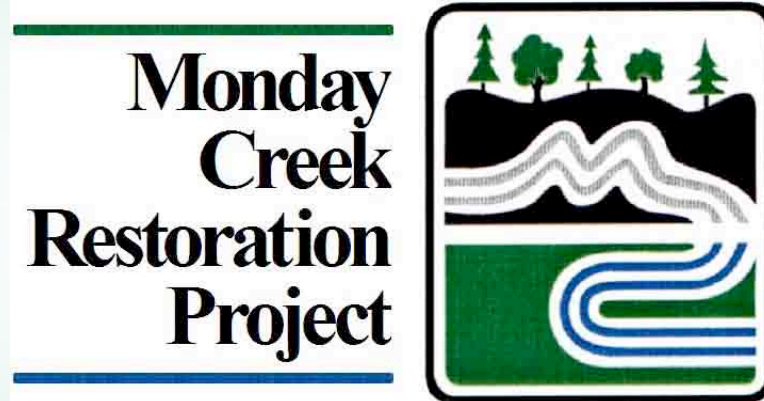


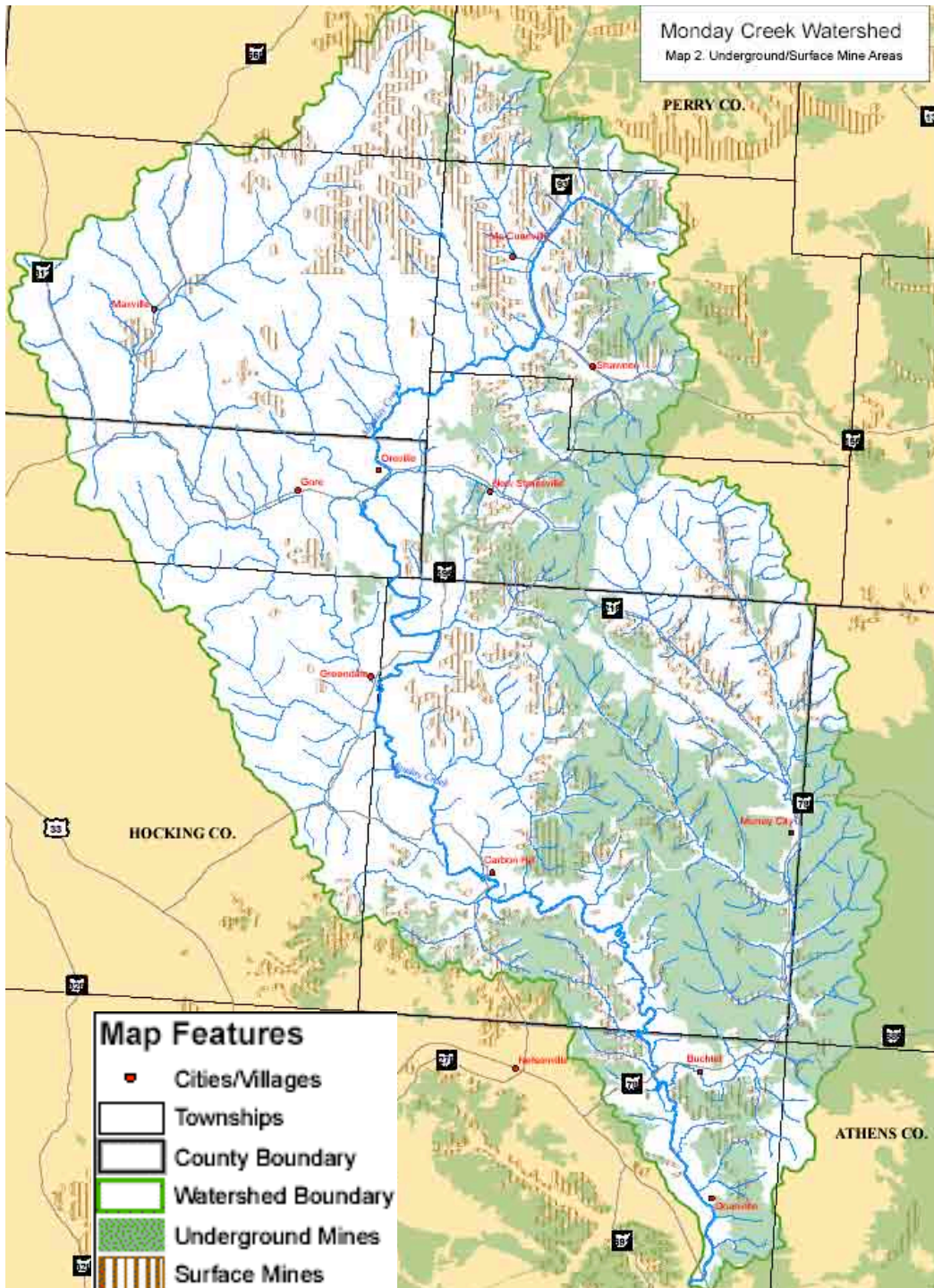
Operation and Maintenance of AMD Treatment Systems

