. Where bathymetric data is available it will be mosaiced with the LiDAR data into a seamless surface.
  - After integration of the bathymetric data, the terrain will be integrated into the digital replica.
- Minnehaha Creek Bridges:
  - StormWise requires rating curves to be developed for bridge structures with piers that are in pressure or pressure and weir flow.
  - The District will provide HEC-RAS models, bridge drawings, or XP-SWMM bridge data they have for Minnehaha Creek bridges.
  - Where rating curves do not exist, HDR will alert the District where information is missing so the District can request bridge drawings or as-built survey from the bridge owner. HDR will utilize HEC-RAS or similar hydraulic modeling software

to pre-process bridge rating curve for input into StormWise for up to six (6) creek bridges.
    - Bridge rating curves will be integrated into the digital replica.
- Overland Flow:
    - Identification of Overland Flow (OF) Regions will leverage ArcHydro or similar automation procedures for multiple purposes.
    - The OF Regions themselves will be auto-delineated and then simplified to a vertex tolerance. OF Regions should be maximized where possible to reduce run times, as separate regions utilize CPU cores better than a single region.
    - If a mapped basin approach is selected for some portions of the model domain, these will also be developed in a similar manner to the overland flow regions.
    - ArcHydro will be used to generate breaklines at thalweg, ridges, and other areas to improve mesh development.
    - Overland flow regions, mapped basins, breaklines, breakpoints, and other mesh generation elements will be integrated into the digital replica.
- Channels/Ponds:
    - In some areas, 1D channel or pond hydraulics may be incorporated into the model as applicable. These locations will be chosen to improve run times or where 1D hydraulics can adequately represent the system. These areas will be defined using channel or pond control volumes.
    - Channel links and cross sections will be placed at appropriate locations using engineering judgement and will be cut from best-available terrain data.
    - Pond control volumes may be auto-delineated using ArcHydro tools and the control structures will be incorporated where applicable.
    - Channel and pond features will be incorporated into the digital replica.
- Groundwater:
    - Groundwater flow regions will be delineated independently from overland flow regions and will be important to limit runtimes.
    - HDR will develop a consistent process to divide and characterize the subsurface domain. Pending results of Task 2 workshops, it is anticipated that a vertically layering of subsurface materials will be used leveraging SSURGO soil data to represent surficial soils and County Geologic Atlas data will be used to describe deeper layers.
    - Vertical layering will likely require non-flat layering with each layer attempting to describe a subset of glacial deposits. This vertical layering would continue down to the bedrock surface which would be assumed as the model bottom as described in the County Geologic Atlas. There is potential of interaction between the bedrock and surficial soils. Lower boundary conditions will be evaluated on a per simulation basis, but may include a head value, leakage rate, or no flow.
    - Groundwater flow regions, soil zone features, rasters representing the top and bottom of the groundwater regions, and other mesh generation elements will be integrated into the digital replica.

Following the import and preparation of the model input data. The initial StormWise model will be developed following an incremental model build approach in four phases.

- Phase 1. Overland flow: A new model will be created and elements for the Overland Flow regions will be imported, including the regions, terrain surfaces, starting water level surfaces, land use map layers, and mesh generation elements. The curve number method will be used temporarily until Phase 4.
- Phase 2. Channels/Ponds: Building on Phase 1 the channel and surface storage elements will be imported including channel nodes and links, cross sections, control volumes, and rating curves. The scenario will be rebuilt to assure no adverse mesh changes and test simulation will be run.
- Phase 3. 1D Network: Building on Phase 2 all remaining 1D network elements will be imported into the model, including pipes, weirs, stage/area nodes, and the 1D node interfaces to the 2D mesh. The scenario will be rebuilt, and the test simulation run again. Instabilities occurring in the 1D network will be handled with dampening thresholds or other countermeasures where applicable.
- Phase 4. Groundwater: Building on Phase 3 all remaining model components will be imported. These include the GW regions and associated mesh elements, more detailed soils data and all Green-Ampt and groundwater look-up tables.

