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Memorandum

To: Freeway Landfill Steering and Technical Advisory Committees
From: Barr Engineering Co.
Subject: Technical Advisory Committee Meeting Held on 2/24/15
Date: 2/26/2015
Project: 23/19 1241.02

The Technical Advisory Committee (TAC) for the Freeway Landfill site in Burnsville met at Barr on2/24/2015. The following topics were discussed:

- Status of review of historical project information by Barr and the MPCA
- Status of Barr's groundwater modeling efforts related to current hydrogeologic conditions around the landfill area and a future scenario related to reduced pumping post-quarry closure
- Discussion of additional tasks to assist the decision making process by the Steering Committee

As Barr has advanced our work over the past month, there have been emerging insights for some key issues that have been under discussion with the TAC, especially related to the presence of shallow groundwater at the Freeway Landfill. Review of the extensive historical information is on-going, but the following paragraphs provide a brief summary of the progress to date to allow consideration of this information for the upcoming Steering Committee meeting on 2/27/15. The information in this memorandum includes a summary of the discussion at the 2/24/2015 TAC meeting.

Emerging Information from File Reviews

One topic of discussion for the TAC involved the potential for waste in the Freeway Landfill to come into contact with water as part of either infiltration from above the landfill waste or upwelling from below due to future changes to pumping at the Kramer Quarry. Early hydrologic and hydrogeologic investigations in 1970 interpreted that the shallow water table beneath the site where the Landfill is now located flowed to the north towards the Minnesota River, and the shallow groundwater table was generally present near or above the top of the Prairie du Chien bedrock surface. Groundwater information from the 1970 data included a groundwater elevation contour map depicting the surface of the groundwater at that time. At that time, the Kramer Quarry located south of the Landfill involved shallower mining operations and was pumping at much lower rates compared to current conditions. The observed conditions from 1970 provides insight for the potential "rebound" of the water table in the Landfill area in the event the current pumping at the Kramer Quarry is significantly reduced or stopped. Note that Barr's on-going modeling

efforts will simulate reduced pumping conditions and resulting groundwater elevations under the landfill that will also take into account the increased pumping in the aquifers since 1970 at other locations, but the information from 1970 is useful to understand potential future conditions.

A site-wide drilling investigation from 2005 (Gorman) documented the elevation of the base of the waste and the top of the bedrock across the Freeway Landfill. By comparing the observed base of waste elevations against the interpreted 1970 shallow groundwater, it was determined that some areas of the existing landfill could come into contact with the groundwater in the future if Kramer Quarry pumping was reduced and the water table returned to levels similar to those measured in 1970. Additionally, the 2005 data identified water in contact with the waste in some areas. Since water was already identified as being in contact with the waste in 2005, most members of the TAC believe that it is reasonable to assume areas of the waste in the Freeway Landfill will likely be in contact with the groundwater under one or more of the various future pumping scenarios that are under discussion.

The ongoing modeling efforts and the recent groundwater level measurements at the Landfill indicate that the current shallow groundwater table is mainly present in the Prairie du Chien bedrock, with the shallow groundwater generally flowing to the south-southwest towards the Quarry, as would be expected given the ongoing dewatering of the Kraemer Quarry.

Based on the available information, it appears that the increasing pumping at the Quarry over the past 40+ years has lowered the water table significantly and reversed the groundwater flow observed in 1970 (which was generally north towards the River) to the present flow (which is generally south-southwest towards the Quarry). If pumping at the Quarry is significantly reduced, it is likely that the groundwater flow would return to flowing towards the Minnesota River at some point in the future once the Quarry has filled sufficiently with water. Note that it could be years to decades before this condition occurs since it will take a significant period of time to refill the Quarry once operations there are terminated. Part of Barr's current task is to provide an estimate of how long it will take for the Quarry to fill with water.

Barr also reviewed historical water quality data in relation to the changing groundwater conditions at the landfill. Hydrogeologic investigations from the 1970s and 1980s included groundwater quality samples collected from wells where the groundwater was in contact with the waste in the Landfill. The information indicated that the groundwater had much higher concentrations of contaminants (metals in particular) when it was in contact with the landfill waste.

In summary, the emerging information from these on-going efforts has provided the following preliminary insights to the TAC:

- The waste in the Freeway Landfill was in contact with water in some areas in 2005.

- If pumping is reduced or stopped at the Quarry, it is likely that there will be areas where the shallow groundwater will come into contact with the waste in the Landfill and the extent of contact will likely depend on the amount of pumping at the Quarry and/or in the vicinity of the Quarry.
- Groundwater quality was impacted when the waste was in contact with the groundwater at the time of past investigations.
- The shallow groundwater flow direction likely will revert back towards the River if pumping is reduced, similar to the conditions in 1970.

