



United States Department of the Interior

NATIONAL PARK SERVICE
Water Resources Division
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IN REPLY REFER TO:

November 29, 2011

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SACN/General

Memorandum

To: Superintendent, St. Croix National Scenic Riverway

Through: Gary Rosenlieb, Acting Chief, Water Resources Division (WRD)
Gary Smillie, Acting Chief, Aquatic Systems Branch (ASB)

From: Larry Martin, Hydrogeologist, Aquatic Systems Branch (ASB)

Subject: Trip Report to investigate potential impacts from the proposed Zavoral gravel mine near Scandia, MN

Summary:

I have reviewed numerous documents related to the proposed gravel mining operation at the Zavoral Site. These documents include those that are posted at the City of Scandia website for the project, geologic maps, and hydrogeologic reports from various sources. I believe that it is highly unlikely that any adverse impact will occur to water or water-dependent resources in the area as a result of the proposed mining operation.

Mining will be entirely above the water table. There will be no pumping to dewater mine pits. There will be no gravel washing. Groundwater pumping at the site will be minimal; only what is necessary to provide water for dust suppression. Groundwater pumping at the site is from a well completed in deep confined aquifers. The St Lawrence Formation (shale) acts as an aquitard to limit groundwater flow between the shallow aquifer and the deeper aquifers, further limiting the potential impacts of groundwater pumping on springs and seeps.

Currently most of the surface-water runoff on the site drains internally. After mining, even more of the area will drain internally. Surface-water runoff drains toward topographic depressions within the site, where it infiltrates to the water table and eventually discharges as springs or seeps in the creeks and on the bluffs to the east of the Zavoral site. There may be a small increase in the

groundwater discharge at springs and seeps post-mining because of the increased surface area that will drain internally.

It would probably be prudent to mark the boundary of the NPS scenic easement through the Zavoral site to reduce the potential for “accidental” incursion of mining activities into the easement.

Description of the proposed mining operation

The Tiller Corporation proposes to operate a gravel mining operation at the site of a dormant, unreclaimed gravel mine in Scandia, MN. The site is often referred to as the Zavoral site, after the name of the landowner. The site is at the top of the bluff on the west side of the St. Croix River and is adjacent to a scenic easement of the St Croix National Scenic Riverway.

Over the past 50 years, land use at the Zavoral site has changed from cropland to vacant open space disturbed by previous mining. In the late 1960s, sand and gravel mining was started at the site. By the mid-to-late 1970s, mining had displaced most of the former cropland. Active mining continued into the 1980s. The property has been largely dormant since the mid-1980s. The site was not reclaimed in any manner; large piles of sand, gravel, and overburden occur randomly across the property along with pits and depressions where materials were removed. The site has mostly revegetated by natural propagation.

Tiller proposes to excavate sand and gravel at the Zavoral site, load it into trucks, and transport it to the Scandia Mine. The material from the Zavoral site would then be combined with materials mined at the Scandia Mine and other sources to produce the desired gradations of aggregate. Sand and gravel mined at the Tiller site would replace material currently transported to the Scandia Mine from other gravel mines in Minnesota and Wisconsin.

Active mining would occur to a maximum depth of 15 feet. Tiller does not propose to excavate below the water table and plans on maintaining a minimum 3-foot separation between the bottom of the pit and the water table. There will be no need to pump groundwater from the shallow aquifer to keep the pit dry.

There are no plans for crushing, washing, or sorting gravel at the site. These activities would greatly increase the amount of water needed for the mining operation. Since these activities won't occur, water use at the site will be limited to dust suppression.

Groundwater pumping is limited to 10,000 gallons per day (gpd). The existing water-supply well at the site is completed in sandstones of the Franconia, Ironston, Galesville, and Mt. Simon Formations. Groundwater flow between the overlying shallow aquifers and the deeper sandstone aquifers is limited by shale comprising the St. Lawrence Formation.

Berms will be constructed during mining to limit/prevent surface runoff from disturbed areas. Post-mining, the reclaimed area will be graded to route surface runoff to internal depressions where it will infiltrate to the shallow water table. In its current state, most of the area already drains to internal depressions where the water infiltrates. Post-mining the area draining to these

internal depressions will be slightly larger, resulting in more infiltration to the shallow aquifer and subsequently more groundwater discharging to the seeps, springs, and creeks to the east of the gravel mine.

The figures in the DEIS seem to show a buffer or setback from the edge of the bluff to the disturbed area along the east side of the proposed mine. However, I could not find wording in the text of the document to verify that the plans include maintenance of an undisturbed area between mining operations and the top of the bluff to act as a buffer between the disturbed area of the mine and the steep slopes of the bluff.