After each import step the model will be run to simulate the runoff response resulting from the addition of each new element. Errors in the model set up will be fixed and erroneous import data will be resolved in model set at each build increment. These updates will be made in both the StormWise model and the digital replica. Additionally, the mesh resolution will be reviewed to confirm adequate representation of hydraulic detail and to locate oddities in model results for refinement of geometry or parameterization. Based on the observed run times and model results, determine if the mesh resolution and additional geometric detail are required to meet the project needs. At the completion of this task, overland flow and groundwater flow mesh elements will be exported into the digital replica.

Task 5B: Initial Model Run and Review of Model Issues

- After incremental model build, all calibration/validation events will be simulated to confirm the model set up for all events.
- Perform sensitivity analysis to support identification of gaps or characterization issues with the preliminary model set up and to target calibration parameter adjustments. The sensitivity analysis will include up to twenty (20) independent parameter, boundary condition, or initial condition adjustments.
    - One (1) event will be selected for sensitivity analysis.
    - A sensitivity analysis will be conducted on the key hydraulic, hydrologic, and groundwater parameters to understand the impact of the parameter value adjustments on the model results, and to help identify the ranges of values to be used for calibration simulations. Parameters for adjustment may include those that control infiltration, groundwater response, and surface runoff response.

Sensitivity runs may also include an initial condition assessment, and the impacts of various surface water and ground water boundary conditions.

- Sensitivity simulations will be compared to watershed observations and use the calibration metrics selected in Task 2 to quantify the goodness of fit of each model run. Statistic and graphical comparisons will be performed in a Microsoft Excel environment.

Task 5C: Document Data Gaps or Issues

- Data gaps, erroneous input data, and initial parameterization challenges found in Task 5b will be aggregated into a Technical Memorandum in this task. Due to the incremental approach to the model build, identification of when, where, and how impactful model issues will be identified and documented systematically.
- Using a relative scoring system, data gaps will be prioritized based on the importance to model performance of each gap. Hydraulic importance may weigh in upstream area, expected storage volume, and downstream impact.
- HDR will review the Upper Watershed Model developed by the District for consistency with the modeling approach developed during Task 2 and updated by HDR and the District through Tasks 3, 4, and 5. This task includes one (1) model review. The general review comments and recommendations will be summarized in a memo with detailed comments listed in a table and provided to the District for comment resolution.
    - HDR anticipates that the District will provide documentation on development of the upper watershed model, and a StormWise model with results files for a single model run.
    - The review will include:
        - Spot checks to confirm that model input data are consistent with the source data but will not check in detail all the model elements.
        - Review of the model for consistency of development within the guidance documents.
        - Overall general appropriate model set up and reasonable simulated response.

Task 5: Deliverables

- StormWise model that has been developed based on datasets created in Task 4 and modeling guidelines in Task 2
- A technical memorandum for the Lower Watershed Model that summarizes:
    - The location of the data gap or erroneous data
    - The nature of the data gap or erroneous data
    - The relative magnitude or importance of the data gap or erroneous data
    - A prioritized list of data gaps that need to be filled via requesting data from partner agencies or field data collection
- A second technical memorandum that summarizes HDR's review and recommendations of the Upper Watershed Model built by MCWD staff

