Historic Marlette Water System

Tahoe Oversight Committee

Agenda Item X (TAHOE)
Meeting Date: 12-18-17

Marlette Water System
Presentation Overview

- History of the System
- Major Components (How the System Works)
- Who the System Serves
  - Storey County (Only source of water for Virginia City, Gold Hill and Silver City)
  - Carson City
- Recent Improvement Projects
- Future of the System

10” dia. lead joint pipe

History of the System

Marlette Water System
History of the System

- **Year built – 1873 (Hermann Schussler)**
  - Owners – Virginia and Gold Hill Water Company 1873
  - Name changed to Virginia City Water Company, 1933
  - Curtis-Wright Corporation – August 8, 1957.
  - Marlette Lake Company Dec 2, 1957.
  - State ownership – June 23, 1963 for $1.65 million.
- **Purpose**
  - Water for domestic and mining use (Comstock District)
  - Only water supply to Virginia City, Gold Hill and Silver City
  - Provides fresh water to Carson City

Marlette Water System
History of the System

- **An Engineering Feat**
  - **Historic Civil Engineering Landmark by ASCE (1975)**

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

  - **Listed on National Register of Historic Places (1992)**

National Register
of
Historic Places

Marlette Water System
History of the System

- **Estimate Annual Water Potential to the System**
  - Marlette Basin: 3,498 AF (1.140 billion gallons)
  - Hobart Basin: 2,771 AF (903 million gallons above Diversion Dam)
  - East Slope: 1,808 AF (589 million gallons)
  - Total: 8,077 AF (2.631 Billion Gallons Annually (5,000gpm))
- **Water Currently Used from the System**
  - 2016/17: 498,352,300 gallons (1,529 AF)
  - 2015/16: 469,297,500 gallons (1,440 AF)
  - 2014/15: 405,519,300 gallons (1,244 AF)
  - 2013/14: 603,020,600 gallons (1,850 AF)
  - 2012/13: 617,282,000 gallons (1,894 AF)
  - 2011/12: 576,363,500 gallons (1,769 AF)
- **2/3 of the water runoff occurs during 3 months in Late Spring**
  - The mountains “breathe”; flows vary due to time of day

Marlette Water System
History of the System

- **Marlette Flume**
  - 30” wide X 14” deep boxed flume
  - 4.38 miles long (Marlette to West Portal)
  - Cover with wood to protect it
  - Later 8” dia. aluminum pipe used (prior to 1957)
- **North Flume**
  - Also known as the “Incline Flume”
  - 8.25 miles long (Incline to West Portal)
  - Collected water from the many creeks on the west side of the mountains

Marlette Flume

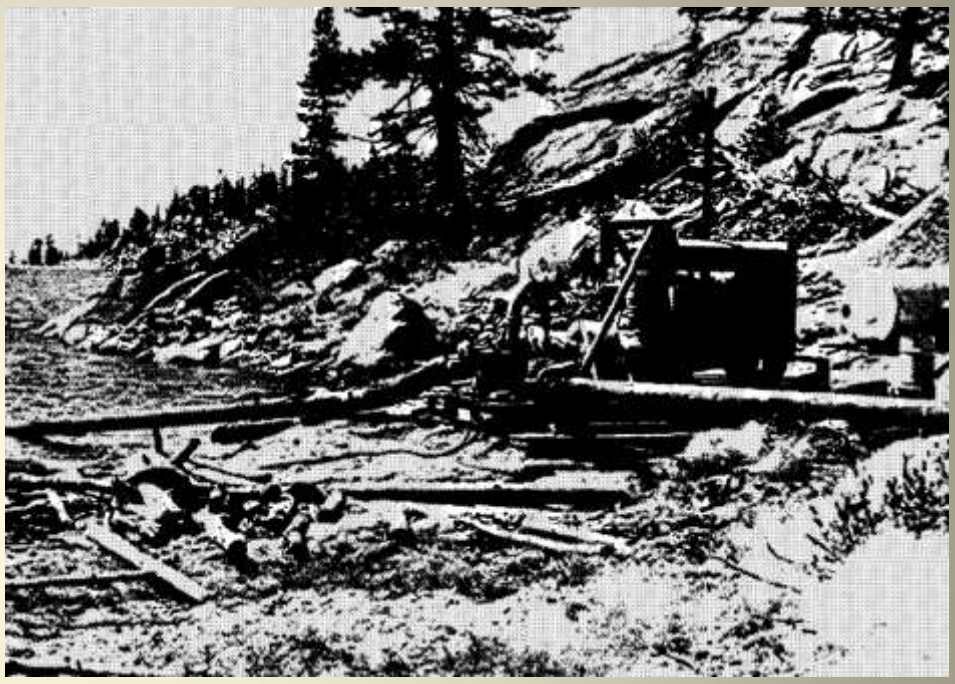
Marlette Water System
History of the System

