

April 3, 2023

Jodi Knaus
East Range Water Board
PO Box 146
16 West Second Avenue North
Aurora, MN 55705

Re: Embarrass Pit Groundwater Model Update

Dear Ms. Knaus:

Barr Engineering Company (Barr) is pleased to submit a proposal to update Barr's existing surface water/groundwater model of the Embarrass Pit (aka, Lake Mine). Barr previously developed a MODFLOW model of the Embarrass Pit and vicinity in 2015 and used it to simulate future scenarios in which the City of Biwabik, the City of Aurora, the City of Hoyt Lakes, and the Town of White all used the Embarrass Pit as their source of drinking water. In 2023, Biwabik is now using Embarrass Pit water and an upcoming project will design and construct a new Embarrass Pit intake and treatment plant to supply water to Aurora and White. The Minnesota Department of Natural Resources (DNR) requested that the 2015 model be updated to reflect present-day conditions that include Biwabik's withdrawals and simulate a future condition with additional pumping for Aurora and White. This proposal contains a scope of work designed to satisfy the DNR's request.

Scope of Work

Barr's proposed scope of work for the groundwater model update includes 4 tasks:

Task 1: Meetings

This task assumes that two meetings will take place prior to Barr beginning the work:

1. A one-hour project kickoff meeting with Barr, SEH, and East Range Water Board (ERWB) staff, and
2. A one-hour conference call with DNR staff to discuss the modeling approach and obtain concurrence on the details of the analyses.

We assume that two Barr staff will virtually attend each of these meetings. If significant deviations from the proposed modeling scope are identified based on the conference call with the DNR, Barr will discuss the project changes with SEH and the ERWB prior to beginning the work.

Task 2: Model Updates and Recalibration

The DNR's request to update the existing model to present-day conditions will require a recalibration. Model calibration is the process of adjusting model parameter values until the model outputs acceptably match actual measurements of historical lake stages and groundwater levels. The 2015 calibration consisted of two components: a steady-state calibration to 2013 conditions and a transient (i.e., time-varying) calibration to 1964-1972 conditions when the Embarrass Pit water level was recovering after mine dewatering had ceased. We propose to use the same calibration approach as before but update the steady-state component of the calibration to represent present-day conditions instead of 2013 conditions. This will require the following information:

- Current stage measurements for Embarrass Pit, Embarrass Lake, Wynne Lake, and Sabin Lake. We assume that SEH/ERWB will provide this information. Our scope does not include time for Barr staff to collect these measurements in the field.
- Current Biwabik pumping rates from the Embarrass Pit, also to be provided by SEH/ERWB. The MPARS database shows zero pumping for permit 2015-1065 through 2021.
- Current pumping rates for Giants Ridge from the Embarrass Pit. This data should be available from MPARS but may need to be requested from IRRRB.

Besides updating the calibration dataset, Barr proposes to make revisions to the model's representations of Wynne Lake, Sabin Lake, and the Embarrass River to incorporate data regarding lake outlet elevations and streamflow that were not available in 2015. The model fit to Wynne and Sabin Lakes was sub-optimal in the 2015 steady-state calibration, and these revisions are expected to improve the fit to the present-day Wynne Lake and Sabin Lake levels in the steady-state recalibration.

Task 3: Predictive Simulation

The updated and recalibrated model will be used to forecast how the future withdrawals for Aurora and White will affect the Embarrass Pit stage, regional groundwater levels, and water levels in other nearby lakes. We assume one steady-state predictive simulation that includes withdrawal for Aurora and White at a rate to be provided by SEH. The forecasted water levels are important to the overall Water Appropriations Permitting process and to inform the design of the new Embarrass Pit intake.

Task 4: Technical Memorandum

Barr will prepare a 5- to 10-page technical memorandum to document the model updates, model recalibration, and results of the predictive simulation. The memorandum will be developed in draft form and reviewed by stakeholders (SEH and ERWB) before it is finalized. Our cost estimate assumes that only minor changes will be made to the document based on the stakeholder review.

Project Management and Staff Assignments

Barr approaches each project by assigning a team of professionals that is structured based upon the specific project needs. Each professional's experience is integrated to the project to achieve effective

solutions to the project challenges. For the successful completion of any project, Barr provides an experienced and dedicated project team to provide services in a cost effective and timely manner.

The typical **Project Team** consists of a **Principal In Charge** (PIC), a **Project Manager**, and **Professional, Technical** and **Support Staff**, which collectively form the Project Team. The team concept has been successful at Barr because each member shares in direct responsibility and accountability for their share of the project to the Project Manager. The following is the list of consulting staff that will likely be used for this project. Specific staff assignments will be based on availability and project timing.

Team Member	Title/Role	Chargeable Rate
Pete Kero	Principal in Charge	\$205
Adam Janzen	Project Manager/Groundwater Modeler	\$170
Jim Lind	GIS Specialist	\$130
Various	Administrative Support	\$100-\$125

Estimated Schedule and Costs

Barr is prepared to begin the scope of this project immediately. The work will take approximately two to three months to complete after the conference call with the DNR.

Based on our experiences on similar projects, Barr has prepared the following cost estimate for consulting tasks required to complete the proposed scope of work. Barr proposes to provide our professional services on a time and materials basis in accordance with our current standard fee schedule. In the event that significant changes to scope and corresponding budget estimates are identified through implementation of the work, recommendations for scope and budget adjustments will be presented to SEH/ERWB for review and consideration.

Task	Cost Estimate
Task 1: Meetings	\$1,700
Task 2: Model Updates and Recalibration	\$11,000
Task 3: Predictive Simulation	\$3,000
Task 4: Technical Memorandum	\$4,300
Total	\$20,000

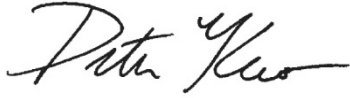
Invoicing

Barr will be contracted to ERWB and we will invoice ERWB once every four weeks. Each invoice will include a preamble describing the work performed and the number of hours worked by each individual employee.

Thank you again for the opportunity to provide assistance on your project. If you have any questions, please call me at 218-262-8611 (or email at PKero@barr.com).

Sincerely,

Barr Engineering Company



Pete Kero, PE
Senior Environmental Engineer
Vice President, Principal in Charge



Adam Janzen, PE
Senior Environmental Engineer
Project Manager