Task 5: Assumptions

- Up to one (1) round of unified comments on the Lower Watershed Model Technical Memorandum will be addressed.
- Digital replica will be a GIS representation of the modeled features and will contain only modeled elements.
- Tools for model review and data integration used by HDR will be shared with the District.
- Digital replica will be for only the lower watershed model, it is assumed the District will develop a digital replica for the upper watershed model.
- Terrain manipulation does not include manual conversion of paper/PDF lake contour maps.
- Modeling methods will be based on consensus reached as part of the Task 2 workshops and deliverables the process detailed here is the approach used for budgeting purposes and significant deviations in level of effort that result from Task 2 will need to be discussed between HDR and the District.
- Model results at the completion of this phase are not final and therefore will not be expected to meet statistical and visual requirements set forth in Task 2.
- Review of the Lower Watershed Model will be performed by the District and the District's external advisory team. Up to one (1) round of unified comments on the Lower Watershed Model will be addressed.
- Development of the Upper Watershed Model by MCWD will follow the guidance documentation developed as part of Task 2 and an overall similar approach and schedule as HDR for Task 5.
- HDR will review of the Upper Watershed model for consistency and overall set up.
- The District will follow a similar model development timeline to HDR so HDR can review the Upper Watershed Model while the Lower Watershed Model memorandum is reviewed by the District.

Task 6: Data Collection and Processing Planning

Upon completion of the initial model build (Task 5), HDR will work in partnership with the District to identify and strategically prioritize missing, low-resolution, or poorly represented datasets that will provide benefit to the accuracy of the watershed-wide hydraulic and hydrologic model.

Task 6A: Data Collection Prioritization

- Data gaps identified as part of previous tasks (Task 1, Task 3, and Task 5) will be aggregated for prioritization. Gaps are anticipated to be primarily related to surface storage features.
- Following the process determined as part of Task 5C, each of the gaps will be assigned a level of hydraulic importance.
- Using relative scoring, each gap fill approach will also be assigned a level of uncertainty which may be based on the source, relative accuracy, level of effort associated with collecting or implementing the cap fill approach, and applicability of the source data or approach.

- Prioritization will combine the level of importance with the uncertainty in the gap fill approach to target items for data collection.
- Gaps will be filled based on the quality of available data, and may include existing models, third party datasets, as-builts, or record drawings.
- In partnership with MCWD, HDR will develop and standardize proposed data collection methods as necessary to clearly define roles, expectations, and datatypes. This process will include developing the following:
    - A prioritized list of data for data collection or mining.
    - Data collection forms based on the prioritized data to be collected. These forms will be provided to the District in a format that can be used for future data collection efforts.
    - A data request plan for data sources the District hasn't obtained from partner agencies or other data sources.
    - A collection plan for prioritized data that outlines the data collection locations, approach for collecting or obtaining data, data format, necessary processing, property access for field data collection, and collection methods.
    - A list of necessary data collection needs, such as property access, partner agency requests, and data mining, from the District.

Task 6B: Data Collection and Data Entry

- HDR, along with Stonebrooke will execute data collection and geospatial data mining efforts approved by the District in Task 6a. Field data collection will proceed after the existing data gaps are documented and prioritized. In collaboration with district staff our team will commence field work and collect data outlined within the collection plan. The data collection is planned to take place after ponding areas have thawed and before most vegetation is in full leaf out condition.
- The budget established for this task allows for four (4) weeks of field data collection. The location and number of sites that need data to be collected are currently unknown and earlier tasks in the project will define what will be collected within the available budget. Both Two-Person and One-Person crews will be available to perform the field data collection. Depending on the site conditions the most efficient method that also provides proper safety for the field staff will be used.
- A Two-Person Crew will be used when working near open water. A Two-Person Crew will also be used if there are other safety concerns or if there are factors that make a Two-Person Crew more efficient than a One-Person crew.
- Geospatial data will be collected with survey grade GNSS receivers, survey devices, and software. We will use NAD 1983 UTM Zone 15N as the horizontal spatial reference and NAVD88 as the vertical datum. Once the data collection needs are established a custom feature data library will be created to improve the speed and accuracy of entering attribute information in the data collection software.
- HDR and Stonebrooke will collaborate closely with the District regarding necessary private property owner access, or other needs as identified in Task 6a.
- Data will be formatted for use with Python scripts developed as part of Task 4.