Based on the 2/24/2015 TAC meeting discussions, the TAC asked Barr to outline potential additional tasks:

Groundwater Modeling Scenarios

Barr is continuing to advance the groundwater modeling efforts, including the two original scenarios that involve (1) modeling current conditions and (2) modeling future conditions where the only pumping at the Quarry would be related to the City of Burnsville's water supply withdrawn at the current rate. The TAC also discussed several other modeling scenarios that are being considered to support decision making efforts. The potential additional scenarios are outlined below:

- If the future scenario (i.e., no Quarry dewatering but Burnsville pumping current volume from the pit lake) shows that the water table will rise above the bottom of the waste, then determine what water level in the lake would be necessary to keep the water table from reaching the bottom of the waste and what pumping rate would be needed to obtain this lake level.

- Assume that there would be no Quarry dewatering and that Burnsville does not pump any water from the pit lake. In this case Burnsville's water demand would be shifted to their existing Jordan wells while Savage's portion of the water pumped from the Quarry would be shifted back to existing wells in Savage. This scenario would also assume water demand at 2035 rates as provided by the cities.

- Assuming that the previous scenario indicates that the shallow groundwater will be in contact with the waste and that the shallow groundwater flow will revert back towards the River, then conduct contaminant transport modeling of the potential groundwater impacts along the following presumed pathway: contaminants leaching from waste to shallow groundwater, and shallow groundwater migrating towards the surface water in the River. In this scenario, only existing data would be used to estimate source conditions (e.g. 1970-80s era water quality data from groundwater samples that had been in contact with the waste). The results of this modeling would be compared to current water quality standards for the River

Based on the discussions during the 2/24/2015 TAC meeting, Barr has conceptualized other modeling scenarios that could be considered to help the decision making process. These are included below:

- Conduct contaminant transport modeling of the future scenario that involves the City of Burnsville appropriating significantly more water from the Quarry than it currently uses. Consider a scenario where the City appropriates up to its total average daily demand along with a significant future supply delivered to Savage. The total amount would be arrived at based on discussions with Burnsville. Under these conditions model lake level and contaminant transport from the Landfill.

- Include a scenario that involves a transient model for a long term flood on the Minnesota River to assess possible impacts to the River from the landfill waste (i.e., would the flood drive groundwater near the River into contact with the waste and then induce water quality impacts to the River as the River recedes). This scenario would include a review of the period of record and identify the single year with the highest average river level and assume reasonable but high end transmissive sediments along the river bank. Groundwater conditions would assume no Burnsville withdrawal from the Quarry to simulate the likely highest water table levels beneath the Landfill.

Water Quality Data Collection

Based on the discussions at the TAC meeting, Barr has developed the following water quality sampling concepts that could be completed to assist with modeling and decision making for the Site.

- Collect samples of water from within the waste (if present). Initial boring locations for this sampling would be in portions of the Landfill where the 2005 data indicates water was in contact with the waste. Barr would recommend collection and analysis of six to eight water samples. Analyze samples for VOCs, RCRA metals, SVOCs, and PCBs. Also analyze trip blank, field blank, and matrix spike/matrix spike duplicate samples for QA/QC purposes. This could be coordinated with the last item discussed below so that the sampling is part of the piezometer installation. Note that available data suggests methane at high concentrations may be present in areas where borings would be drilled so drilling would have to proceed with caution.

- Collect water samples from the groundwater beneath the Landfill and analyze these samples for VOCs, RCRA metals, SVOCs, and PCBs. Sampling locations would be selected within the footprint of the waste at a series of locations that would help the TAC understand if the Landfill is currently negatively impacting existing groundwater. The sampling could also result in the installation of new permanent monitoring wells at key locations in or around the Landfill. It will be important to separate perched water from the actual water table in this exercise. The point would be to see if current infiltration through the waste is picking up contaminants and transporting them to the groundwater in or beneath the landfill.

- If there is a seep in the north wall of the Kraemer Quarry and it is accessible, collect a water sample from the seep. Analyze samples for VOCs, RCRA metals, SVOCs, and PCBs. Also analyze trip blank, field blank, and matrix spike/matrix spike duplicate samples for QA/QC purposes.

- Drill a pattern of piezometers near the saturated waste (based on the 2005 data) to determine if a groundwater seep is active under the Landfill. Assume 8 piezometers/monitoring wells. 5 finished in the waste at bedrock level surrounding the highest water level readings from 2005, one finished in the upper Prairie du Chien, one finished in the lower Prairie du Chien, and one finished in the Jordan. Set the wells up so that water samples can be collected. Analyze the data for cation/anion balance to fingerprint the various water samples. Compare these chemical fingerprints to determine if water in the waste is similar to either of the known groundwater samples. If samples of water in contact with the waste are chemically similar to either of the known groundwater samples this would indicate the water in the waste is from a groundwater seep rather than infiltrating precipitation. This task should be coordinated with the first two tasks if either of them are also undertaken.

It is important to note that most of the data collection tasks identified above cannot be completed in a short time frame due to permits, safety concerns-related planning, and, potentially, drilling contractor availability.