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**SURFACE AND SUBSURFACE GEOLOGY
TUNNEL NO. 8 REHABILITATION PROJECT
OAKDALE IRRIGATION DISTRICT
STANISLAUS COUNTY, CALIFORNIA**

1.0 INTRODUCTION

This document summarizes Condor's observations and interpretations of the geologic conditions at Oakdale Irrigation District's (OID) South Main Canal Tunnel No. 8. Tunnel No. 8 is located approximately 4.5 miles downstream of Goodwin Dam where the Main Canal headgates are located.

2.0 BACKGROUND

The subsections that follow summarize the tunnel history.

2.1 TUNNEL HISTORY AND OPERATION

The subject tunnel, herein designated "Tunnel No. 8," is located along a portion of the OID South Main Canal system, which conveys surface irrigation water from the Stanislaus River at Goodwin Dam and reservoir. Tunnel No. 8 is located approximately 4.5 miles downstream of the OID South Main Canal headgates and approximately 0.9 miles southeast of the town of Knights Ferry, California.

Based on discussions with OID personnel, Condor understands that Tunnel No. 1 was originally constructed in the early 1900's. Tunnel modifications and repairs were performed occasionally throughout the 1900s. The tunnel itself has remained un-lined since original construction. In 2010, OID repaired the canal sidewalls and invert upstream and downstream of the tunnel and installed shotcrete liners.

3.0 PROJECT DESCRIPTION

The project consists of enlarging the tunnel to improve hydraulic capacity, stabilizing the tunnel ground, and lining the tunnel invert and sidewalls (to reduce erosion).

4.0 INVESTIGATIONS AND DATA

The subsections that follow present Condor's methodology and results/data for each component of our investigation work. Condor and OID maintenance personnel have been unable to inspect the interior of the tunnel due to observed unstable ground during site visits. Condor geologists have observed the following and interpretations are made based on our experience with the geology in the area.

4.1 GEOLOGIC CONDITIONS

The ground surface above the canal at the site is characterized by gently rolling, grass-covered hills with no tree cover. A thin (6-inches or less) section of soil is exposed over Table Mountain latite above Tunnel No. 8.

Geologic mapping and observations at the upstream and downstream portals by Condor indicates that the tunnel was constructed along or just below the geologic contact between Table Mountain latite and the underlying Mehrten Formation. In general, the characteristics of the sedimentary facies within the Mehrten Fm are as follows:

- Sandstone: the predominant unit encountered within the Mehrten Fm is a fine- to medium-grained sandstone with varying amounts of silt. The rock is generally moderately well indurated, massive, soft to moderately hard, very weak to weak. Sandstone also occurs as poorly indurated medium- and coarse-grained sand with some gravel and very little to no fines. In general, induration, hardness and strength decrease as grain size increases.
- Conglomerate: the cobble conglomerate encountered within the Mehrten Fm is typically comprised of rounded volcanic cobbles in a medium- to coarse-sand matrix. The cobbles range in size from 3-inches to greater than 12-inches in diameter, with the majority of cobbles ranging from 3-inches to 6-inches in diameter. The cobbles are generally moderately hard to hard and weak to strong, and the sand matrix is typically soft to low hardness and extremely weak to weak.
- Siltstone/claystone: very little siltstone and claystone was encountered. Siltstone and claystone occur only as thin interbeds and are typically soft to low hardness and very weak.

Condor expects that the majority of the tunnel was constructed through Mehrten Formation sandstone and that tunneling will encounter lenses of conglomerate and minor beds of siltstone/claystone.