Task 6C: Data Processing

- HDR will use the refined Python scripts developed in Task 4 to process data collected in Task 6b. These outputs will be presented in a format that is model-ready, and compatible with GIS software including proper georeferencing and data schema.
- HDR will consider updating Python scripts to improve data collection and processing.

Task 6: Deliverables

- Data field form templates for data collection and future use by the District.
- Technical memorandum summarizing the Data Collection Plan and Data Request Plan.
- Data Register developed as part of Task 1 will be updated to include additional collected datasets.
- Geodatabase(s) of watershed-wide model-ready datasets based on the model approach.
- Metadata will be developed for data collected.

Task 6: Assumptions

- Python scripts developed as part of Task 4 will be approved prior to commencement of this task.
- Data collection and gap filling will focus on elements (e.g. conduits, storage features, bridges) to be included in the model, as determined in Task 2.
- Data collection and gap filling will occur for the upper and lower watershed areas.
- Prioritization of data to be collected, and data collection methods will consider limitations of not to exceed budget provided.
- District is responsible for obtaining access to private property.
- Field survey is limited to 20 days of data collection performed by a 2-person crew.

Task 7: Model Build

The final model build will use the results of Task 5 and Task 6 to construct a model ready for calibration and validation. Through calibration and validation, model parameterization approaches and parameters will be refined to represent the watershed system response more accurately. As the Project Team proceeds through the Upper and Lower model calibration and validation, technical alignment calls and working sessions will occur regularly to navigate challenges and decision points as they arise.

Task 7A: Model Build

- The final model build is anticipated to use findings from the preliminary model build (Task 5) and the additional data collection and processing (Task 6) to develop a final model ready for calibration. Adjustments to the surface mesh, groundwater mesh, 1D network, stormwater network, and channels/ponds will be made in Task 7a based findings from Tasks 5 and 6 and run time needs coordinated with the District.
- Once the model is updated, simulations will be performed to understand the runoff response resulting from the addition of new data. Errors in the model set up will be fixed and erroneous import data will be resolved in model set. These updates will be made in

both the StormWise model and the digital replica. Additionally, the mesh resolution will be reviewed to confirm adequate representation of hydraulic detail and to locate oddities in model results for refinement of geometry or parameterization. Based on the observed run times and model results, determine if the mesh resolution and additional geometric detail are required to meet the project needs. At the completion of this task, overland flow and groundwater flow mesh elements will be exported into the digital replica.

Task 7B: Model Calibration and Validation

- Workshops held in Task 2 will select calibration and validation performance metrics, performance criteria, and calibration events and periods. It is assumed that calibration will be performed on one (1) long term period (up to one year) and two (2) events (up to two weeks each), and validation will be performed on one (1) long term period and one (1) event.
- The model will be calibrated and validated to observed stream flow, stream stage, lake levels, and groundwater elevations.
    - Stream flow and stage will be calibrated and validated at up to three (3) locations including USGS stream flow and stage observations near the downstream model limits (USGS 05289800), and up to two (2) other stream flow/stage observations from other high-quality sources.
    - Lake elevations will be calibrated and validated at up to three (3) locations spread throughout the lower watershed area. Data sources may include monitoring by the District, MNDNR, and/or other high-quality sources.
    - Groundwater elevations will be calibrated and validated at up to five (5) locations spread throughout the lower watershed area. Data sources may include observation wells operated by the District, MNDNR, and/or other high-quality sources.
- Discrepancies between simulated and observed data will be reconciled through systematic adjustment of model parameters and/or modification to the spatial characterization watershed characteristics to better replicate the watershed response.
- Performance metrics will include statistical and graphical and will be applied to the time series of simulated and observed stream stage, stream flow, and groundwater elevation data.
- Calibration
    - Calibration of the event conditions may start with completing the long-term calibration to better understanding the baseflow conditions, and to support characterization of various initial wetness conditions. Or may start with the event used for sensitivity analysis to leverage learnings on parameter adjustments specific to that event.
    - Long term calibration will first target characterizing the volume of water leaving the system, then appropriate partitioning of evapotranspiration and total watershed runoff over the period, the amount of baseflow between events, then rainfall and runoff from each event, and finally the peak and timing of each event response.

