technical memo

Project Name |	Trout Habitat Preservation Project (THPP)	**Date** |	5/03/2023
To / Contact info |	BCWD Board of Managers		
Cc / Contact info |	Karen Kill, District Administrator		
From / Contact info |	Derek R. Lash, PE, CPESC		
Regarding |	THPP Trench Inspection Results		

Background

At the February 9, 2022, Board Meeting, EOR presented the Board with a technical memorandum summarizing the performance of the Trout Habitat Preservation Project (THPP) through 2021. The main finding of that memorandum is that the THPP is experiencing decreased performance and needs a retrofit. In response to the finding, the BCWD Board of Managers requested that EOR submit a scope of services to conduct a feasibility study to evaluate retrofit options for the project.

At the June 8, 2022, Board Meeting Derek Lash and Camilla Correll presented a scope and fee estimate summarizing work for a THPP Retrofit Feasibility Study. The Board of Managers asked whether lower-cost options – such as asking a neighboring farmer to scarify the basins to increase infiltration was an option. The managers requested to schedule a site visit with staff and managers to help the managers better understand the issues and options.

On July 27th BCWD managers and staff, as well as EOR staff visited the site.

At the August 10, 2022, Board meeting Derek Lash and Camilla Correll attended the meeting to discuss next steps following the site visit. Derek revisited the engineer's memo reviewing options for improving performance of the stormwater infiltration facilities constructed for the THPP.

The managers discussed the infiltration trench which was added to the THPP in 2007 and its impact on the overall performance of the project. Karen Kill described the overall performance of the system by citing the infiltration rates included in the 2021 THPP Monitoring Report. The managers discussed task 3 specifically, which would provide infiltration rate information on the trench investigation to determine where the system has failed (e.g., at the surface under the gravel filter or at the bottom at the BMP interface with the underlying soils).

Inspection Summary and Results

On October 27, 2022, engineering staff from EOR visited the THPP site to perform an inspection of the infiltration trench. Staff included Derek Lash, Ellen Kimlinger, Brian Rucker, and Jay Michels. The tasks included a visual inspection of the trench surface and assessment of the infiltration performance of the trench. Per the Minnesota Stormwater Manual (Stormwater Manual) visual inspection is a Level 1 Assessment and infiltration performance (Capacity Testing) is a Level 2 Assessment. For this inspection, a standard Level 1 Assessment and a non-standard Level 2 Assessment was performed. A Level 1 Assessment typically takes one day to complete, and a standard Level 2 Assessment can take up to a week for a more rigorous test. For reference, the Stormwater Manual includes four levels of assessment. In the end, the objective is to determine if the stormwater BMP is malfunctioning.

Trench Dimensions

The EOR team measured the horizontal dimensions of the trench surface and the depth to the bottom of the PVC pipe observation well. Based on the visible pea gravel the trench surface measurements were similar (8-feet wide X 20-feet long) to those specified on the THPP Infiltration Trench & Outlet Modification plan set dated October 2006. However, the depth measured approximately seven (7) feet deep compared to the 10-foot depth as specified on the plan set. It is important to acknowledge the plan set includes a note that states "The trench depth may vary depending on soils found. Modified as directed by the Engineer." Therefore, it is presumed the trench was constructed to a depth where suitable soil (sand) was encountered as described in the THPP Infiltration Recovery Technical Memorandum prepared by EOR staff on April 6, 2006. The 2006 memorandum included results from soil borings drilled in the vicinity of the trench which indicated coarse sand between two (2) and 10 feet below the ground surface.

Trench Surface

In addition to recording dimensions of the trench, samples of the pea gravel surface material were collected and submitted to a soil testing laboratory to determine the particle size distribution. Pea gravel is typically considered a 3/8-inch diameter aggregate and is usually washed to remove smaller soil particles such as silt and clay. Samples collected appeared to be relatively clean, which was supported by the laboratory material test report indicating no more than 4.5% of the material passing the No. 200 (P200) or 75-micron (0.0029 inches / 0.07366 millimeters) Sieve Size. In comparison, the Stormwater Manual engineered (bioretention) media mix specification for infiltration or modified filtration practices typically specifies a portion of the mix to include construction sand with a maximum percentage of material passing the No. 200 Sieve Size of 3%.