Presented by



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Monday Creek Watershed

- 15,000 acres of underground mining
- 3,000 acres of surface mining
- Over 3,000 mine features identified



Monday Creek Treatment Systems

- **There are currently 13 treatment systems in the watershed.**
- **According to Monday Creek AMDAT plan, approximately 54 systems will need to be constructed in the future.**



Limestone Leach Bed



Successive Alkalinity Producing System



Steel Slag Leach Bed



Lime Doser



Treatment system components include:



- Inlet and Outlet
- Under drain system
- Valves
- Clean outs

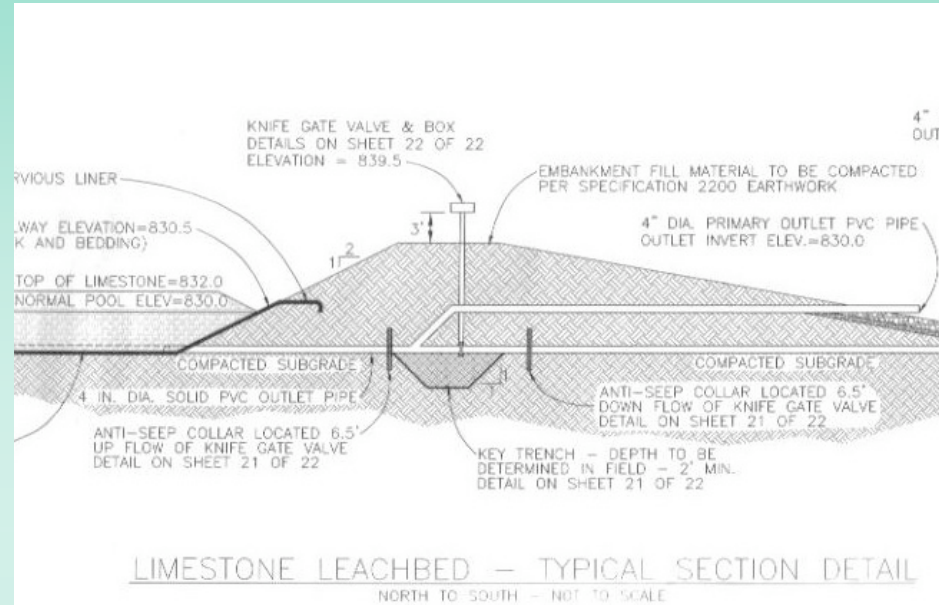
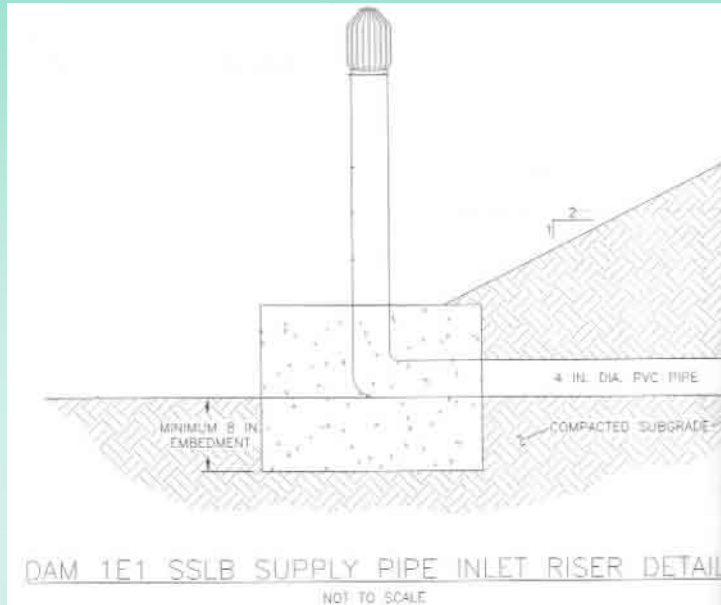