    - Long term simulations are anticipated to include a less stringent calibration criteria, may focus on flow and discharge more than stage, and calibration comparison may occur at a longer interval (days instead of each output interval).
    - Calibration of a single event will adjust parameters to refine total runoff volumes, peak flows, and finally peak water surface elevations.
    - Calibration will focus on parameters that are uncertain or assumed and not on those primarily based on physical measurements.
    - Calibration is anticipated to be iterative, such that previously calibrated scenarios may be modified with an improved watershed representation with the intent to create a unified parameter set at the outset of calibration.
    - Final calibrated parameters will be a merge of parameters from previous calibration events to form a single validation parameter set.
- Validation will use the validation parameter set selected as part of calibration and simulate the long term and single event validation scenarios. Statistical and graphical comparisons between observed and simulated data will follow the same approach as calibration.
- HDR will review the Upper Watershed Model developed by the District for consistency with the modeling approach developed during Task 2 and updated by HDR and the District through the remaining project duration. This task includes one (1) model review. The general review comments and recommendations will be summarized in a memo with detailed comments listed in a table and provided to the District for comment resolution.
    - HDR anticipates that the District will provide documentation on development, calibration, and validation of the upper watershed model, and a StormWise model with results files for final calibration and validation simulations.
    - The review will include:
        - Spot checks to confirm that model input data are consistent with the source data in areas updated since Task 5.
        - Review of the model for consistency of development within the guidance documents.
        - Overall general appropriate model set up and reasonable simulated response.
        - Review of watershed response relative to calibration and validation events.

Task 7C: Model Build Report

- HDR will develop a technical memorandum documenting the calibration and validation.
- HDR will develop a summary report which references and appends the previously developed technical memorandum. The report is anticipated to provide the overarching description of the project as a whole including: Introduction and background, summary of data used for model development, description of automated procedures used to develop model inputs, additional non-scripted processing required to develop model inputs, documentation of additional data collection to fill critical gaps, an assessment of the

model based on calibration and validation, additional tasks to support refinement of the existing model, and model maintenance.

Task 7: Deliverables

- Calibrated StormWise model for the Lower watershed of MCWD including updated data collected as part of Task 6.
- Technical Memorandum documenting the calibration and validation of the lower watershed model.
- Standardized watershed modeling report outline that can be used for the Upper and Lower Watershed Model
- Technical memorandum that summarizes the HDR's review and recommendations of the Upper Watershed Model built by MCWD staff
- Draft Summary Report for the Lower Watershed
- Final Summary Report for the Lower Watershed

Task 7: Assumptions

- Up to one (1) round of unified comments on the Calibration and Validation Technical Memorandum will be addressed.
- Up to one (1) round of unified comments on the Draft Modeling Report for the Lower Watershed will be addressed.
- Up to one (1) round of unified comments on the Final Modeling Report for the Lower Watershed will be addressed.
- Upper and Lower Watershed Models will not be combined.
- Lower Watershed Model will be calibrated and validation using an upstream surface boundary condition of observed water levels, flow, and/or historical operations.
- Modeling methods will be based on consensus reached as part of the Task 2 workshops and deliverables the process detailed here is a proposed approach for discussion and cost estimation purposes.
- Measures of model performance may require additional leniency pending model runtimes and project schedule limitations.
- Review of the Lower Watershed Model will be performed by the District and the District's external advisory team. Up to one (1) round of unified comments on the Lower Watershed Model will be addressed.

3B MILESTONES + DELIVERABLES

We propose the following schedule, following the timeline proposed in the LCCMR Grant. This schedule can be adjusted per coordination with MCWD.