Attachment

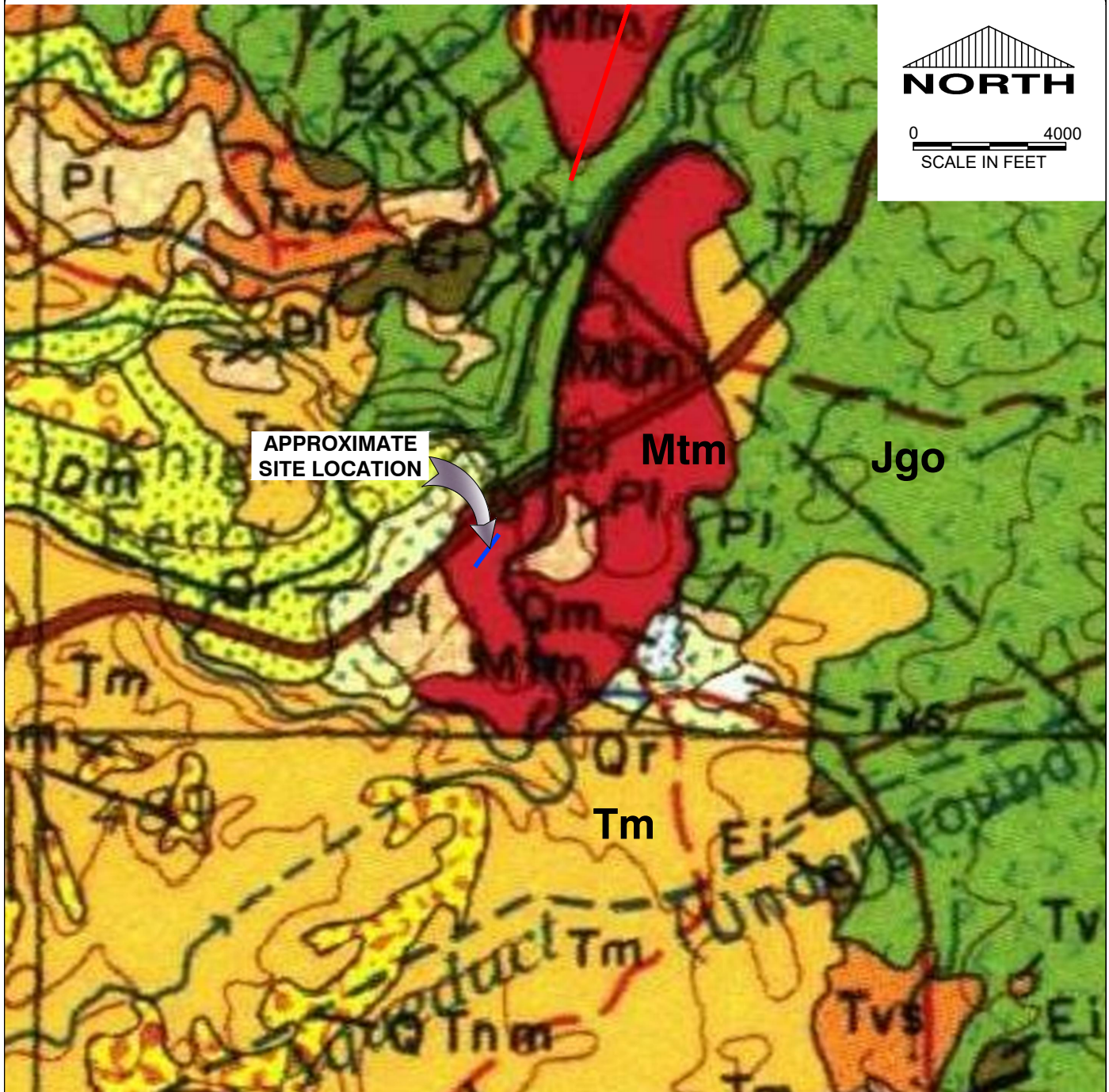
Figure 1 – Geologic Map

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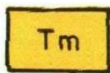




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SCALE IN FEET



LEGEND



Mehrten Formation (*Andesitic conglomerate*)



Table Mountain Latite



Gopher Ridge Volcanics

GEOLOGIC MAP OF THE SAN FRANCISCO-SAN JOSE QUADRANGLE, CALIFORNIA D.L.WAGNER 1991



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GEOLOGIC MAP
TUNNEL 8 SOUTH MAIN CANAL
OAKDALE IRRIGATION DISTRICT
STANISLAUS COUNTY
KNIGHTS FERRY, CALIFORNIA

FIGURE
1

3818R_F1 Geologic