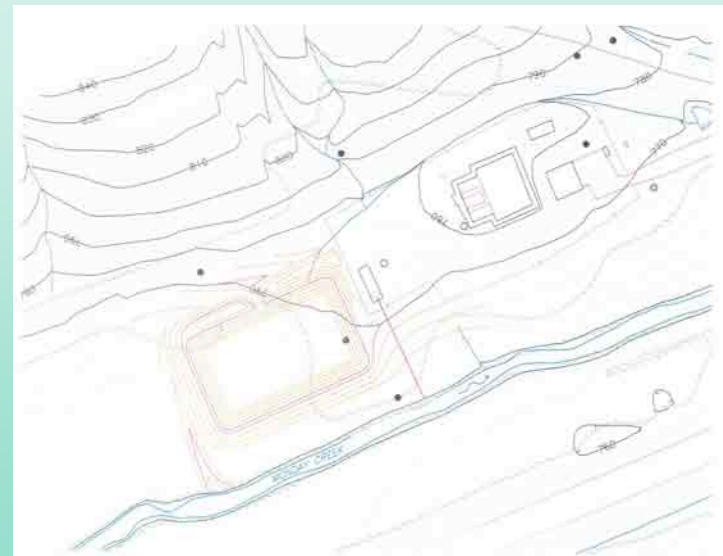
- **Chemical storage**
- **Delivery mechanism**
- **Mixing channels**
- **Access panels**
- **Housing or work area**



Know the System



- **Get a set of “as built” plans.**
- **Identify critical features.**
- **Know how it operates.**



Personnel

- Who can access the system?
- Who is responsible for O&M at the site?
- Communicate with stakeholders.



Develop a Schedule

- Water Quality Monitoring
- Maintenance and Inspection
- Flushing
- Shut down and re-start
- Chemical delivery



Passive Systems

- What is the treatment goal?
- How long does it take a bed to fill?
- Seasonal flow variability and residence time.



Active Systems

- Goal
- Flow variability and rate of application
- Material consistency



System Access



- **What type of equipment is needed to access system components?**
 - **Keys**
 - **Valve stems, handles**
 - **Meter wrenches, pipe wrenches**



Perform Regular Inspections



- **Is the system functioning properly?**
 - Monitor water quality, flow rates and head pressure changes.
 - Inlet and Outlet - screening devices, standpipes.
 - Debris accumulation and algae growth.

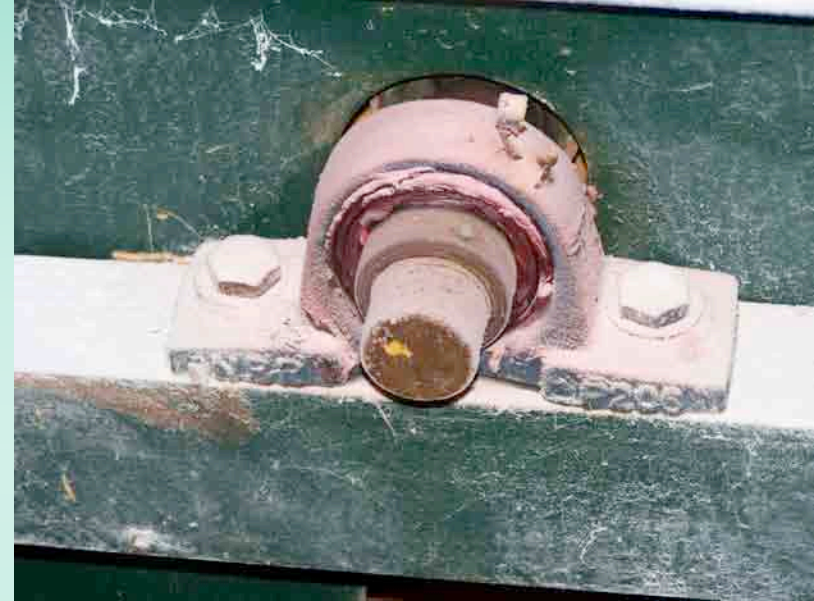




- **Observe pipe integrity - build up of material, metal or sludge accumulation**
- **Document changes in performance.**