Offsite impacts to surface-water bodies will be limited by implementation of a Stormwater Pollution Prevention Plan (SWPPP). The plan will be reviewed by and a permit is required from the Carnelian-Marine-St. Croix Watershed District (CMSCWD). The plan is to reduce offsite impacts by limiting runoff from active mining areas, construction of silt fences and berms, and reducing the amount of potential contaminant sources (e.g. fuel tanks) at the site.

Description of hydrogeology

A west-east schematic cross-section showing the geologic formations underlying the Zavoral Site is shown below. In general, there are three aquifers (upper, middle, and lower) which are separated by a relatively impermeable aquitards or confining units. Red and blue shading was added to the aquitards to distinguish them from the aquifers.

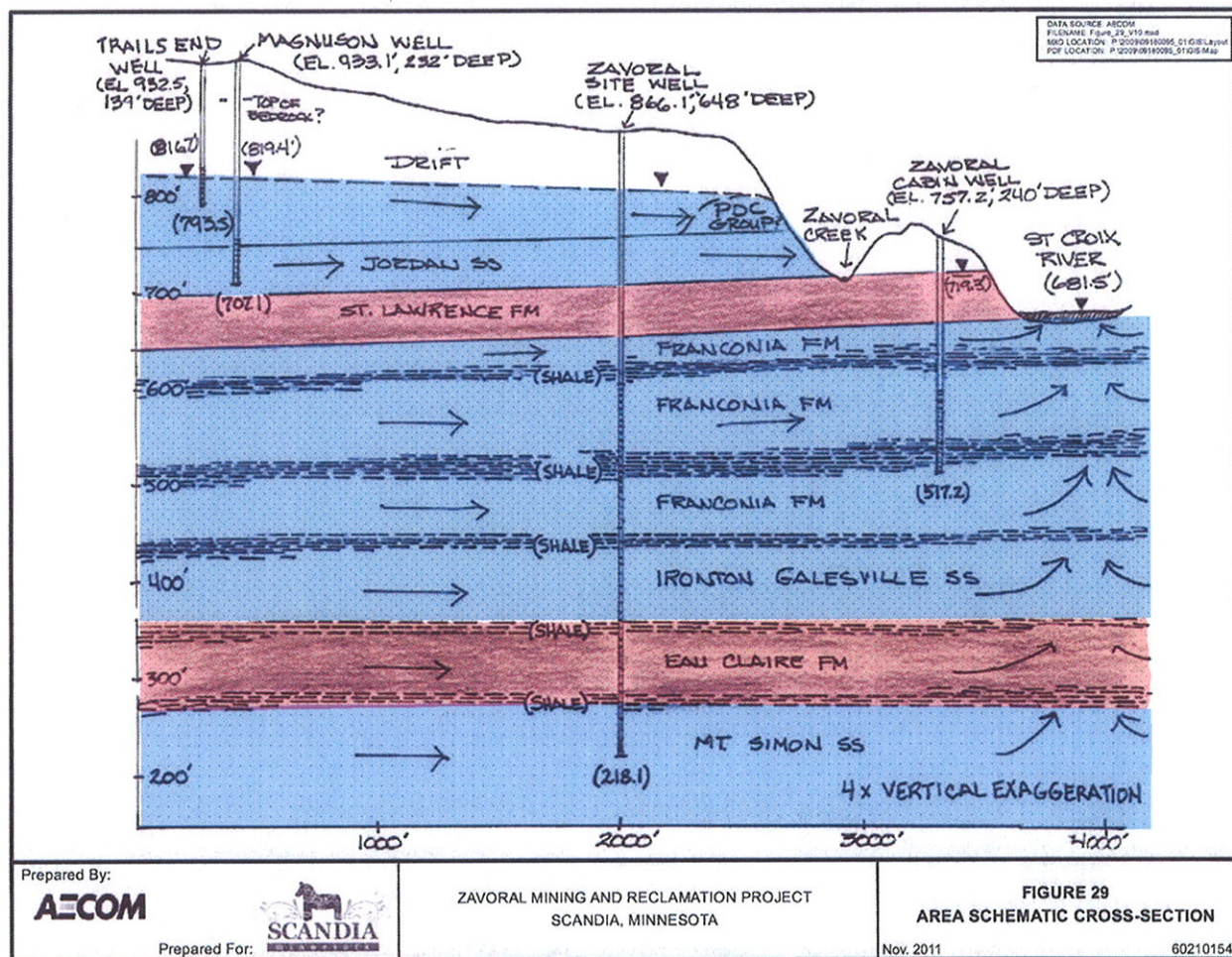
The upper aquifer includes the glacial drift sediments (sand and gravel) and sandstones of the Prairie Du Chien and Jordon Sandstone units. These formations are considered a single aquifer because groundwater can freely move between the units. Most of the domestic wells north, south, and west of the Zavoral Site are completed in the upper aquifer.

