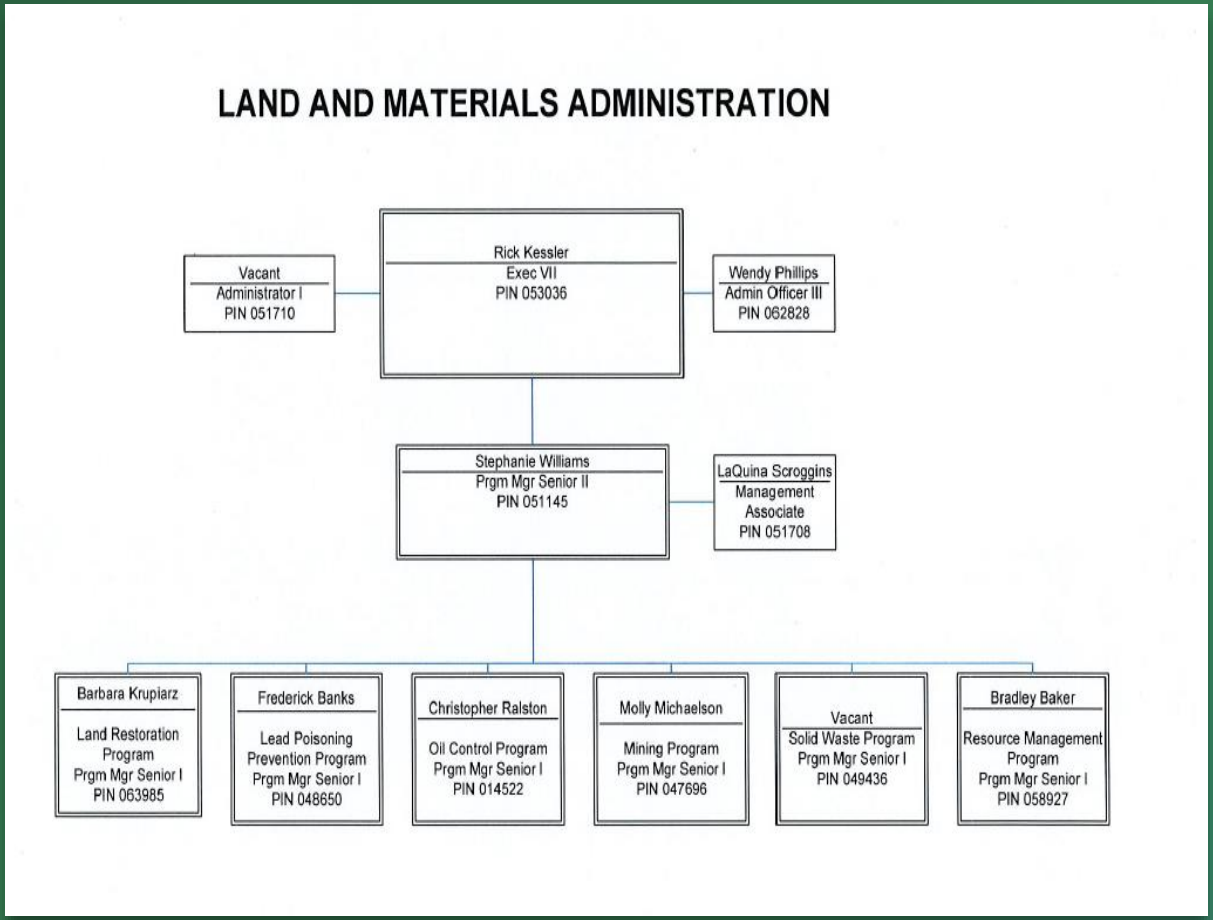
Maryland Abandoned Mine Land Division

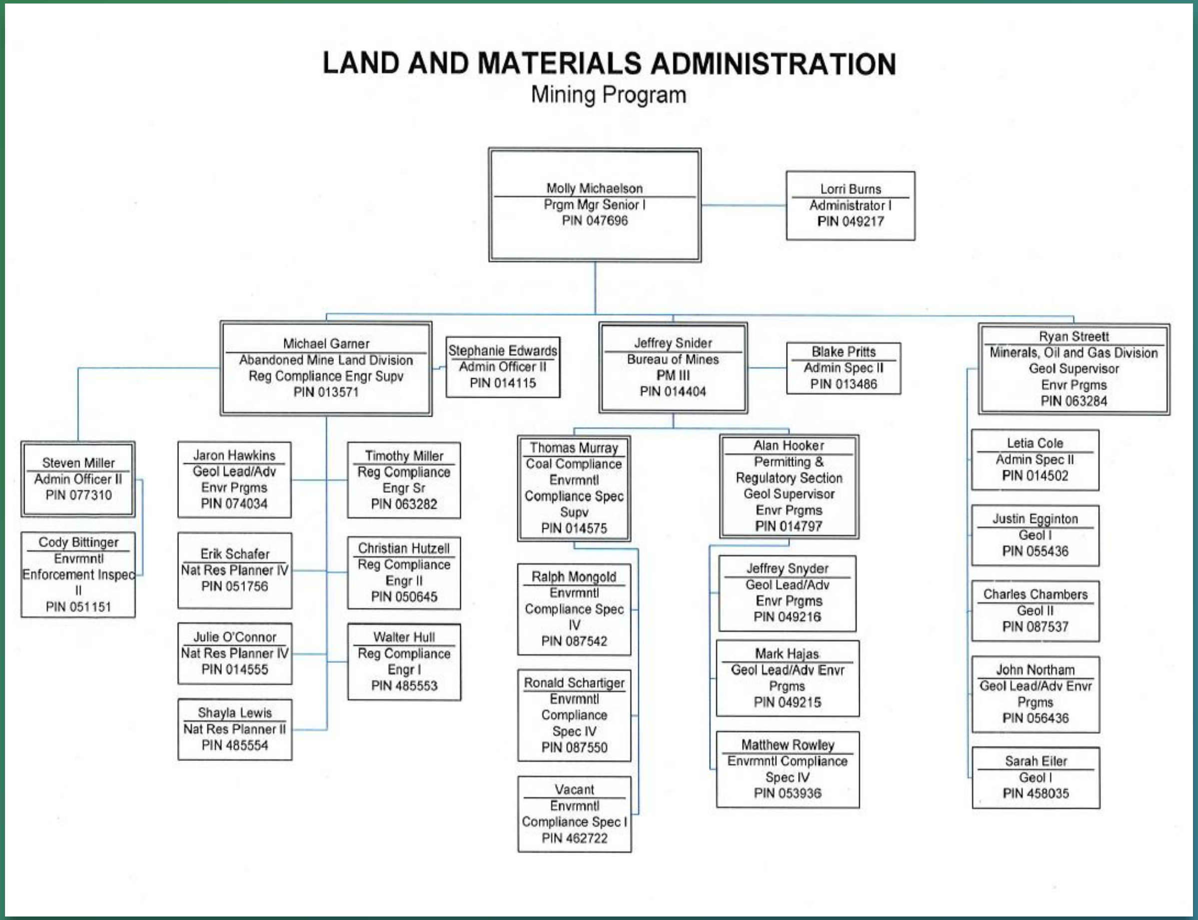
Department of the Environment

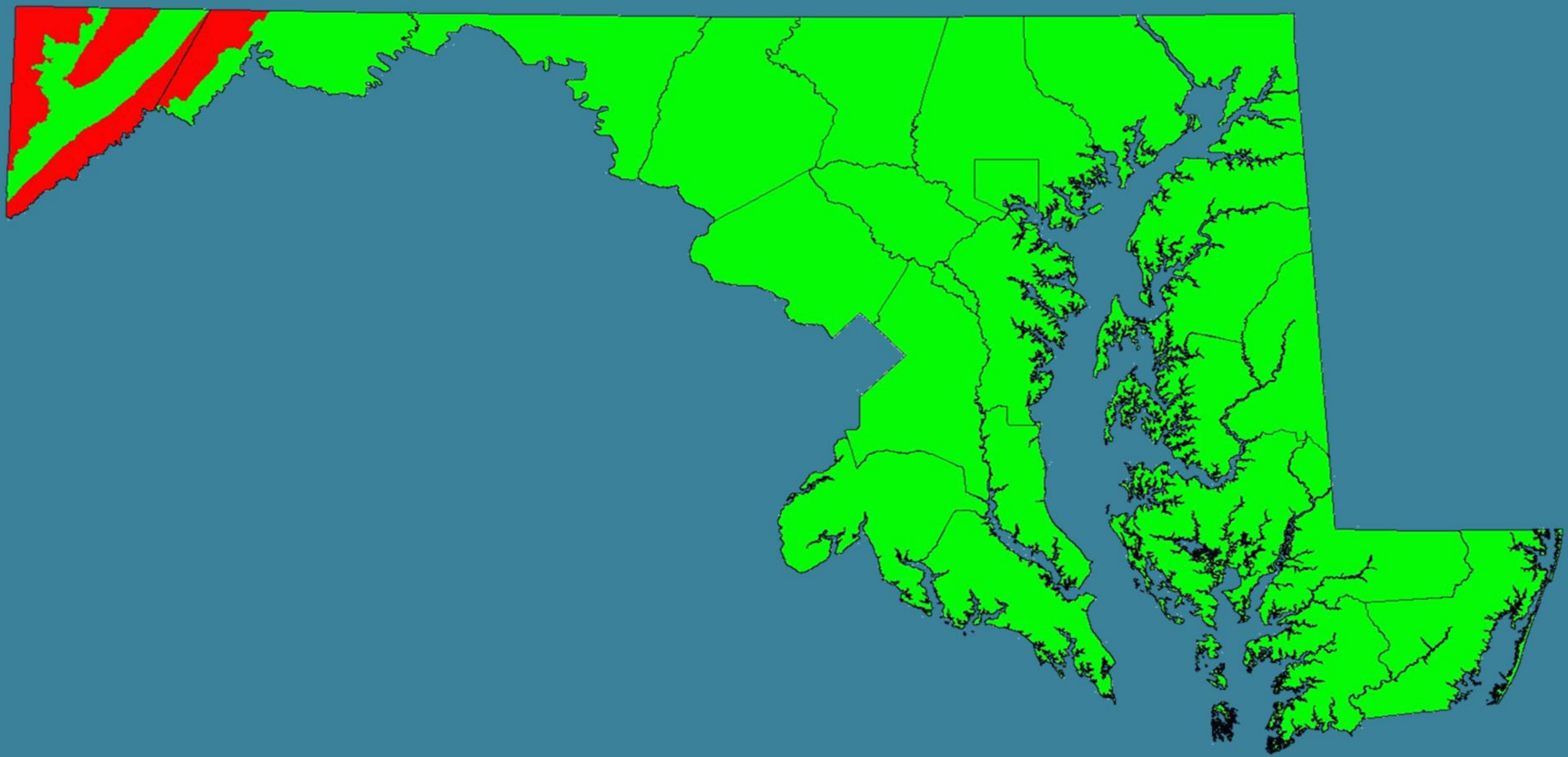
Land and Materials Administration

Mining Program

MDE- Land and Materials Administration (LMA) Organizational Chart







Key Dates in Maryland's Coal Mining History and Regulation

1876

The MD General Assembly created the Mine Inspector's Office for Allegany and Garrett Counties.

- Mission was related to mine safety, tracking coal production, and ensuring proper "Weights and Weighing".

1922

MD General Assembly created the Bureau of Mines replacing the Mine Inspectors Office.

1955

The first State surface coal mining laws were passed which marked a regulatory shift from miner's safety to environmental protection.

1977

The federal Surface Mining Control and Reclamation Act of 1977.

- Set national standards for the surface impacts of coal mining and reclamation as well as created the federal Abandoned Mine Land Trust Fund.