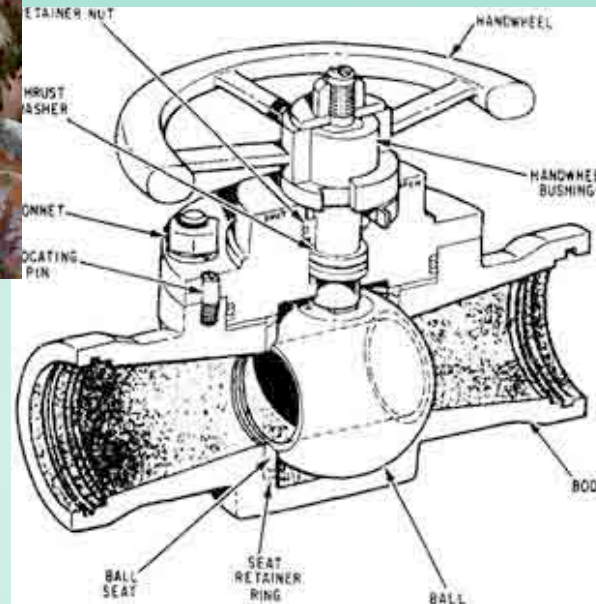


Maintenance



- **Lubricate - chains, bolt threads and locking nuts**
- **Grease bearings - gear boxes, auger, shaft and axles**





- **Exercise valves!**
 - Open and close at least 4 times a year.
- Is it a gate valve or ball valve?
- Will the valve open and close completely?





- **Flushing is a rapid drawdown of water to remove metal floc accumulated in the system**
- **Flush lines until discharge waters run clear.**
 - **Frequency determined by flow rates, iron and aluminum concentration.**



Example

Location	Aluminum mg/l	Iron mg/l
Inlet	20	20
Outlet	8	7
Reduction	12	13

Flow rate of 300 gpm = 90 lbs per day

Flow rate of 30 gpm = 9 lbs per day

- 90 lbs/day x 90 days = 4 tons
- Monitor treatment efficiency - increase flush as needed.
- At a minimum flush once per quarter.



Chemical Handling



- **Observe safety precautions (MSDS sheets)**
- **Calcium oxide storage should not exceed 60 days (absorbs moisture)**
- **Potency of material declines with increased storage time**
- **Access panels and pipe unions need to be checked for leaks (gasket integrity)**



Problems



- **Accumulation of grit and sediment in lines**
- **Wear on parts**
- **Seasonal temperature variation – corrosion, rust**





- **Freezing temperatures – locks, valves and boxes, housing, delivery mechanism**
- **Build up of materials on intakes, pipes and channels (metals, vegetation, leaf litter, ice, snow)**
- **Physical stability and erosion control particularly spillways or embankments**
- **Pests – bees, ants, beaver, muskrats**



Understand Site Limitations

- **Access roads – seasonal, remote locations**
- **Topography**
- **Electricity**
- **Water source**
- **Buried valves and piping**



Safety Issues



- **Chemical- burns skin / eye contact, inhalation**
- **Mechanical equipment – injuries**
- **Confined spaces – entrapment, gases (carbon monoxide, hydrogen sulfide)**
- **Falls – wet surfaces, ice, limestone, ladders, embankments**



Annual Costs



- Chemical supply
- Equipment and tools
- Labor
- Repair of critical items (pipes, valves, machinery)



Maintenance Fund

- **Specialized maintenance, including**
 - Welding
 - Plumbing
 - Earthwork
- **Sludge Disposal**
- **Litter Removal**
- **Vandalism**



In summary...

- **To achieve aquatic use attainment goals or improve water quality in AMD impacted watersheds many treatment systems will need to be constructed in the future.**
- **All treatment systems have a life expectancy.**
- **Most systems will require some degree of operation and maintenance.**



- **Prior to project implementation, stakeholders need to understand what is required to maintain these systems.**
- **Operation and maintenance is necessary to monitor efficiency and will aid in meeting the projected lifespan and project goals.**
- **Future planning to meet costs.**

