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Memorandum

To: File, Jamie Lancaster, William Cook, Anna Truszczynski, Elizabeth Booth, Feng Jiang, Bill Frechette, John Ariail, Christine Voudy, and Edward Rooks

From: Wei Zeng

Date: January 18, 2024

Re: Additional assessment of potential impacts from Twin Pines Mineral's (TP's) Charlton County operations on the St. Mary's River (and sturgeons utilizing the river as their habitat)

Introduction

In my memorandum dated November 16, 2023, I stated that a supplemental memorandum will be provided to assess impacts from TP's operations on Atlantic and short nose sturgeons utilizing the St. Mary's River (the River) as their habitat. Meetings organized by the St. Mary's Riverkeeper have taken place and resulted in an ongoing data collection effort. Under this effort, EPD's Watershed Planning and Monitoring Program is collecting bathymetric data of the River, including sections of the river designated as critical habitat. Meanwhile, the US Fish and Wildlife Service is planning a series of sonar scans to collect substrate data. These data collections will enable the development of an open-channel hydraulic model and a water quality model of the River.

While the data collection and subsequent model development efforts go on, the agency's various permitting programs are in need of an assessment based on best available information. For this purpose, I would like to provide an assessment using available data from United States Geological Survey (USGS).

Available USGS Data

According to Federal Register published by National Oceanic and Atmospheric Administration on August 17, 2017 (https://www.federalregister.gov/documents/2017/08/17/2017-17207/endangered-and-threatened-species-designation-of-critical-habitat-for-the-endangered-new-york-bight), the

uppermost end of the designated habitat is at the confluence between the Middle Prong St. Mary's River and the main stem St. Mary's River.

Within the reaches of the St. Mary's River designated as critical habitat, USGS has a flow monitoring gage with a substantial period of record of daily flows and stage heights. USGS 02231000 St. Mary's River near McClenny, FL has 96 years of data. The gage has a rating curve relating gage height to flow rate. Numerous field measurements have been taken for purposes of data verification and to correct and update the rating curve. See pages 7 and 8 in my November 16, 2023, memorandum for relevant discussions on the use of gages for assessing impacts to the St. Mary's River.

Potential Impact on Surface Water Elevation

There will be no surface water withdrawal from the St. Mary's River as part of TP's mining operation. Therefore, there is no direct reduction of flow in the river and its tributaries resulting from the proposed operations.

However, the Water Supply Program has previously analyzed how the proposed groundwater withdrawal from the Floridan Aquifer and the proposed dewatering of the mining pit may have an indirect impact on flows in the River, with overly conservative assumptions. (See my November 16, 2023, memorandum for more details.) Below, the potential flow impacts to a reduction of water level in the River at the cross-section of the USGS McClenny gage will be examined.

Previously an overly conservative assumption that the entire 0.87 cfs (i.e. half of the mining pit dewatering) was treated as a flow reduction from the River. The assumption that a groundwater withdrawal from the surficial aquifer (which is another way of understanding the effect of the mining pit dewatering) is 100% translated into a reduction of flow within a stream is extremely conservative. The Floridan Aquifer in southwest Georgia, where there is a well-known hydraulic connection between the aquifer and the surface water streams, only has a ratio of surface water reduction from a unit volume of groundwater withdrawal of approximately 40%. It should not be assumed that the same ratio (and its representative connectedness between the surficial aquifer and the St. Mary's River) would apply in the area of the proposed mining operation, since the values of hydraulic conductivity of the Floridan Aquifer in southwest Georgia (from below 70 ft/day to above 500 ft/day – cited from USGS Scientific Investigations report 2006-5070) are much higher than those in the proposed mining area (0.00000456 ft/day to 53.5 ft/day – cited from TPM GW Model Report dated Sep 14, 2021). However, for the purpose of another conservative assessment, let's assume that it is the case here. A 40% reduction in surface water flow would be 0.35 cfs.

When this amount is reduced from the daily flows in the historical record, the resulting gage height is also reduced. The reduction in the gage height (or surface water elevation) is a good indicator of the extent of impact the aquatic species may experience. Figure 1 shows the magnitude of reduction in surface water elevation assuming the river flow at the McClenny gage is reduced by 0.35 cfs. Based on this graph the maximum reduction in surface water elevation is lower than 0.009 ft. Table 1 shows that the largest reductions are associated with the known drought years. Among these drought years are 2000, 2001, 2002, 2006, 2007, 2011, and 2012 and the maximum reduction in water surface elevation is about 0.0088 ft (or 2.7 mm, or roughly one tenth of an inch). Within a drought year, the

maximum reduction usually happens between the months of May and October, when the river flows drop.