1982

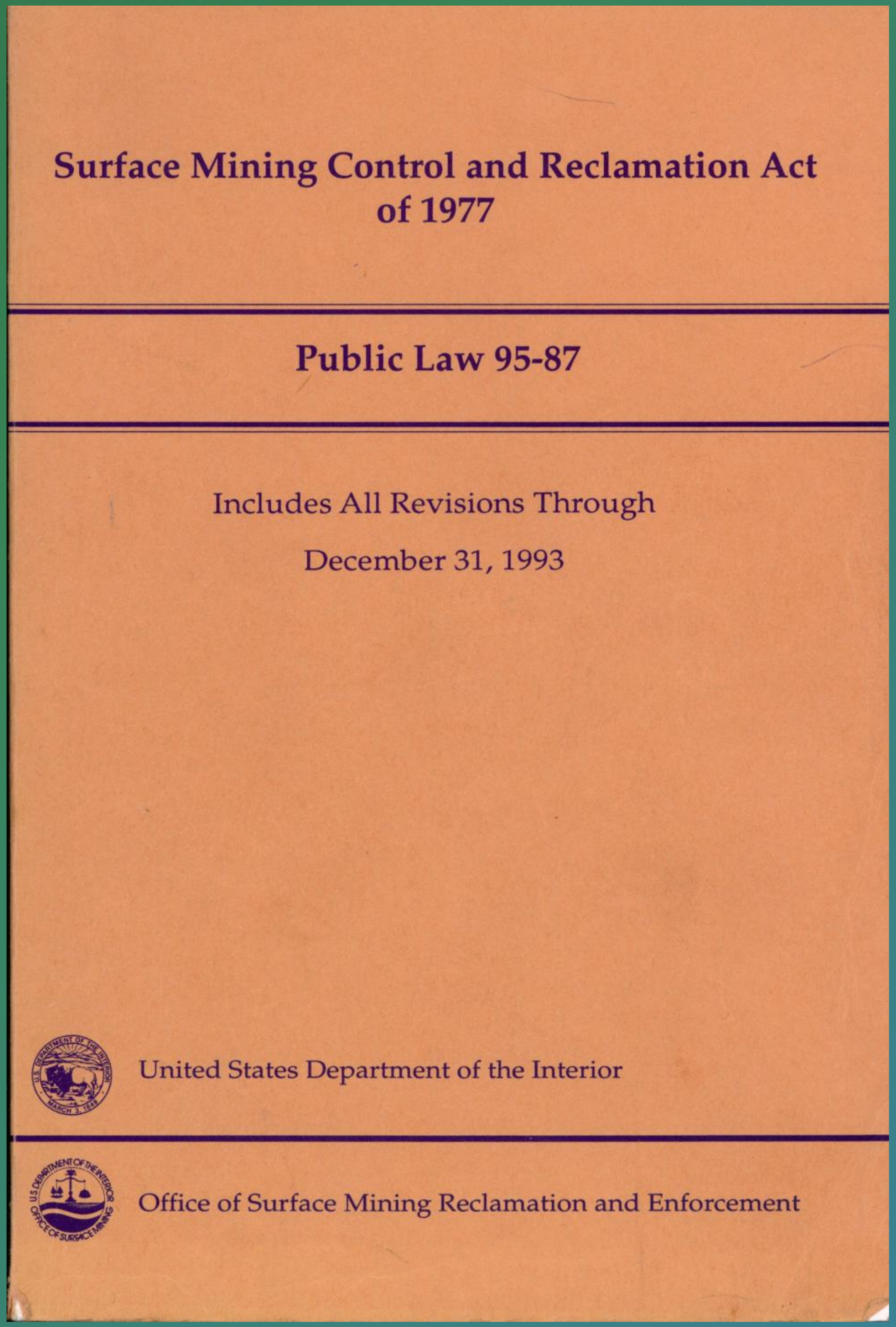
MD received federal approval from the DOI-Office of Surface Mining for the coal mine regulatory program and abandoned mine land program.

2009

The AML Section of the Bureau of Mines became a Division of the Mining Program.

Surface Mining Control and Reclamation Act of 1977 (SMCRA)

- Provided National mining and reclamation standards for active mines.
- Established the Abandoned Mine Reclamation Fund by taxing coal production.
  - $0.22/ton for surfaced mined coal
  - $0.09/ton for deep mined coal
- Set abandoned mine reclamation priorities
- Defines “abandoned” as mined and unreclaimed prior to the date of the Act (August 3, 1977).
- The Infrastructure Investment and Jobs Act (IIJA) extended the AML tax and provide other funding.


Surface Mining Control and Reclamation Act of 1977

Public Law 95-87

Includes All Revisions Through

December 31, 1993

United States Department of the Interior

Office of Surface Mining Reclamation and Enforcement

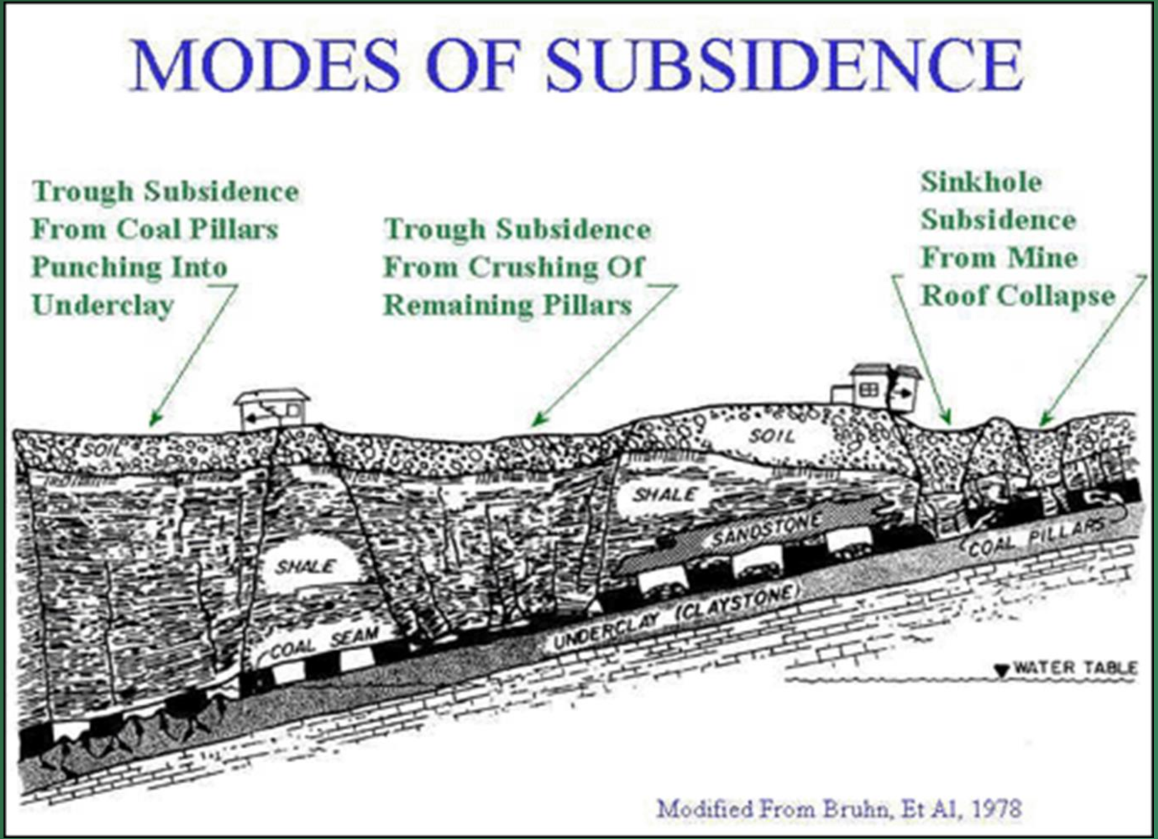
Abandoned Mine Reclamation Priorities SMCRA of 1977 Section 403(a)