- **Incline Tunnel**
  - 3,994 feet long
  - Connection made from both side on May 13, 1877
  - Lined with timber over half the length
  - 7 feet high
  - 4.5 feet wide at the top
  - 6.5 feet wide at the floor
  - Allowed water from Marlette to reach the Comstock in August 2, 1877
  - Collapsed in 1957

West Incline Tunnel Portal, 1968

Marlette Water System
History of the System

- **Marlette Pump Station (Original)**
  - 8” dia. pipeline to Hobart Creek
  - Pumps over the eastern ridge (400‘ elevation gain)
  - Installed after the Tunnel collapse
  - 1966-2009 remote diesel generator
  - delivery of fuel 3 times a day (in late summer/early fall)
  - Current pump located at the northeastern shore of Marlette Lake
  - Controlled by SCADA



Marlette Lake – Pump Station (1968)

Major Components

Marlette Water System
Major Components

Marlette Lake Side

- Marlette Lake
- Marlette Pump Station/ Gen Site
- Hobart Reservoir
- East Slope Catchments
- Diversion Dam / Red House
- Lakeview Tank
- Air Boxes to Carson City
- Inverted Siphon (Lakeview Tank to I-580)

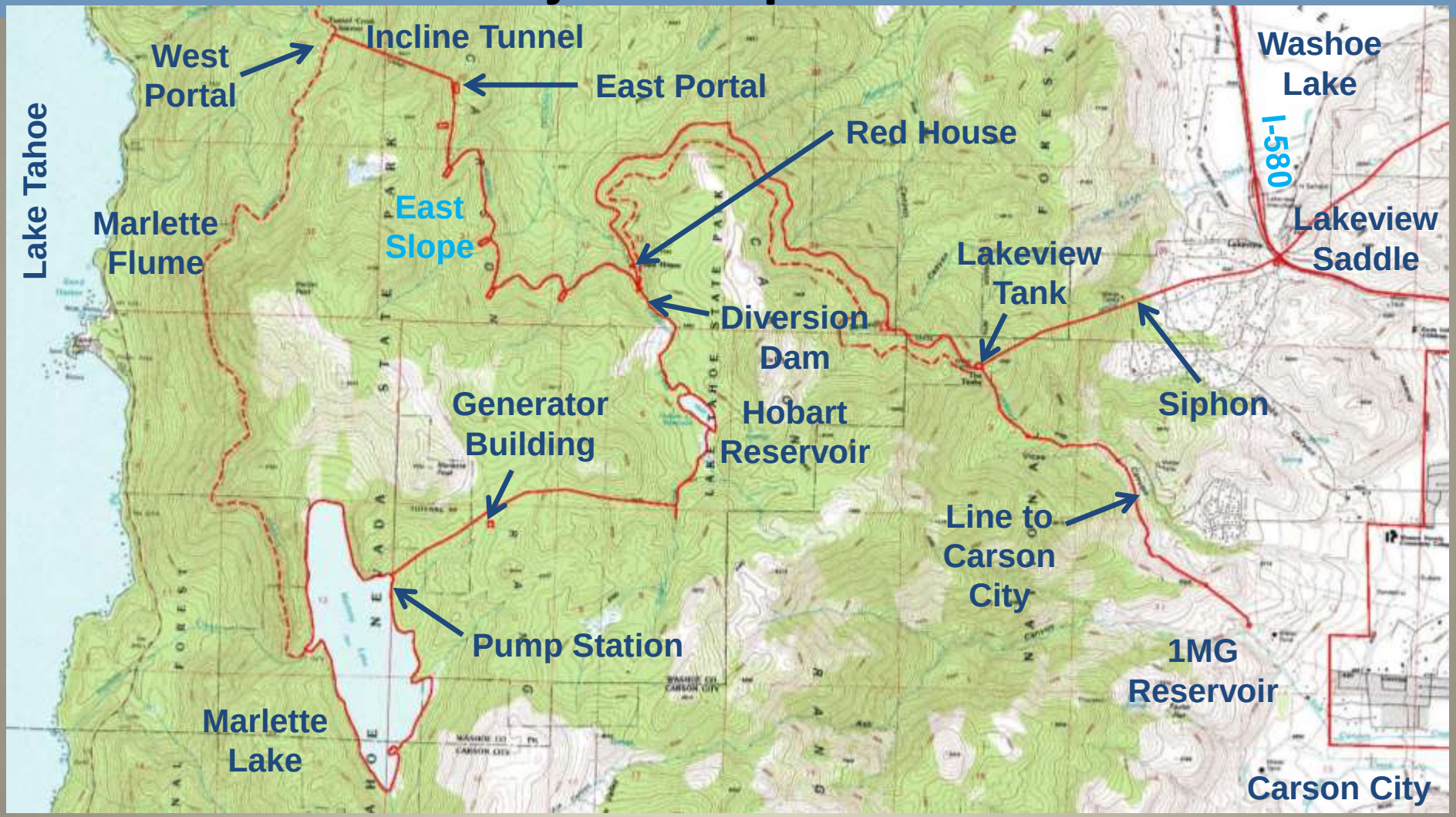
Abandoned Components

- Marlette & North Flume Routes
- Incline Tunnel

Storey County Side