If we make even more conservative assumptions by treating the entire 0.87 cfs as if it is a direct withdrawal from the St. Mary's River, a similar set of results can be obtained. Figure 2 shows the magnitude of reduction in surface water elevation with the assumption that flow is reduced by 0.87 cfs. From this graph it is found that the maximum elevation reduction is slightly more than 0.02 ft. Table 2 shows that the largest reductions are associated with the known drought years. Among these drought years, the maximum reduction in surface water elevation is 0.0212 feet (or 6.5 mm, or roughly a quarter of an inch).

The uppermost end of the sturgeons' designated critical habitat is at the confluence between the Middle Prong St. Mary's River and the St. Mary's River. The USGS McClenny gage is the uppermost gage in the portion of the river that is designated critical habitat. There may be a realistic way of assessing potential impacts on surface water elevation at the upper end of the critical habitat, after the open-channel hydraulic model is developed (or perhaps after another gage is established at that location)[1].

Because of the conservative assumptions, the likely impact is expected to be less than shown here.

Potential Impact on Sturgeons

The precise impact on sturgeons' spawning habitat will only be determined after the bathymetric survey, sonar scan, and open-channel hydraulic model development are completed. However, based on best professional judgement it is reasonable to anticipate very little impact on either the reduction in the amount of habitat available or water depth needed for fish passage, given the information developed and documented above.

Water Quality

EPD will continue to work with the US Fish and Wildlife Service, the National Marine Fishery Service, and the St. Mary's Riverkeeper in conducting bathymetric survey and sonar scan of the River. An open-channel hydraulic model and a water quality model will be developed for the River. These models will be calibrated against field data, and in the future they may be used to provide more detailed assessment on impacts from alterations (not limited to the mining operations by TP) to the River.

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[1] The approach of using existing gages and drainage ratios to develop a synthetic flow time series has been considered and rejected. Aside from the McClenny gage, there are two other gages upstream that could potentially serve as the reference gage for developing a synthetic flow time series. These are the USGS 02228500 North Prong St. Mary's River at Moniac, GA and USGS 02229250 Middle Prong St. Mary's River near Taylor, FL. The Moniac gage has been rejected because this gage recorded numerous days of zero flow. When scaled up using a drainage ratio approach, the resulting flow time series will also include zero flows in the same periods. With a number of tributaries joining the St. Mary's River between the Moniac gage and the confluence (including the sizable Middle Prong St. Mary's River), it is unreasonable to assume these zero flows. The Taylor gage has been rejected for two reasons. First, it only has 5 years of record. Second, its unit hydrologic yield appears to be different than that of the other two gages, making a drainage ratio approach less than desirable. In either case, the synthetic flow time series will not provide a way for assessing changes in surface water elevations because of the lack of a rating curve at the location.

Summary

There is no direct water withdrawal from the St. Mary's River. Under TP's proposed water management, there is no discharge of wastewater into the River. Based on best available information from USGS and assessments based on such, potential indirect impacts on the River and the sturgeon species making use of the River will likely to be very little.

EPD will continue to work with partners in developing additional tools and data to enhance the collective understanding of the River and any potential impacts resulting from alterations to the River.

Table 1. Elevation maximum difference (ft) with 0.35 cfs flow reduction

Month	**2000**	**2001**	**2002**	**2006**	**2007**	**2011**	**2012**
January	0.0066	0.0060	0.0066	0.0028	0.0049	0.0074	0.0067
February	0.0045	0.0067	0.0049	0.0027	0.0048	0.0039	0.0070
March	0.0055	0.0067	0.0045	0.0037	0.0056	0.0050	0.0066
April	0.0067	0.0061	0.0061	0.0047	0.0080	0.0067	0.0074
May	0.0083	0.0083	0.0078	0.0063	0.0084	0.0080	0.0082
June	0.0083	0.0080	0.0088	0.0078	0.0074	0.0083	0.0037
July	0.0080	0.0054	0.0060	0.0080	0.0067	0.0078	0.0025
August	0.0046	0.0076	0.0046	0.0079	0.0038	0.0070	0.0025
September	0.0043	0.0067	0.0047	0.0080	0.0038	0.0080	0.0026
October	0.0056	0.0070	0.0049	0.0083	0.0036	0.0067	0.0036
November	0.0070	0.0075	0.0052	0.0080	0.0043	0.0067	0.0046
December	0.0067	0.0076	0.0035	0.0078	0.0047	0.0064	0.0048