Priority One – "the protection of public health, safety, and property from extreme danger of adverse effects of coal mining practices"

Priority Two – "the protection of public health, safety, and from adverse effects of coal mining practices"

Priority Three – "the restoration of land and water resources and the environment previously degraded by adverse effects of coal mining practices…"

OSM's AML Inventory Manual – PRIORITY 1 and 2



Subsidence: Any surface expression of AML-related subsidence which damages property and poses danger to human safety and health. These may be tension cracks, troughs, shearing faults, or caving caused by AML-related underground mine voids.

PRIORITY 1 & 2 PROBLEM TYPES		WORK UNITS	
Code	**Description**	**English**	**Metric**
CS	Clogged Streams	Miles	Kilometers
CSL	Clogged Stream Lands	Acres	Hectares
DH	Dangerous Highwalls	Feet	Meters
DI	Dangerous Impoundments	Count	Count
DPE	Dangerous Piles and Embankments	Acres	Hectares
DS	Dangerous Slides	Acres	Hectares
GHE	Gases: Hazardous/Explosive	Count	Count
UMF	Underground Mine Fires	Acres	Hectares
HEF	Hazardous Equip & Facilities	Count	Count
HWB	Hazardous Water Bodies	Count	Count
IRW	Industrial/Residential Waste	Acres	Hectares
P	Portals	Count	Count
PWAI	Polluted Water: Agricultural & Industrial	Count	Count
PWHC	Polluted Water: Human Consumption	Count	Count
S	Subsidence	Acres	Hectares
SB	Surface Burning	Acres	Hectares
VO	Vertical Openings	Count	Count

OSM's AML Inventory Manual – PRIORITY 3 and Water Supplies

Hazardous Equipment/Facilities: Any AML-related dilapidated hazardous equipment or facilities located within close proximity to populated areas, along public roads, or other areas of intense visitation.

PRIORITY 3 and 403(b) PROBLEM TYPES		WORK UNITS	
Code	Description	English	Metric
SA	Spoil Area	Acre	Hectare
BE	Bench	Acre	Hectare
PI	Pits	Acre	Hectare
GO	Gob	Acre	Hectare
SL	Slurry	Acre	Hectare
HR	Haul Road	Acre	Hectare
MO	Mine Opening	Count	Count
SP	Slump	Acre	Hectare
H	Highwall	Feet	Meter
EF	Equipment/Facility	Count	Count
DP	Industrial/Residential Waste	Acre	Hectare
WA	Water Problems	Gallons	Liter
O	Other	Count	Count
WS	Water Supplies	Count	Count

AML DIVISION – Funding Sources and Uses

Funding Agency	Fund Name	Allowed Uses	Annual Amt
DOI, Office of Surface Mining	AML Funds	Any Pre-SMCRA eligible site that has a Priority 1 or 2 abandoned mine feature	$3,000,000
DOI, Office of Surface Mining	Watershed Cooperative Funds*	New AMD treatment systems and upgrades to old treatment systems for AMD from Pre-SMCRA mines	$0 - $125,000
DOI, Office of Surface Mining	Civil Penalty	Post-SMCRA bond forfeiture sites that require improved water treatment and/or land reclamation	$0 - $315,000
DOI, Office of Surface Mining	Acid Mine Drainage Abatement and Treatment Fund	Treatment and abatement of AMD from Pre-SMCRA mines and operation and maintenance of existing systems. Land reclamation of Pre-SMCRA sites that are creating AMD.	
EPA	319 Program and 104(B)3	New AMD treatment systems, Watershed Improvement Plans, Upgrading of existing AMD treatment systems	$0 – $600,000
US Fish and Wildlife Service	Eastern Brook Trout JV	Projects that improve brook trout habitat	$0 - $25,000
Capital Budget – General Obligation Bonds	Maryland Mining Remediation Prog.	Any Pre-SMCRA site that is impacting the health, safety and/or the environment. Historically used for AMD abatement.	$500,000
MDE	Deep Mine Fund	Damage from mine subsidence and sealing of mine openings	$0 - $25,000
MDE	Bituminous Coal Open Pit MiningFund	Land Reclamation at Pre-SMCRA sites and Post-SMCRA sites where the bonds are released or forfeited.	$0 - $900,000

Infrastructure Investment and Jobs Act (IIJA)

- Signed into law on November 15, 2021.
- The IIJA authorized and appropriated $11.293 billion to the Abandoned Mine Reclamation Fund to which $10.873 will be distributed in AML Grants by OSMRE to eligible states and tribes over a 15-year period.
- With IIJA our annual funding increased from $3.0 million under the fee-based SMCRA program to approximately $7.7 million ($4.7 million IIJA).
- IIJA grant money may be used to address coal AML problems including:
  - Priority 1, 2, and 3 problems include:
  - Hazards resulting from legacy coal mining that pose a threat to public health, safety, and the environment within their jurisdictions (including, but not limited to, dangerous highwalls, waste piles, subsidence, open portals, features that may be routes for the release of harmful gases, acid mine drainage, etc). ;
  - Water supply restoration (infrastructure):
  - Coal AML emergencies.
  - Stand alone Mine Drainage treatment problems (Priority 3). These can be addressed without being combined with a Priority 1 or 2 problem as with SMCRA funded projects.

What is Acid Mine Drainage (AMD) and how is it formed?