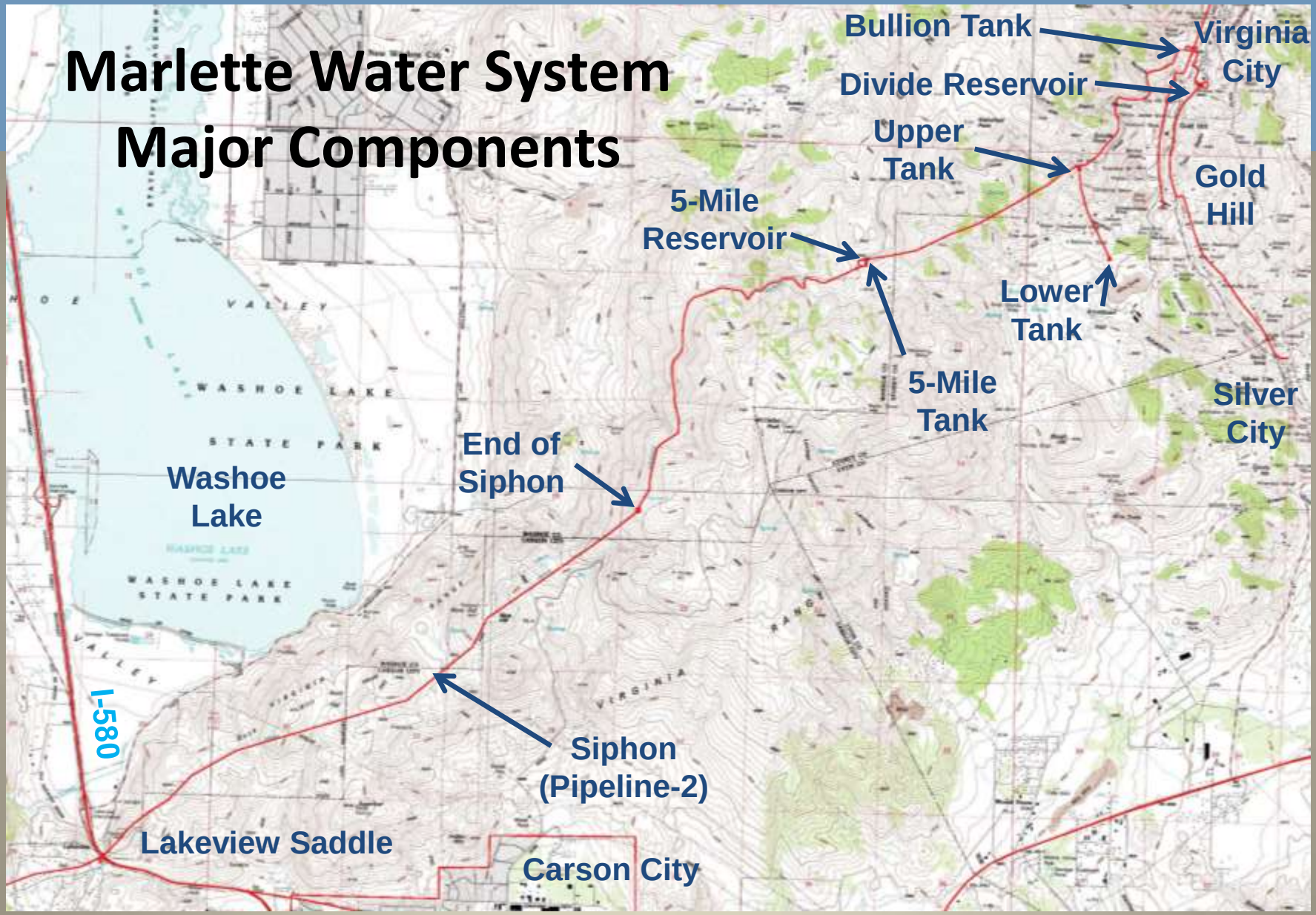
- Inverted Siphon (I-580 to Terminus near 5-Mile Reservoir)
- 5-Mile Reservoir
- 5-Mile Tank
- 5-Mile Tank to Virginia City
- Comstock Mining Component
- Bullion Tank and Treatment Plant
- Virginia City Hillside Tanks
- Divide Tank / Divide Reservoir
- Silver City Water Tank

Marlette Water System
Major Components



Marlette Lake Side (West of I-580)

Marlette Water System Major Components



Storey County Side (East of I-580)

Marlette Water System
Major Components

- **Marlette Lake**
  - Marlette Lake is located at 7850 ft. above sea level (1600-ft. above Lake Tahoe)
  - 11,500 acre-feet storage (3,749 million gallons) of water.
- **Historical Facts**
  - Named after Seneca Hunt Marlette, Civil Engineer, first Surveyor General in Nevada
  - First created as a lake for logging operations by the Elliot Brothers in 1863
  - Purchased by the Carson and Tahoe Lumber and Fluming Company (CTLFCo) in 1873
    - Raised the dam to 24'
  - CTLFCo gave rights to the Virginia City and Gold Hill Water Company (VGHWC) in 1875
    - VGHWC raised the dam to 37' (2,000 million gallons)
  - Purchased by Curtis-Wright Corporation in 1957
    - Raised the dam to 52' (present height)