The filter fabric specified on the plan set was to be a material with a transmissivity of no less than 100 gallons per minute. For infiltration trenches, the Stormwater Manual specifies a Minnesota Department of Transportation (MnDOT) Type I non-woven geotextile (Mirafi 140N, Amoco 4547, Geotex 451, etc.). The filter fabric reviewed in the 2007 photo construction record appears to be a woven monofilament silt fence type material given the narrow strips (3-feet +/-) that were installed versus a roll of fabric that is typically the full width (10-feet) of the trench.

Infiltration Performance

Following the review of the trench geometry and surface materials, the trench was then flooded with water pumped from the adjacent pond. The pond water was visually clean with no sediment or debris observed. The pumped water filled the trench and covered the entire surface in approximately 45 minutes. Once the trench was filled, EOR staff recorded the infiltration rate and observed the water to draw down 32 inches (2.67-feet) below the trench surface in approximately one (1) hour. Given the high rate of infiltration, the recording time to drain the trench was stopped after the first hour. Based on the observed infiltration rate, it is presumed it would take an additional 1.5 to 3 hours to fully drain the trench under the field conditions.

Conclusions and Next Steps

The trench dimensions measured in the field reflect the width, length, and depth as specified in the THPP Infiltration Trench & Outlet Modification plan set dated October 2006. In addition, the surface is covered with approximately 4 inches of pea gravel and filter fabric in accordance with the plans, though it is not known if the filter fabric meets the specification of 100 gallons per minute transmissivity.

The trench surface pea gravel appeared relatively clean, and based on the findings from the laboratory results the amount of silt and clay material is minimal (P200 allowable of 3.0% versus measured of 4.5%).

Lastly, the infiltration performance appears more than adequate to meet industry standards of an infiltration trench. Per the Stormwater Manual the drawdown period for an infiltration practice is typically 48 hours (generally for BMPs with vegetation) which is a performance characteristic a Level 1 Analysis cannot confirm. But, given how quickly the trench drained it is presumed it would meet this standard under dry conditions. The caveat being, the inspection was performed on a dry trench with no water in the adjacent pond, which may impact the trench performance if standing water or ground water impedes flow from the trench.

In conclusion, the results of inspecting the THPPP trench suggest it has sufficient capacity to continue to function as designed. However, it is still unknown why the infiltration rate for the infiltration basin has depreciated as observed in the 2021 monitoring. We recommend testing the lower elevations of the infiltration basin following the protocols of a Level 2 Assessment that is used to determine infiltration capacity or rates. The cost to perform that work can be found in the following table and will take approximately 2 days to complete the field testing and 1 to 2 days to prepare a summary of the testing. This work will primarily be performed by a geotechnical testing firm using a Double Ring Infiltrometer or similar device.

Additional Testing Scope

The following table outlines the cost and hours anticipated for testing the infiltration basin.

Task	Description	Hours	Cost
1. EOR Project Management & Coordination	Coordinate the testing work with a geotechnical subconsultant to conduct infiltration testing. Prepare a summary of results.	10 to 15	$2,100.00
2. Geotechnical Subcontractor Infiltration Testing	Conduct up to four double-ring infiltrometer or similar tests on the large infiltration basin. Perform side by side tests on the existing vegetation and sediment, as well as on an area void of vegetation or sediment.	20 to 30	$4,400.00
	Total	**30 to 45**	**$6,500.00**

If approved, this work would be conducted in the summer once the basin has dried.

Requested Action

Authorize the engineer to coordinate and manage infiltration testing for not to exceed $2,100 and subcontract for geotechnical investigation for not to exceed $4,400.