- *AMD is formed when surface or ground water comes in contact with rock that contains iron sulfides (pyrite) or other sulfer-bearing materials. This acidic water can leach iron, aluminum, manganese, and other metals into the water. When this water contacts the oxygen in the air, under the right conditions, metals will precipitate out.*
- *Not all mine drainage is acidic. Not all mine drainage looks bad, at least not until treatment is started. Sometimes ugly mine drainage is not as bad as it looks while crystal clear water may not be as good as it seems. When the acidity is high and pH is low, the metals are dissolved in solution and their presence is not visible.*
- *The chemistry of mine drainage can vary greatly depending on the coal pavement, overlying strata, type of mining, method of reclamation, etc.*


Hoffman Drainage Tunnel (1906)


Braddock Run

Coal Mine Drainage can be either net acidic or net alkaline

- In acidic mine drainage, total acidity exceeds total alkalinity. The drainage may contain elevated concentrations of iron, sulfates, aluminum, and/or manganese as well as other contaminates.
- In alkaline mine drainage, alkalinity equals or exceeds acidity and sulfates, iron, and manganese concentrations are usually elevated.

Effects of Mine Drainage and Mineral Deposition in Streams

- Low pH can be lethal to fish and other benthic organisms.
- Most have a defined range of pH tolerance below which death will occur.
- Most animal life is nearly absent in streams with pH < 3.5.
- Metals can cement the stream bed rocks and sediments smothering macroinvertebrates and fish eggs hindering reproduction.
- Cover fish gills (Al) and body surfaces.
- Affects food sources for fish
- Acidic water can also be very corrosive to concrete and steel culverts.
- Metal Precipitate can cause streams, ditches, and small culverts to plug resulting in minor flooding conditions.
- Drinking water contamination.
- Clogged drainage pipes resulting in wet yards and basements.

Treating Mine Drainage

- The Abandoned Mine Land Division operates 64 Mine Drainage Treatment Systems in Allegany and Garrett Counties.

- Types of Treatment used by AMLD:

  - *Active Treatment* – The addition of alkaline chemicals directly to the mine discharge or stream.
  - *Passive Treatment – The use of ponds, wetlands, ditches, and limestone to treat the mine drainage through biological and geochemical processes.*

  - The method we use to treat the Mine Drainage is determined by the water quality characteristics and the flow. Passive treatment can require 2 to 10 acres of ground to construct a system to properly treat the mine drainage. Passive treatment is limited to relatively low flows (<100 gpm) and pH >3.5. Active treatment requires less space and can treat any water quality and greater flows.

Active Treatment in Maryland

- Lime Dosers (water powered and electric)
- Caustic Soda Drip
    - AMLD Operates 12 Lime Dosers and one caustic drip in Allegany and Garrett Counties.

Chemicals Used to Treat AMD:

- Calcium Carbonate (Limestone Dust)
- Calcium Oxide (Pebble QuickLime)
- Calcium Hydroxide (Hydrated Lime)
- Sodium Hydroxide or Liquid Caustic (Stored in lined steel tanks)

Aarons Run Tipple Bucket Style Doser

Shallmar Aquafix Waterwheel Style Doser

Jennings Run Doser – Electric Powered

Passive Treatment Technology

- Passive Treatment for Mine Drainage is defined as treatment without the use electrically or mechanically operated components, or chemical reagents such as hydrated lime or other reactive alkaline or oxidizing materials.
- Passive treatment, though not maintenance free, typically requires less regular maintenance than active systems.
- AMLD Operates 30 Passive Treatment Systems and 22 Sand Dumps in Allegany and Garrett Counties

Types of Passive Treatment used in Western Maryland

- Anoxic Limestone Drains (ALD)
- Vertical Flow Ponds (VFP)
- Successive Alkalinity Producing Systems (SAPS)
- Limestone Leach Beds
- Limestone Channels
- Constructed Wetlands
- Steel Slag Beds
- Settling Basins
- Sand Application Areas or Sand Dumps (semi-passive)

Passive Treatment in Maryland

- Anoxic Limestone Drain (ALD)

  - Buried limestone trenches or beds that react with AMD and produce alkalinity in an oxygen free environment. Once water discharges from the ALD and is introduced to air, iron and other metals begin to precipitate. An ALD is typically followed by a settling pond and/or a constructed wetland.

  - Limitations: Al, DO

Passive Treatment in Maryland

- Vertical Flow Ponds (VFP)
  - Ponds containing perforated pipe, 3 to 5 feet of limestone, and a 6” to 1’ layer of compost on top of the limestone.
  - The water level of the pond is typically one to two feet over the compost.
  - AMD enters the pond and flows vertically through the compost where the oxygen is removed by bacterial respiration. This prevents iron from precipitating in the limestone thus clogging the bed.
  - The water then passes through the limestone layer where alkalinity is added and the pH of the water increases.
  - The water then enters the perforated piping where it discharges from the VFP into a settling pond where the water is reintroduced to oxygenated air and the metals precipitate.
  - A Successive Alkalinity Producing System (SAPS) is a series of these VFP’s and settling ponds.

Vertical Flow Ponds (VFP's)

Passive Treatment in Maryland

- Limestone Leach Beds
  - Excavated ponds filled with limestone where AMD flows horizontally through the system.
  - The water reacts with the stone as it works its way through the bed.
  - Water discharges from the bed through a perforated pipe or ditch to the receiving water body.
  - Limitations: Over time metals precipitate in the stone resulting in armoring and clogging of the bed rendering the limestone ineffective. Stone must be replaced periodically. How often depends on water quality and flow of the mine drainage.

Limestone Leach Beds

Other Passive Treatment Techniques used in Maryland

- Constructed Wetlands
- Settling Basins
- Limestone Channels

  - Are typically used in conjunction with other passive technology depending on water quality.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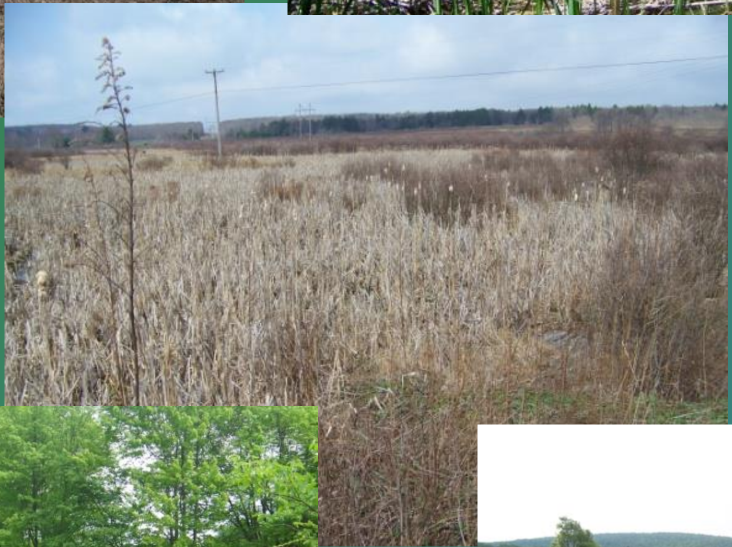