Marlette Dam

Marlette Water System
Major Components

Marlette Lake - Near Dam

Marlette Water System
Major Components

Marlette Lake Pump Site
Before Erosion

Marlette Lake Pump Site After Site Rebuild

Marlette Water System
Major Components

- Marlette Generator Building (KG Walters) (2009)
  - Installed 4” gas line to Generator Site
  - 2 gas powered generators
  - SCADA Controlled to call for water from Marlette pump station
  - Remote; requires helicopter or snowmobile access to site in the winter
  - $7.5 million

Marlette Generator and Generator Building

Marlette Water System
Major Components

- **Hobart Reservoir**
  - **Capacity: 35 million gallons**
  - **(2) 12” dia. outlet pipes to Hobart Creek**

Hobart Reservoir

Marlette Water System
Major Components

- **Hobart Dam**
  - — Rubble and earthen dam, built 1877
  - — 1,300’ long x 550’ wide x 28’ high with 7 foot freeboard

Hobart Reservoir Dam – Outlet Control Building

Marlette Water System
Major Components

- East Slope Catchments
  - Collects snowmelt / runoff water
  - Collects runoff from springs
  - Old route of the flume from East Portal to Diversion Dam (2.65 miles)
  - Collects water from collapsed Tunnel (East Portal)
  - Water collected into an 8” dia. steel pipe (flumed pipe) increasing to 12” dia. pipe at Diversion Dam
  - Water directly feeds into the 24” dia. pipe (directly north of Diversion Dam)
  - Currently contains (6) six major catchments

East Slope Pipeline (Near Diversion)

Marlette Water System
Major Components

- **East Slope Catchments (Lumos) 2014**
  - Increase flow Capacity off East Slope
  - Reduces cost of pumping water from Marlette Lake
  - Catchment #6 replaced first (2014)
  - Remaining catchments constructed in 2015/16
  - Catchments add ~200gpm to System
  - Water with less turbidity
  - 6 catchments total
  - 1 catchment at East Portal

Rebuilt Catchment #6 (2014)

Marlette Water System
Major Components

Stream Catchment #6

<u>Inlet</u>
Before (Top)
After (Bottom)

<u>Sediment Trap</u>
Before (Top)
After (Bottom)

Marlette Water System
Major Components

Inlet
Flooded from Runoff

Stream Catchment #6
Spring 2017

Sediment Trap
Showing Runoff Bypassing Catchment

Marlette Water System
Major Components

Catchment #6 Inlet Showing Reshaped Inlet Bowl to Improve Runoff Collection

Sediment Trap with Extension/Overflow Piping and Reworked Drainage Channel

Marlette Water System
Major Components

- **Diversion Dam**
  - Main intake point for the 24” dia. flumed pipe to Lakeview Tank
  - The dam acts as a stilling basin
  - Overflow of the dam at 4’ wide opening - 1” deep = 143gpm
  - Monitored and Controlled by SCADA
  - Actuated inlet valve at Hobart Creek
- **Red House (Site No Longer In Use)**
  - 1,500’ downstream from the Diversion Dam on Hobart Creek
  - Past home of water operator
  - Location of a smaller rock dam, used to divert water in “Lower Flume”

Red House and Red House Dam

Marlette Water System
Major Components

Diversion Dam – Prior to Work Project in 2017

Marlette Water System
Major Components

Diversion Dam – After Work Project in 2017

Marlette Water System
Major Components

- **Lakeview Tank**
  - Terminus of 4.6 mile long 24" and 18" dia. flumed pipe from Diversion Dam
  - Another settling basin
  - Located at former site of (2) two wooden tanks "The Tanks"
  - Hydraulically located to be higher in elevation than "End of Siphon"
  - Diverts water to Virginia City
  - Diverts water to Carson City
  - Location of flow meters and actuated flow control valves
  - Controlled by SCADA