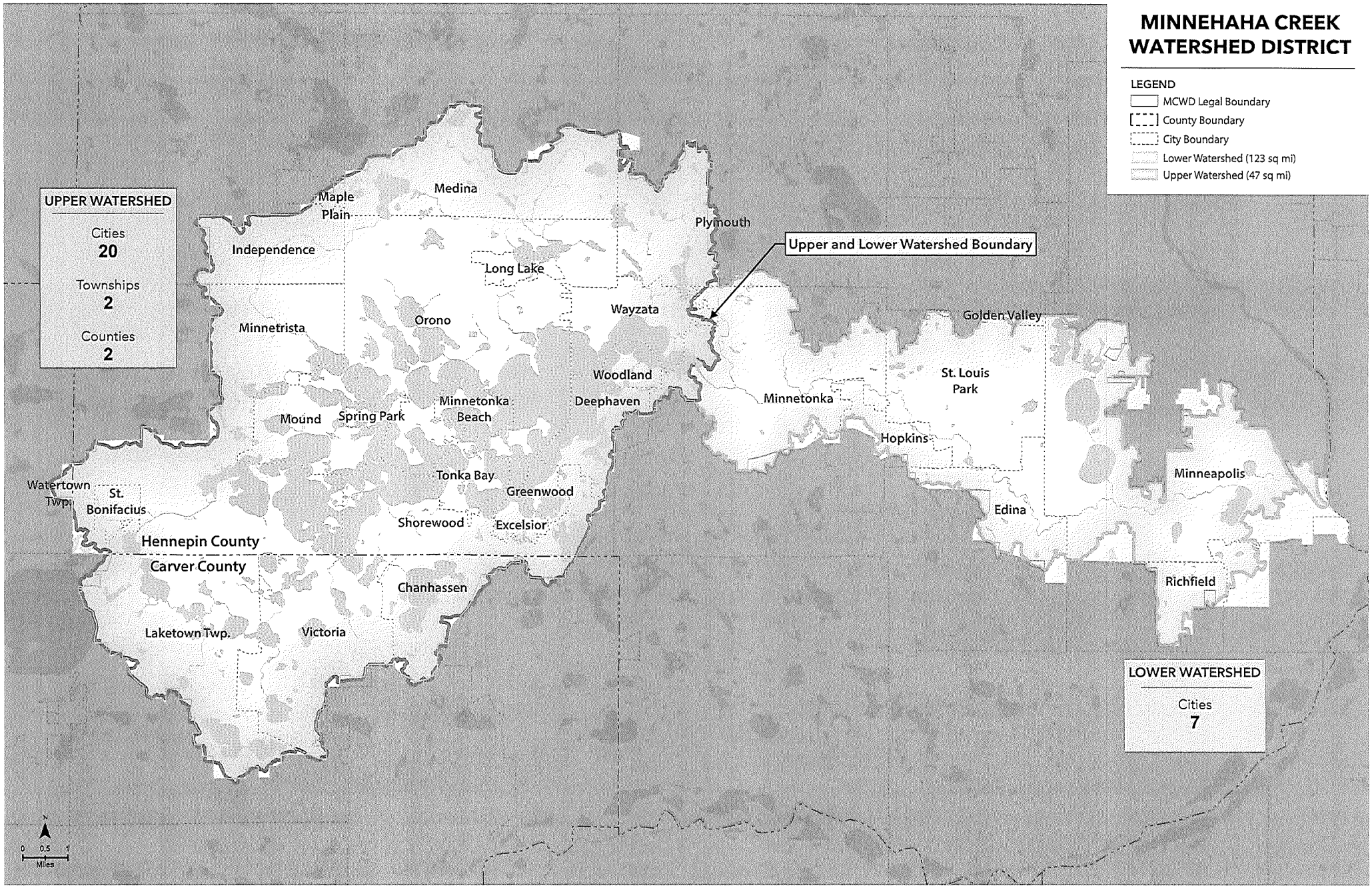
TASK	TASK DESCRIPTION	2024 APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	2025 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
	Notice to Proceed	4/18																	
01	**Data Discovery and Data Review**																		
1A	Data Discovery																		
1B	Data Review Documentation																		
02	**Model Build Approach**																		
	Workshop 1 - Goal Setting and Prioritization																		
	Workshop 2 - Surface Water Model Build																		
	Workshop 3 - Groundwater Model Build																		
	Workshop 4 - Model Validation and Maintenance																		
03	**Non-Pipe Stormwater Dataset**																		
3A	Non-Pipe Stormwater Dataset Strategy Development																		
3B	Initial Non-Pipe Stormwater Data Mining and Data Collection																		
04	**Review and Refinement of Programmatic Data Processing Scripts**																		
4A	Existing Stormwater Infrastructure Script Review																		
4B	Existing Stormwater Infrastructure Script Refinement																		
4C	Script Documentation																		
05	**Preliminary Model Build**																		
5A	Model Build																		
5B	Initial Model Run and Review of Model Issues																		
5B	Review District Model Build																		
5C	Document Data Gaps or Issues																		
06	**Data Collection and Processing Planning**																		
6A	Data Collection Prioritization																		
6B	Data Collection and Data Entry																		
6C	Data Processing																		
07	**Model Build**																		
7A	Model Build																		
7B	Calibration and Validation																		
7C	Model Build Report																		

