



# Twin Pines Minerals, LLC

## WATER QUALITY AT TWIN PINES MINE

Prepared For:

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PROPOSED HEAVY MINERALS MINE  
ST. GEORGE, CHARLTON COUNTY, GEORGIA

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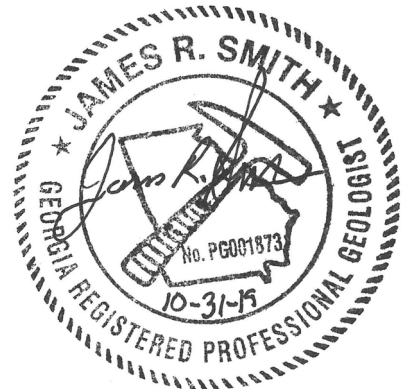
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# **TTL**



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## INTRODUCTION

On July 3, 2019, Twin Pines Minerals (TPM) submitted an individual permit application to the U.S. Army Corps of Engineers for impacts to waters of the United States to develop a heavy mineral sand mine along Trail Ridge in Charlton County, Georgia (Figure 1). The proposed mine is located 3.2 miles west of St. George, Georgia, along Georgia State Highway Route 94. Trail Ridge is a 0.6 to 1.2 mile wide and 99 mile long topographic ridge that separates the Okefenokee Basin and Swamp from the coastal plain of Georgia (Force and Rich, 1979). It represents the crest of a former beach complex and was formed as inland sand dunes near the proposed Twin Pines Mine (e.g., Pirkle et al. 1993). The ridge is underlain by a shallow aquifer, locally known as the surficial aquifer, which forms a hydrologic divide between the Okefenokee swamplands to the west and the Saint Mary's River to the east. At the proposed mine site, the water table is very shallow with water depths of only a few feet. The surficial aquifer is perched on the clays of the upper Hawthorn Group, which is considered to be the upper confining unit to the Floridian Aquifer in the region (e.g., Williams and Kuniansky, 2016).

The proposed permit area is approximately 2,414-acres, located southeast of the Okefenokee National Wildlife Refuge (ONWR) boundary; however, TPM will only mine an approximate 1,268-acre area located about 2.7 miles from the ONWR boundary (Figure 2). The portion of the proposed permit area extending from the western mining boundary to the edge of the permit boundary will be avoided and will provide a buffer to the ONWR.

TPM currently owns/leases approximately 12,000 acres of property that have been utilized as the project study area for the hydrogeological field studies related to the proposed mine. This area is comprised of five (5) contiguous tracts identified as Loncala, Dallas Police & Fire, Keystone, TIAA, and Adirondack. Reference to "project study area" in this report refers to activities conducted within the proposed mining area and these adjacent tracts. This report is being submitted to document field sampling activities for the collection of background water quality data and the results of the associated laboratory analyses.

The project study area is underlain by the surficial aquifer system. Based on subsurface boring data collected, the soil/sediments that make up the surficial aquifer are generally comprised of unconsolidated sand; however, laterally discontinuous zones of lower permeability consolidated humate-cemented sands are locally present in the proposed mining horizon. These laterally discontinuous humate-cemented sand zone layers locally create semi-confining to confining conditions. Fine-grained silts and clays occur below the proposed mine horizon and are likely reworked sediments from the underlying Hawthorn Group.

Precipitation provides most of the recharge for the surficial aquifer. As rainfall infiltrates through the soil zone or sediments it is chemically altered through mineral dissolution, precipitation, cation exchange, oxidation reduction, anion exchange, and dissolution of organic molecules. Surface water on the property is dependent on precipitation for recharge, but appears to be in contact with groundwater (within low-lying areas of the site) during periods of seasonally high precipitation.

Current land use at the site generally consist of industrial forestry operations and recreational hunting. Historical operations during the late 1800s and early 1900s included industrial forestry operations for the harvesting of resins and distillation of turpentine. An adjacent property owner reported that at least a portion of the study area was used as a cattle ranch in the last 50 years. Based on the historical land use at the site, groundwater and surface water samples were collected to evaluate baseline water quality data within the project study area.

## FIELD SAMPLING PROCEDURES

On April 25 and 26, 2019, TTL personnel collected groundwater samples from six (6) piezometers and two (2) surface water locations to evaluate background water quality data at the TPM project site. The groundwater samples were collected from piezometers PZ08, PZ14, PZ16S, PZ28D, PZ43, and PZ48S. The surface water samples were collected from SW-1 and SW-2. Samples SW-1 and SW-2 were collected along the east and west sides, respectively, of the project study area and should be correctly labeled as SW-1 (E) and SW-2 (W). However, it should be noted that TTL's field sampling technician inadvertently transposed the surface water sample labels as SW-1 (W) and SW-2 (E) on the laboratory chain of custody. The piezometer and surface water sampling locations are shown on Figure 3.