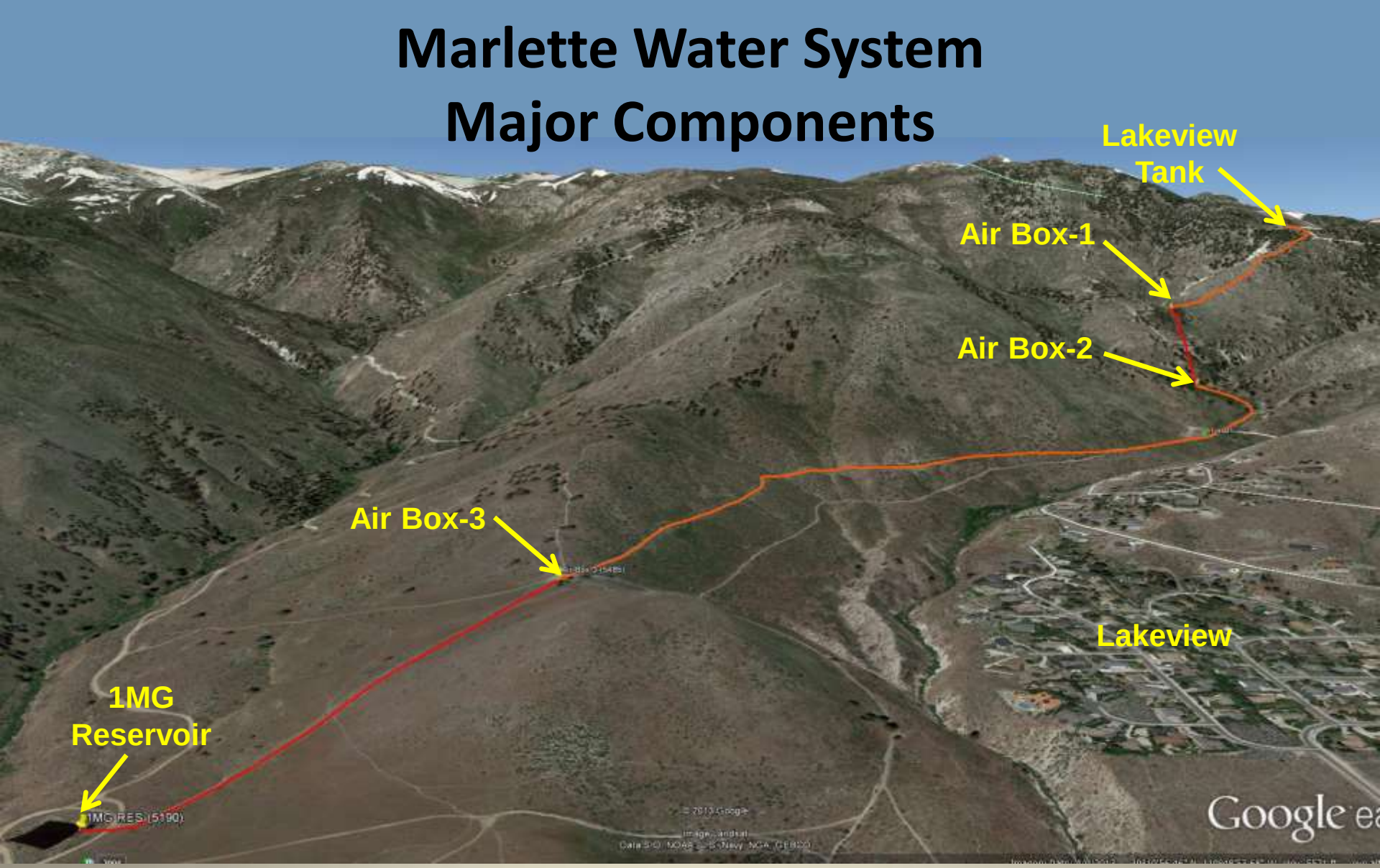
Lakeview Tank

"The Tanks"