Table 2. Elevation maximum difference (ft) with 0.87 cfs flow reduction

Month	**2000**	**2001**	**2002**	**2006**	**2007**	**2011**	**2012**
January	0.0163	0.0150	0.0165	0.0070	0.0123	0.0187	0.0167
February	0.0112	0.0167	0.0122	0.0066	0.0120	0.0097	0.0176
March	0.0136	0.0167	0.0114	0.0092	0.0142	0.0126	0.0163
April	0.0167	0.0154	0.0153	0.0116	0.0190	0.0167	0.0187
May	0.0206	0.0206	0.0196	0.0159	0.0212	0.0196	0.0206
June	0.0206	0.0203	0.0206	0.0196	0.0189	0.0211	0.0093
July	0.0196	0.0134	0.0150	0.0195	0.0167	0.0190	0.0063
August	0.0115	0.0191	0.0115	0.0198	0.0096	0.0174	0.0063
September	0.0107	0.0165	0.0115	0.0189	0.0096	0.0197	0.0064
October	0.0138	0.0177	0.0123	0.0212	0.0091	0.0166	0.0091
November	0.0174	0.0188	0.0130	0.0197	0.0108	0.0167	0.0116
December	0.0167	0.0189	0.0088	0.0196	0.0117	0.0157	0.0120

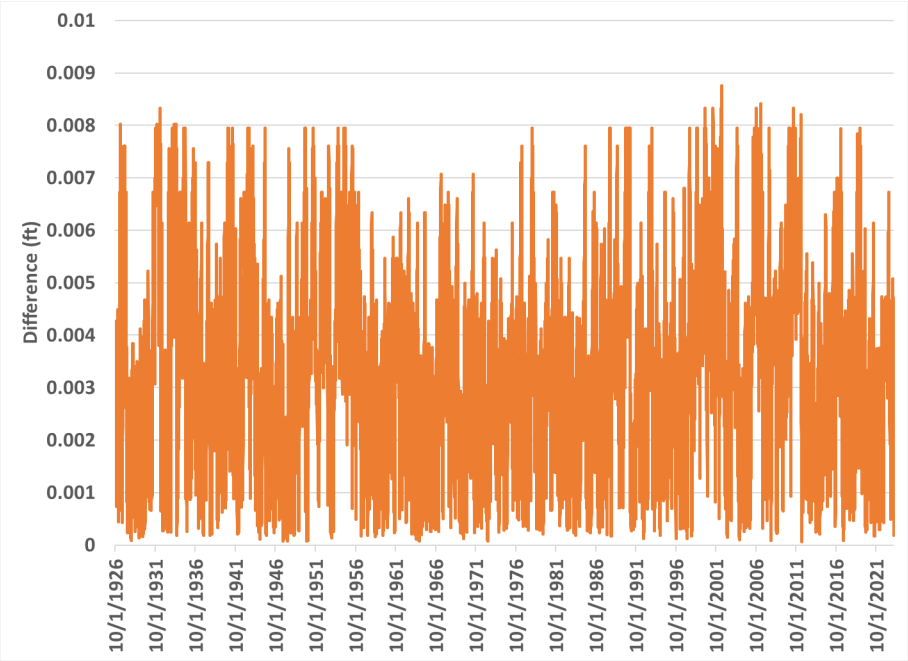

Figure 1. Elevation difference with 0.35 cfs flow reduction

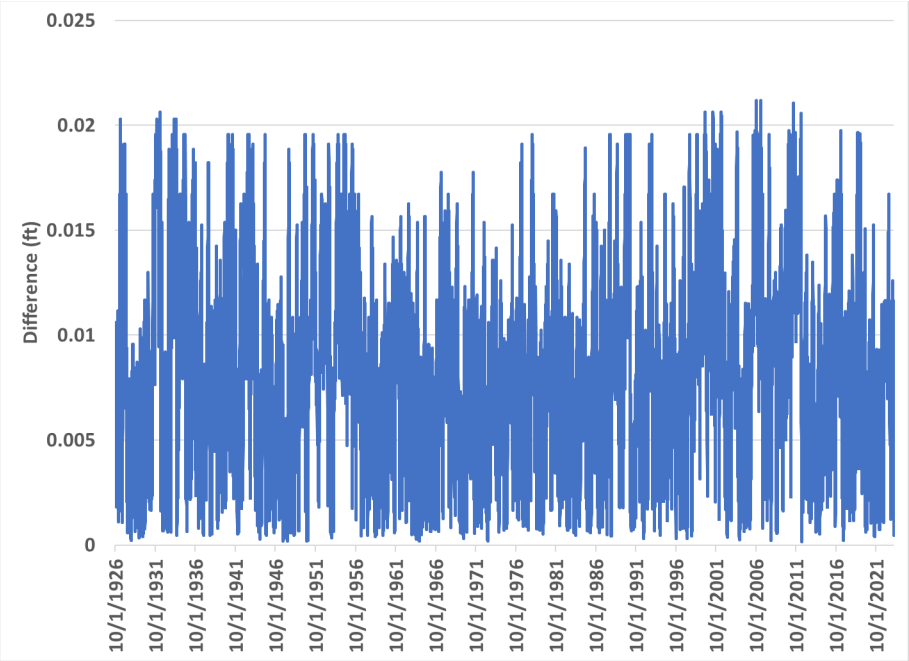

Figure 2. Elevation difference with 0.87 cfs flow reduction