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Passive Treatment in Maryland

- Limestone Sand Application Areas or “Sand Dumps”
  - High calcium carbonate limestone sand is placed along the stream bank from constructed access roads or pull-off areas typically where streams intersect roadway at culverts or bridges.
  - During high flow periods, the sand is carried downstream where it incorporates into the bedload providing a treatment buffer during periods of low flow and seasonal fluctuations to the water quality.
  - Good for increasing alkalinity in streams that are not severely impacted.
  - AMLD operate 22 Sand Dumps in Western Maryland.
  - Limitations: Water with high flows, slow moving streams, high metal content

Limestone Sand Dump Examples

Recently Completed AMD Treatment Projects

- Everhart Refurbish and Improvement Project – Completed in September of 2022 (Passive)
- Jennings Run Lime Doser Project – Completed in June of 2023 (Active)

Everhart Refurbish and Improvement Project

Aerial photos taken in 2014.

Everhart Refurbish and Improvement Project

- The project was a partnership between AMLD, Trout Unlimited, and The Nature Conservancy in Maryland (landowner).
- This project consisted of upgrading one of our three passive AMD treatment systems within the Cherry Creek Watershed in Garrett County. Cherry Creek is one of the main tributaries feeding Deep Creek Lake.
- Original treatment system was constructed in 2001.
- The system had consumed most of the limestone and by 2022 the effectiveness of the treatment had greatly diminished.
- The plan was to convert the system from a Successive Alkalinity Producing System (SAPS) to multiple limestone leach bed systems by splitting the flow of the AMD.

Everhart Refurbish and Improvement Project

- Funding for the project was obtained from a OSMRE Watershed Cooperative Agreement Program (WCAP) Grant obtained by Trout Unlimited and from the AMLD AMD Set-Aside fund.
- Total Project cost amounted to just under $500,000.
- The system upgrades were completed in two phases.
  - Phase I, which was completed by Pine Mountain Coal Co., involved the modification of the second treatment cell, splitting the AMD flow between two cells with a series of pipes, and the major upgrade of the access road into the site.
  - Phase II, which was completed by First Fruits Excavating, involved the modification of the first treatment cell and the final upgrades to the access road.

Everhart Refurbish and Improvement Project
Water Quality of the Everhart Discharge

Water Quality (avg last 10 yrs):