Marlette Water System
Major Components

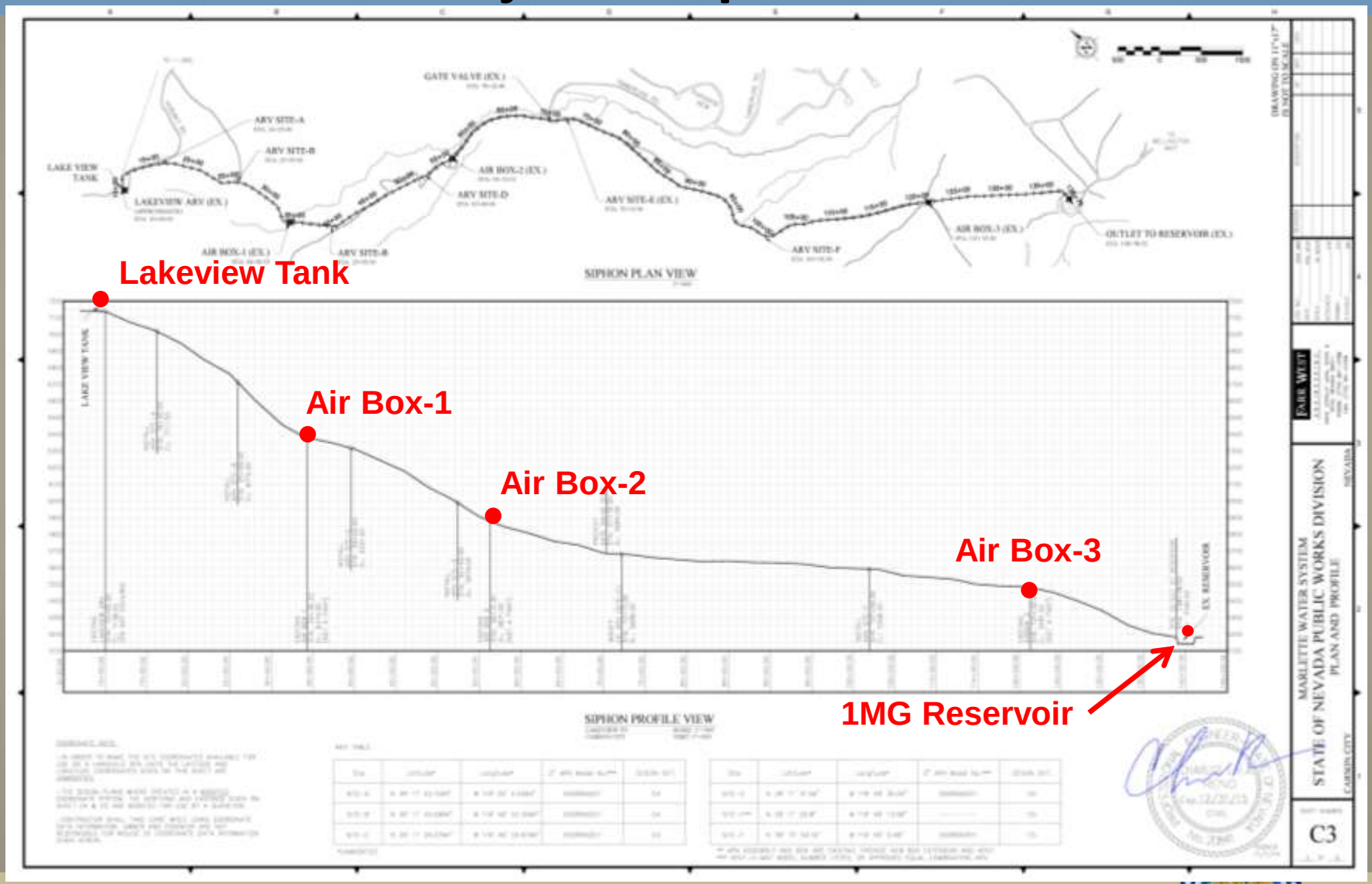
Lakeview Tank Site and Control Building

Marlette Water System
Major Components



Line from Lakeview Tank to 1MG Lined Reservoir

Marlette Water System
Major Components



Marlette Water System
Major Components

- **Air Boxes in Line to Carson City**
  - **3 Air Boxes**
  - **Boxes hydraulically reset atmospheric pressure in 8” dia. steel pipe**
  - **Capacity of 8” pipe: 1,800gpm (up to 946 MG per year)**
  - **Terminates at 1MG concrete lined Reservoir**
  - **Feeds Carson City Water Treatment Plant at Ash Canyon**