Prior to the collection of groundwater samples, each piezometer was purged a minimum of three well volumes with a peristaltic pump. New Teflon®-lined and silicone tubing were used for the purging and sampling activities at each piezometer. A YSI 556 MPS multi-parameter meter equipped with an in-line flow-through cell was used to field measure pH, specific conductivity, temperature, oxidation-reduction potential, and dissolved oxygen during purging. A Hach 2100P turbidity meter was used to measure turbidity. Field measurements recorded during the purging of each piezometer are reported in the well stabilization/sampling field forms included in Appendix A. Upon completion of the purging of each piezometer, groundwater samples were slowly pumped from the discharge end of the tubing directly into the laboratory-provided sample containers. The sample containers were capped, labeled and, promptly placed on ice in a cooler for transport to the laboratory.

Samples of surface water were field measured for dissolved oxygen, temperature, pH, and specific conductance at the time of sample collection (Table 1). During the collection of surface water samples, unused and unpreserved laboratory-provided sample containers were used to collect water samples directly from the two surface water monitoring locations. Next, the surface water was poured directly into the laboratory provided container for each respective analysis. The sample containers were capped, labeled and, promptly placed on ice in a cooler for transport to the laboratory.

The groundwater, surface water samples, and accompanying chain of custody were shipped via FedEx overnight delivery to Xenco Laboratories (Xenco) in Norcross, Georgia. The samples were received by Xenco's Norcross, Georgia laboratory on April 27, 2019 and then shipped to Xenco's Houston laboratory on April 29, 2019 for analysis. Xenco's Houston laboratory noted that all samples were received in good condition and within an acceptable temperature range and holding times. The piezometer and surface water sampling identifiers and laboratory analysis performed are listed in Table 2.

## SUMMARY OF RESULTS

A summary of the analytical results from the April 2019 sampling event are provided in Table 3. The laboratory analytical report as provided by Xenco Laboratory is provided in Appendix B. Median concentrations and ranges of field parameters and constituent concentrations are compared in the Table 4.

### Field Measured Parameters

#### pH

Typical pH values of groundwater and surface water tend to range from 6.0 to 8.5 standard units (s.u.); however, the median pH values of groundwater and surface water samples collected at the site were 4.35 and 5.35 s.u., respectively (Table 1).

#### Dissolved Oxygen

The field measured concentrations of dissolved oxygen were significantly lower in groundwater as compared to surface water (Table 1). The median dissolved oxygen concentrations of groundwater and surface water samples were 0.86 and 7.51 milligrams per liter (mg/L), respectively.

#### Specific Conductance

The field measured concentrations of specific conductance were lower in groundwater as compared to surface water (Table 1). The median specific conductance values of groundwater and surface water samples were 62.5 and 240 microsiemens per centimeter ( $\mu\text{s}/\text{cm}$ ), respectively.

#### Oxidation Reduction Potential (ORP)

The median ORP value of groundwater samples was 279 millivolts (Table 1). The ORP value of surface water samples was not field measured.

#### Laboratory Analytical Data

Concentrations of detected constituents in groundwater samples were compared to groundwater protection standards. The groundwater protection standard consisted of USEPA Regional Screening Levels (RSLs) for tap water, and or the USEPA Maximum Contaminant Levels (MCLs) and Secondary MCLs for drinking water. Based on the results of the laboratory analysis of groundwater samples, the following exceedances of a groundwater protection standard were noted:

- Aluminum exceeded the EPA RSL for tap water of 2.00 mg/L in two of the six groundwater samples.
- Iron exceeded the Secondary MCL value for drinking water of 0.300 mg/L in all six groundwater samples; however, lower pH of the groundwater most likely mobilized iron in the aquifer matrix.
- Manganese exceeded the Secondary MCL value for drinking water of 0.050 mg/L in one of the six groundwater samples.

Laboratory analytical results for the remainder of the constituents will be compared to data obtained during future sampling events.

## REFERENCES CITED

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- Williams, L.J., and Kuniatsky, E.L., April 2015 (Revised March 2016), Revised Hydrogeologic Framework of the Floridan Aquifer System in Florida and Parts of Georgia, Alabama, and South Carolina: U.S.G.S, Professional Paper 1807, Version 1.1