Tasks ■ Meetings — Dependencies

3C COST

PROPOSED BUDGET

TASK NO.	DESCRIPTION	HDR PROFESSIONAL STAFF HOURS																		COSTS			
		ANDREW JUDD	NICK THOMAS	KEN TREFZGER	BRYCE CRUEY	ALEX MILLER	RYAN FUGGI	ZAINE ARTH	RIKITA PATEL	SEAN TUOHEY	BRYAN BLAISDELL	AMBER RITCHIE	MIKE MCMAHON	TED SHANNON	KRISTY JUNGERS	ERIC BRENTON	KELTON BARR LLC	STONEBROOKE ENGINEERING	HDR HOURS	HDR SUB HOURS	HDR LABOR FEE	HDR SUB LABOR FEE	EXPENSES	TOTAL
	Billing Rates	$260	$180	$280	$250	$165	$185	$155	$135	$170	$230	$170	$285	$230	$140	$110	$180	$250	--	--	--	--	--	--
1	Data Discovery and Data Review	8	32	4	4	48	16	0	0	48	16	24	16	8	2	2	20	0	228	20	$43,660	$3,600	$0	$47,260
2	Model Build Approach	20	40	8	4	50	0	0	32	16	0	8	0	0	2	0	4	0	180	4	$32,570	$720	$3680	$36,970
3	Non-pipe Stormwater Dataset	16	24	12	12	40	80	0	100	48	16	0	0	32	2	2	0	0	384	0	$69,440	$0	$0	$69,440
4	Review and Refinement of Programmic Data	24	36	8	8	42	52	0	0	48	152	0	0	24	2	4	0	0	400	0	$82,870	$0	$0	$82,870
5	Preliminary Model	32	88	8	8	180	80	68	80	24	16	40	40	44	4	4	16	0	716	16	$131,320	$2,880	$0	$134,200
6	Data Collection and Processing Planning	24	48	8	8	56	72	0	80	24	48	12	0	8	4	4	0	178	396	178	$72,480	$44,500	$0	$116,980
7	Model Build	40	128	12	12	180	72	48	84	16	16	32	8	20	4	4	14	0	676	14	$121,320	$2,520	$0	$123,840
	Totals	**164**	**396**	**60**	**56**	**596**	**372**	**116**	**376**	**224**	**264**	**116**	**64**	**136**	**20**	**20**	**54**	**178**	**2980**	**232**	**$553,660**	**$54,220**	**$3,680**	**$611,560**