The St. Lawrence Formation consists of many thin beds of shale and siltstone. At the Zavoral Site, it is thought to be an aquitard or confining unit. The relatively low permeability of the unit inhibits flow of groundwater between the upper and lower aquifer.

The middle aquifer includes the Franconia, Ironston, and Galesville Formations. These formations are primarily sandstones with thin shale beds. The middle aquifer is as a water supply for wells near the St. Croix River because the upper aquifer is either too thin or not present.

The Eau Claire Formation consists of siltstone, very-fine-grained sandstone, and shale. The permeability is much lower than the overlying and underlying sandstone formations. IT acts as an aquitard or confining unit, separating the middle and lower aquifers.

The Mt. Simon Sandstone is the deepest aquifer used in the vicinity of the Zavoral Site. It consists of fine-to-coarse-grained quartz sandstone. The Mt Simon is not often used as a water source because there is generally an adequate supply obtainable from the shallower aquifers. The existing well at the Zavoral Site is screened in both the middle and lower aquifer, including the Franconia-Ironston-Galesville aquifer and the Mt. Simon aquifer.



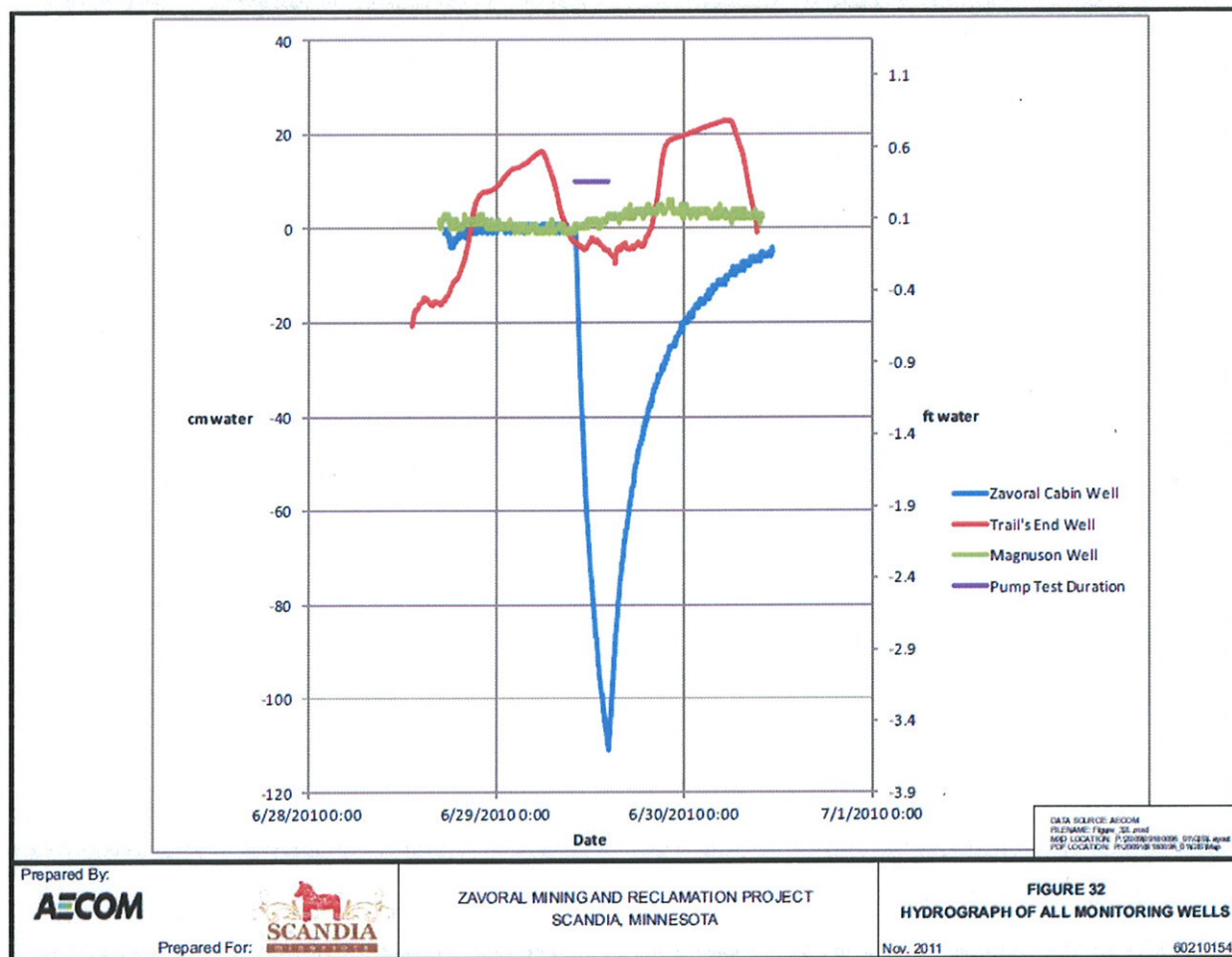
Pumping test analyses

An aquifer test was conducted using the existing well at the Zavoral site. The well is completed in the Franconia-Ironton-Galesville aquifer and the Mt. Simon aquifer. The well was pumped at about 660 gpm for 4:20 hours. More than 170,000 gallons of water were pumped during the test; 17 times the maximum daily allowable pumping from the well. Water levels were monitored in a well completed in the glacial drift sediments (Trails End Well), a well completed in the Jordon Sandstone (Magnuson Well), and a well completed in the Franconia Formation (Zavoral Cabin Well). Surface-water flow was monitored at several locations adjacent to the Zavoral Site during the pumping test.

Water levels in the Trails End Well (completed in the glacial drift aquifer) appear to be affected by some other influence. The water level begins to decline prior to the start of pumping and remains at a depressed level for many hours after the pumping has stopped. This is not the pattern that would be expected if the water level was being affected by pumping from the deep well at the Zavoral Site.

Water levels in the Magnuson Well (completed in the Jordon Sandstone) rose slightly when the Zavoral gravel mine was pumped.

Water levels in the Zavoral Cabin Well show the typical response pattern to pumping of a nearby well completed in the same aquifer. Water levels decline quickly after pumping starts and gradually recover after pumping stops. The Zavoral Cabin well is 1300 feet east of the pumped well. Water levels in the Zavoral Cabin well were drawn down about 3½ feet after pumping the well at the Zavoral site at 660 gpm for 4:20 hours. Water levels at the Zavoral Cabin well recovered to near static level within 24 hours.