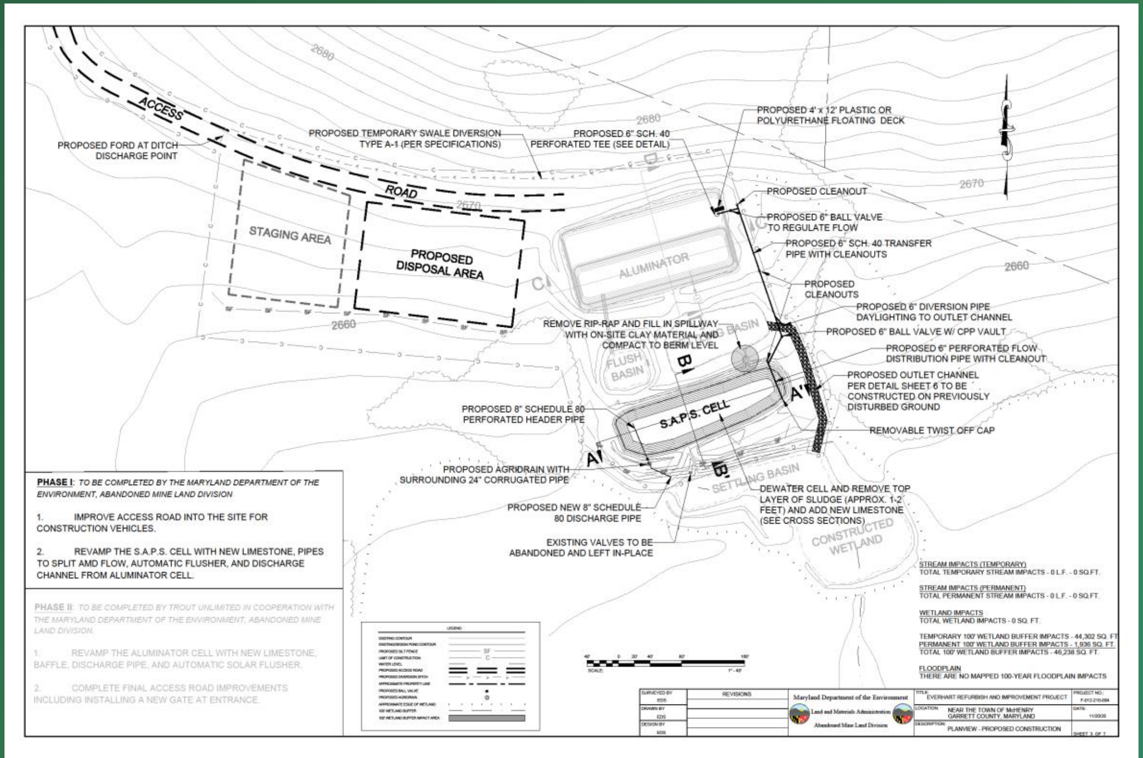
AMD Into the System

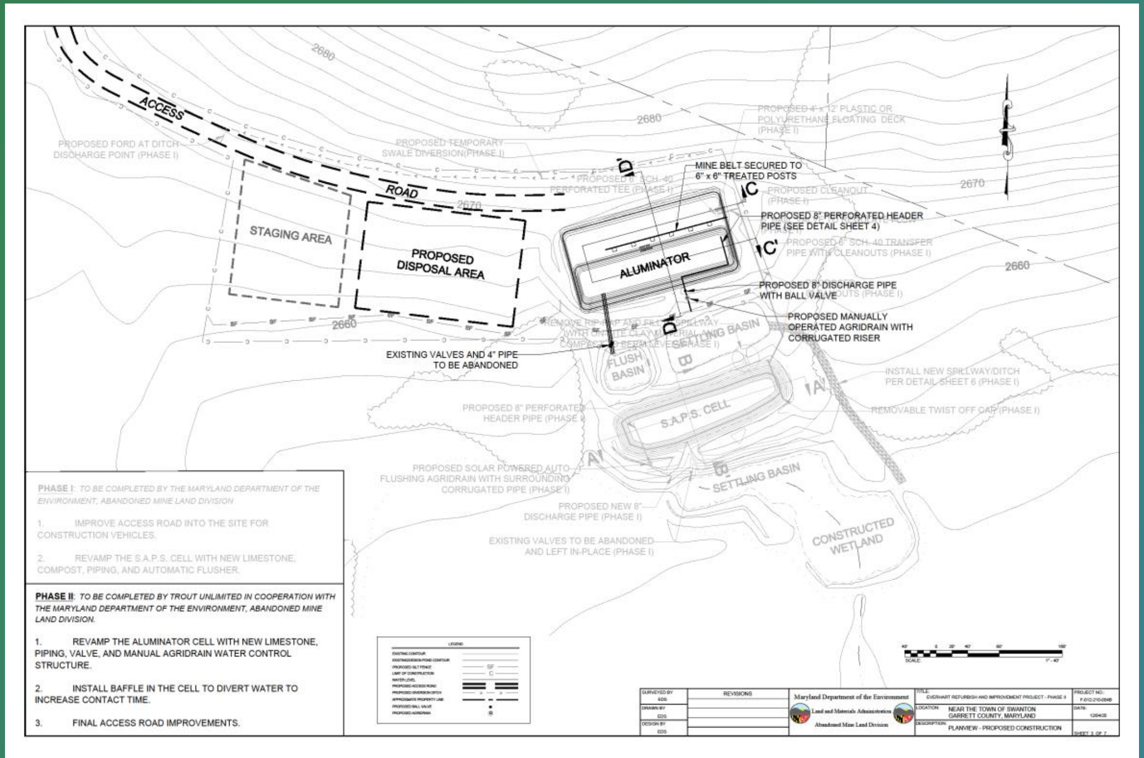
pH – 3.0 – 3.5
Acidity – 161.4
Alkalinity – <5
Iron – 47.9
Aluminum – 6.4
Manganese – 21.6
Sulfate – 328.3
Specific Conductance – 793.4
Flow – 10 – 80 gpm

- AMD Out of the System Pre-2022 Upgrades
    - pH – 3.1 – 3.7
    - Acidity – 96.5
    - Alkalinity – <5
    - Iron – 12.4
    - Aluminum – 4.7
    - Manganese – 19.7
    - Sulfate – 312.4
    - Specific Conductance – 743.8
    - Flow – 10 – 80 gpm

Everhart Refurbish and Improvement Project

Construction Plans





Everhart Construction - Phase I

Everhart Construction - Phase II

Water Quality of the Final Treatment System Effluent following Modifications

- Water Quality:
  - AMD out of the Refurbished Treatment System
    - pH: 7.7 – 7.9 *(3.0-3.5)*
    - Acidity: -113 *(161.4)*
    - Alkalinity: 128 *(<5)*
    - Iron: 0.09 *(47.9)*
    - Aluminum: 0.10 *(6.4)*
    - Manganese: 0.94 (21.6)
    - Sulfate: 294.5 *(328.3)*
    - Specific Conductance: 791.5 *(793.4)*
    - Flow: 10 – 80 gpm