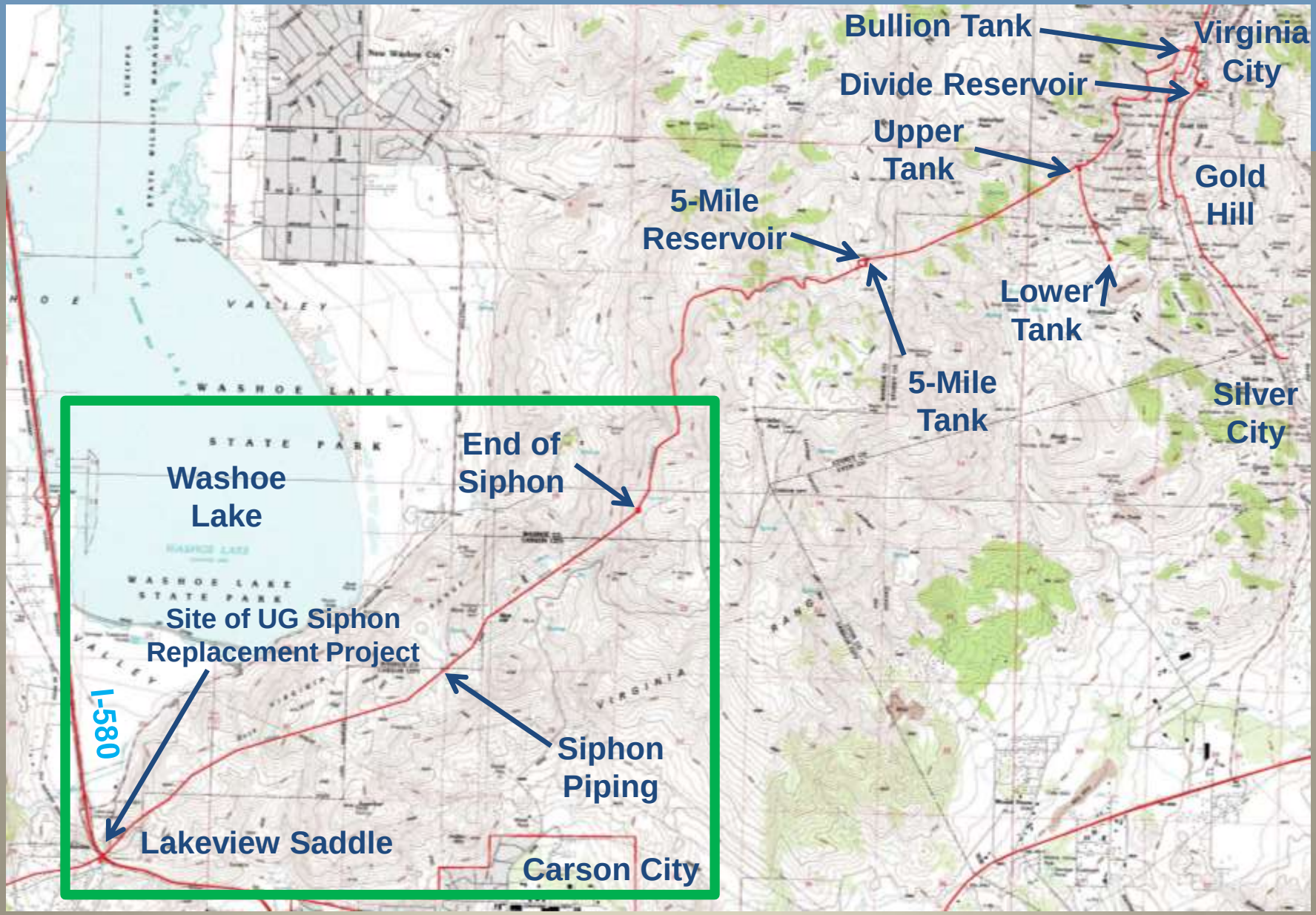
Air Box-1 Reconstruction

Marlette Water System
Major Components

Air Box-2 Reconstruction

Marlette Water System
Major Components

1MG Concrete Reservoir – from Air Box-3



Storey County Side (East of I-580)

Marlette Water System
Major Components

- **Siphon (Lakeview Tank to End of Siphon)**
  - 7 miles long inverted siphon (Schussler)
  - Engineering Feat for its time
  - At lowest point (Lakeview Saddle) 700psi
  - Pressure moves water miles without pumps to “End of Siphon”
  - Pipeline -1 (1873): 11” dia. steel pipe (double riveted pipe; 1Million rivets)
  - Pipeline-2 (1875): 10” threaded steel pipe
  - Pipeline-3: (1887): 11.5” locking steel pipe
  - 1887-1941 all three pipes were used to moved 10 MGD to Virginia City
  - Frequent breaks diminished its reliability
  - Pipeline-1 and 3 relocated 1941-1974
  - Current siphon (Pipeline-2) in desperate need of replacement

Pipeline-1 (Riveted Pipe)

Marlette Water System
Major Components

- **Inverted Siphon Replacement Under I-580**
  - **Inverted Siphon Piping Under Roadway was directly buried**
  - **At lowest point (Lakeview Saddle Under Roadway) 700psi**
  - **This Project Replaced the Inverted Siphon Piping and placed it in a Piping Sleeve Under the I-580 Roadway**
  - **New Installation in Piping Sleeve will Isolate Piping from Vibration due to Road Traffic**

New Pipe Sleeve Installation Under I-580

Marlette Water System
Who the System Serves

- Historic Comstock District – Sole Source of Water for these areas
  - Virginia City
  - Gold Hill
  - Silver City
  - Comstock District receives nearly 2 million visitors per year
  - Largest Historic District in the United States
- Carson City
  - Fresh Uranium-free water
- Comstock Mining Inc.
  - Raw water for mining and milling operations
- Nevada Department of Wildlife (NDOW)
  - Spawning At Marlette Lake
  - Guzzlers at remote sites

Marlette Water System
Who the System Serves

- **Spawning**
  - Gates used to isolate fish for gathering eggs
  - Fish eggs used at NDOW fisheries to stock lakes throughout all of Nevada

Spawning Gates at Marlette Lake

Guzzler Near 5-Mile Reservoir

Marlette Water System
Recent Improvements

- **3.7 miles of 10 dia. Pipe (CSA) (2003)**
  - End of Siphon to 5-Mile (replaced the old Pipeline-1 pipe)
- **Bullion Tank (CSA) (2005)**
  - Storage of raw water near Water Treatment Plant in Virginia City
- **Marlette Pump & Generator (KG Walters) (2009)**
  - Replaced old diesel generator at Marlette Reservoir
- **ARV project (Farr West) (2013)**
  - Installed to allow rapid recharge of siphon line, restore flows to Virginia City

Marlette Water System
Recent Improvements

- **Comstock Mining Metering (Farr West) (2012; phase 1)**
  - Metering of connection and to ensure protection of water supply
- **5-Mile Reservoir Lining (Farr West) (2014)**
  - Additional storage closer to Virginia City
- **Divide Reservoir Lining (Farr West) (2014)**
  - Storage in Virginia City for wildland fire protection
- **East Slope Catchments (Lumos) (2014 -2015)**
  - Gathering of loss runoff; will require less pumping from Marlette Lake
- **SCADA Controls (2000-present)**