The aquifer test showed that the St. Lawrence Formation acts as an aquitard at this locale. Pumping groundwater from the deeper Franconia-Ironton-Galesville and Mt. Simon aquifers did not affect water levels in the shallow glacial drift and Jordan Sandstone aquifers.

All but one of the private, domestic wells within 1½ miles of the site are completed in the shallow aquifer. The only wells completed in the deeper aquifer are the irrigation supply well at the Abrahamson Nursery and the Zavoral Cabin well.

More than 170,000 gallons of water were pumped during the aquifer test; more than 17 times the daily limit for pumping the well during mining operations. Since there was no observable drawdown of water levels in the wells completed in the shallow aquifer during the test, it follows that there would be no change to groundwater discharge at springs, seeps, or to the creeks from the shallow aquifer. The amount of water pumped from the deeper aquifer during mining operations will be small (relative to the flow of groundwater through the aquifer) and of short duration. The pumping should have no measurable effect to groundwater discharge from deeper aquifer. Also, the deeper aquifer is at or below the level of the St. Croix River (Figure 29); groundwater discharge on the bluffs and to the tributary creeks occurs from the shallow aquifer.

Conclusions

The hydrologic changes before and after mining can be summarized as;

- Currently land surface is above the water table. After mining, land surface will be above the water table. Groundwater flow across the site will not be interrupted or changed.
- Currently the site is largely internally drained. After mining, the site will be internally drained. The acreage contributing to internal drainage will increase by 11 acres; from 53 acres to 64 acres. The small increase in area with internal drainage will provide a small increase of infiltration to the local groundwater system. This groundwater will discharge at springs and seep areas in the adjacent creeks and as seep areas on the bluffs. The change will probably be immeasurable.

Hydrologic impacts during mining operations are summarized as;

- During mining, groundwater will be pumped from the confined aquifer to provide water for dust suppression. The maximum pumping will be 10,000 gallons per day and 1,000,000 gallons each year.
- Pumping groundwater from the deeper Franconia-Ironton-Galesville and Mt. Simon aquifers is unlikely to affect water levels or groundwater flow in the shallow aquifer (glacial drift and Jordon Sandstone). The aquifers are hydraulically separated by an aquitard; the St. Lawrence Formation.
- Some of the water sprayed on the ground for dust suppression might infiltrate to the water table and eventually discharge at springs, seeps, or creeks on the bluffs and in the valleys east of the mine site. Discharge from the springs and seeps is more likely to increase than to decrease.

If there are any questions regarding this trip report, please call me at (970)-225-3515.

cc:

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MWRO – Gary Vequist
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