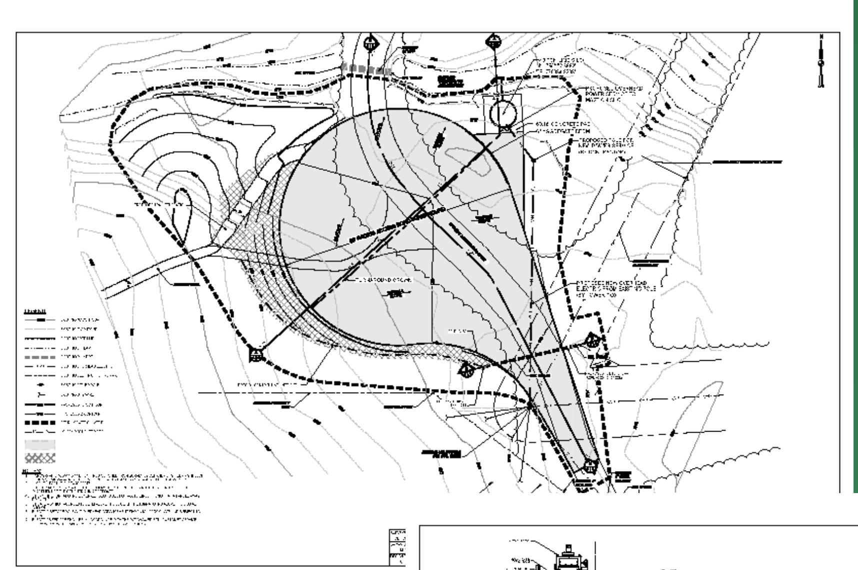
    - *( ) Raw AMD*

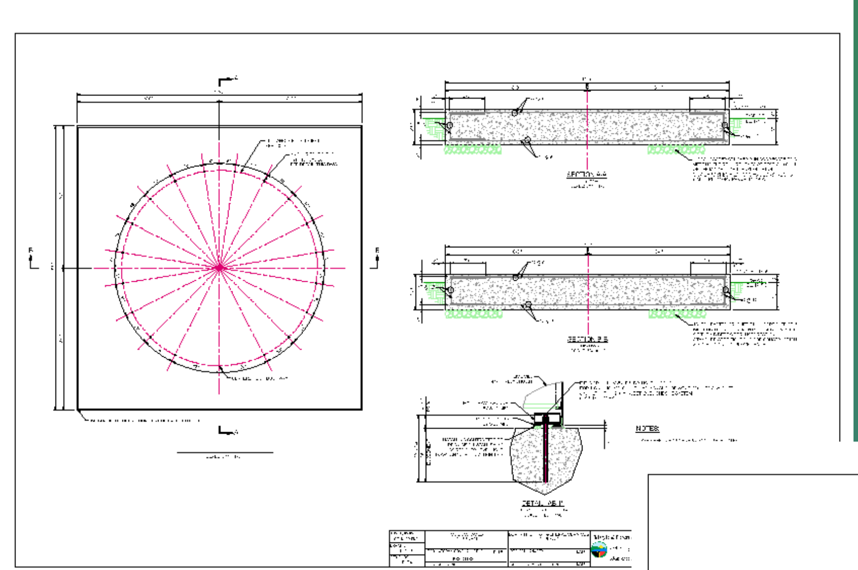
Jennings Run Lime Doser Project

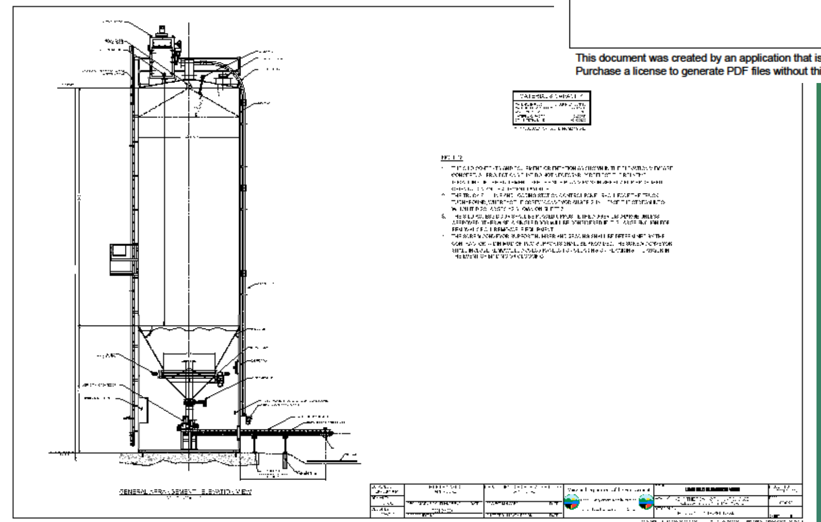
- The project design was completed by Tetra Tech, Inc.
- The project included the construction/installation of a new electric powered lime Doser and delivery truck turn-around area.
- The Doser includes a 40-ton silo using Calcium Carbonate for treatment.
- This project was funded through State Capital Funds or Go-bond money.
- It was completed in June of 2023 at an approximate cost of $720,000.

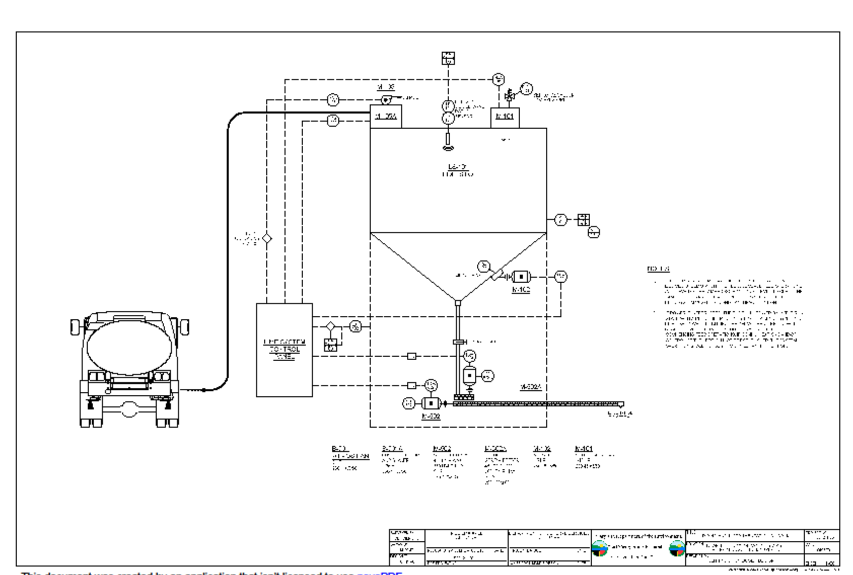
Jennings Run Lime Doser Project

Construction Plans









Jennings Run Lime Doser Project
Water Quality

- Water Quality:
  - Stream at Doser - Prior to Treatment
    - pH – 3.0 – 3.8
    - Acidity – 95.2
    - Alkalinity – <10
    - Iron – 0.9
    - Aluminum – 12.1
    - Manganese – 0.8
    - Sulfate – 115.6
    - Specific Conductance – 357.8
    - Flow – 50 - 700+ gpm

Jennings Run Lime Doser Project

Pre-Construction Site Conditions

Jennings Run Lime Doser Project

Site Construction Photos

Jennings Run Lime Doser Project

Construction Photos

Water Quality of the Stream after Doser Installation

- Water Quality:
  - Downstream location following Treatment
    - pH – 6.6 – 7.3 (3.0 – 3.8)
    - Acidity – -8.5 (95.2)
    - Alkalinity – 22.5 (<10)
    - Iron – 0.15 (0.9)
    - Aluminum – 2.85 (12.1)
    - Manganese – 0.46 (0.8)
    - Sulfate – 147 (115.6)
    - Specific Conductance – 356 (357.8)
    - Flow – 50 – 700+ gpm

( ) Stream Prior to Treatment

Past and Present Accomplishments

- Aaron's Run – Installed Doser and multiple passive treatment systems in the watershed. The stream was de-listed in 2015 from the EPA 303D list for pH impaired streams.
- North Branch Potomac River – Virtually lifeless prior to 1994 due to AMD from pre-law mining. Several dosers(9) and passive treatment systems were installed in the watershed. Today the river is a high-quality stocked trout stream and a popular destination for anglers, kayakers, rafters, and nature enthusiasts. In 2010, a report was completed by "Downstream Strategies" stating that boaters and anglers spend roughly $3 million annually. Economic impacts of the North Branch alone were 10 times the cost of treatment using the dosers at that time.
- Casselman River – Sand Dumps and multiple passive treatment systems have greatly improved brook trout populations in the watershed according to fish surveys completed by Maryland DNR Fisheries from 2016 to 2018 (post implementation).
- It is estimated that approximately 120 miles of AMD impaired streams have been improved.

In Conclusion:

- Much has been accomplished over the last 30-40 years but there is much more to do. We will continue to work hard to improve Western Maryland’s pristine water and land resources.
- Shout out to Connie Loucks and Joe Mills.

THANK YOU!

Any Questions?