MINNEHAHA CREEK WATERSHED DISTRICT
LEGEND
MCWD Legal Boundary
County Boundary
City Boundary
Lower Watershed (123 sq mi)
Upper Watershed (47 sq mi)
UPPER WATERSHED
Cities
20
Townships
2
Counties
2
Upper and Lower Watershed Boundary
Maple Plain
Medina
Plymouth
Independence
Long Lake
Wayzata
Orono
Minnetrista
Golden Valley
Woodland
St. Louis Park
Minnetonka
Deephaven
Minnetonka Beach
Mound
Spring Park
Hopkins
Tonka Bay
Minneapolis
Watertown Twp.
St. Bonifacius
Greenwood
Edina
Shorewood
Excelsior
Hennepin County
Carver County
Chanhassen
Richfield
Laketown Twp.
Victoria
LOWER WATERSHED
Cities
7
N
0 0.5 1
Miles

MCWD 2D Model Agreement

Final Audit Report 2024-04-17

Created:	2024-04-11
By:	Deb Johnson (officeadministrator@minnehahacreek.org)
Status:	Signed
Transaction ID:	CBJCHBCAABAA-GP6exxuuz5V23WPMb8_R3U1f-LHBep4

"MCWD 2D Model Agreement" History

Document created by Deb Johnson (officeadministrator@minnehahacreek.org)
2024-04-11 - 3:47:14 PM GMT

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Agreement completed.
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February 20, 2026

Dear Brian Beck,

The Minnehaha Creek Watershed District (MCWD) is developing a watershed-wide model to support the Climate Action Framework (CAF). Through the model, MCWD will be capable of understanding and predicting the impacts of current and future climate conditions. Future applications of the model, beyond the scope of this project, will evaluate the impacts of future climate on flood risk and how projects, policies, and operational actions may alter those impacts.

HDR and MCWD (Project Team) are working collaboratively to develop a model through a shared understanding of model goals and shared decision-making process. The Project Team is nearing completion of the model build and have defined the tasks and level of effort required to complete. Additional project budget will be required to complete the model build.

The budget increase is mainly due to additional efforts focused on:

- The readiness of the stormsewer infrastructure datasets for use in the scripting process,
- The readiness of the scripts which convert the delivered municipal data into model ready format, and
- A more involved decision-making processes than anticipated.

These tasks and their impact to scope, schedule, and budget were discussed between HDR and MCWD when they were encountered and an approach defined with an understanding that we would continue monitoring and adjusting to balance between project goals and budgetary and schedule constraints. The project team also made adjustments to the scope to save budget in other areas, which included a more streamlined data collection and calibration/validation process.

At this time a preliminary model has been built, reviewed by external technical experts, and the remaining process to complete model development has been identified through discussion with MCWD staff. The remaining tasks include incorporating improvements in the model identified through external review or known as part of the preliminary model development, calibration of the model to up to two flood events, and documentation of these tasks.

hdrinc.com

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It is anticipated that the remaining cost to complete these tasks will be $56,000. There is $23,000 remaining in the budget requiring, and an additional $33,000 to complete the tasks as described above. HDR acknowledges that some of the unanticipated time associated with decision making was required for Project Team alignment and we are willing to cover those costs of $5,000. This request is for an additional $28,000 to support the remaining items listed above. The anticipated completion date of these tasks is April 30, 2026. The table below provides a summary of remaining tasks and cost to complete.

Sincerely,
HDR Engineering Inc.

Nicholas Thomas
Technical Project Manager

Andrew Judd
Project Manager

Task	Total
Update Model	$ 29,000
Calibration	$ 13,000
Reporting/Coordination	$ 14,000
Cost to Complete	$ 56,000
Budget Remaining	$ (23,000)
HDR Covered Costs	$ (5,000)
Total Requested Amendment	**$ 28,000**