Marlette Water System
Recent Improvements

- **Air Release Valve Project (Farr West) 2013**
  - Fabricated weldolets for installation of high pressure valves.
  - Pressures reach 620psi
  - All stainless steel components
  - Double acting air-release/air-intake (combination valves)
  - Increased fill rate to less than 1 day and no need to visit each remote site to bleed air out of system
  - Increased reliability of the water supply to V.C.
  - 15 ARV sites

High Pressure Valve being Installed

Marlette Water System
Recent Improvements

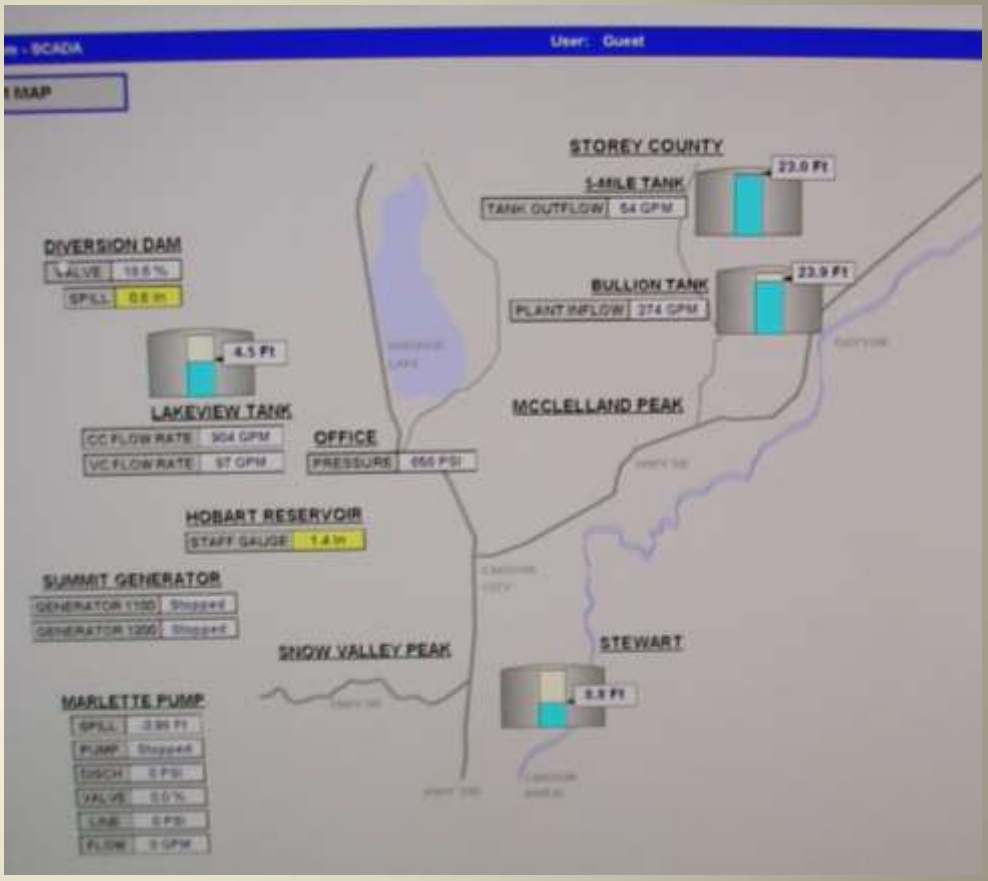
5-Mile Reservoir – Outlet Structure

Marlette Water System
Recent Improvements

Reconstructed Catchment #6 (2014)

Marlette Water System
Recent Improvements

- **SCADA Control Systems (Sierra Controls / Farr West) 2000-2014**
  - **Real time SCADA Monitoring of all sites (since 2000)**
  - **Transducer readings**
    - **Marlette Lake**
    - **Diversion Dam**
    - **Lakeview Tank**
    - **5-Mile Reservoir**
    - **5-Mile Tank**
    - **Comstock Lower Tank**
    - **Bullion Tank**
    - **Divide Tank**
  - **Meter reading and reporting (2010)**
  - **Actuated valve control (2010)**
  - **Flow rate control (2010)**
  - **Meter reading (2010)**
  - **Water balancing**
  - **Smartphone controlled**



Screenshot of System Controls

Marlette Water System
Future of the Water System

- **Completed Improvement Projects**
  - Air Box Upgrades
    - Spring 2015
  - East Slope Catchments
    - Fall 2015
  - ARV Project, Vicee Canyon
    - Fall 2015

Gate Valve (5-Mile to V.C.)

Marlette Water System
Future of the Water System

- **Future Improvement projects**
  - New pipe line from East Slope to Diversion Dam
  - Replace piping from Sawmill to Diversion
  - Complete East Slope Catchment Improvements
  - Diversion Dam Metering for East Slope
  - Dam Restoration (Marlette and Hobart)
  - VFD and Transfer Switch for Marlette Pumping

Pipeline-1 (riveted)

Marlette Water System
End of Presentation