Tioga River Watershed Restoration: Design Consideration and Updates

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IMWA / West Virginia AMD Task Force Conference

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Today's Speakers

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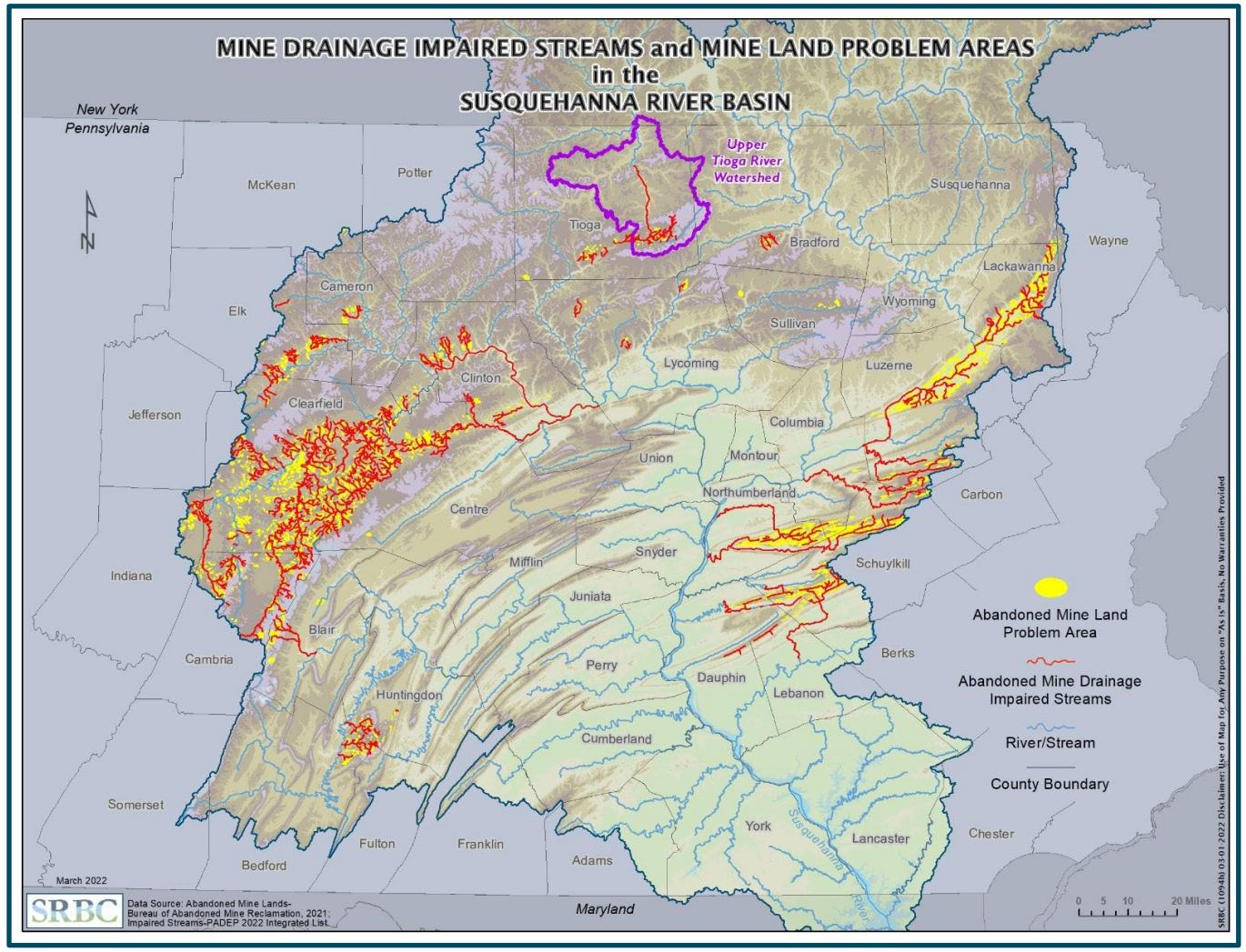
Mine Drainage Impaired Areas in the Susquehanna River Basin

- Susquehanna River Basin Coal
  - Main Bituminous
  - Anthracite
  - Broadtop
  - Northern Bituminous
- Tioga River headwaters impacted legacy deep and surface mining impacts in it's headwaters near the Borough of Blossburg and town of Morris Run.



https://www.srbc.net/our-work/pamphlets/abandoned-mine-drainage.html

Problem: Tioga River Watershed AMD-Impaired Areas

- The Tioga River's main impact is from five major deep mine discharges, which all enter the Tioga River within a 5-mile (8-km) stretch of river:
  - DFB099 – Impacts the tributary of Fall Brook.
  - DMR04 – Largest loading impact to Morris Run
  - DMR03 – Second largest loading impact to Morris Run
  - DMR01 – Third largest loading impact to Morris Run
  - DCC05 – Largest loading impact to the entire Tioga River
- Consequently, these discharges have caused over 20-miles (32-km) of the Tioga and its tributaries to be listed as AMD-Impaired and have rendered them fishless.

Impact: Quantity and Quality of Discharges

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Table 1. Anticipated MD Discharges Flow (MGD) and Constituent Concentrations (mg/L)*

Parameter	DCC05	DFB099	DMR01	DMR03	DMR04
Flow (MGD)					
Minimum Daily Flow	0.510	0.212	0.007	0.051	0.472
Average Daily Flow	2.369	1.310	0.169	0.260	1.167
Maximum Daily Flow	4.720	2.988	0.584	0.704	2.600
Acidity (mg/L)					
Minimum	270.00	59.00	70.00	209.00	126.00
Average	374.80	89.00	165.00	276.00	164.00
Maximum	550.00	131.00	225.00	331.00	400.00
Aluminum (mg/L)					
Minimum	18.88	8.27	11.13	22.13	10.46
Average	31.12	10.49	14.39	28.24	12.50
Maximum	43.64	13.20	17.60	32.41	17.76
Iron (mg/L)					
Minimum	22.44	0.44	1.57	4.61	3.36
Average	31.50	0.56	3.39	5.29	5.78
Maximum	43.15	0.66	7.00	6.21	17.00

* Data represent sampling events from 2014-2018. See Tioga QHUP or SRBC's Mine Drainage Data Portal at https://www.srbc.net/minedrainageportal/ for additional sampling information.

*Average Influent:

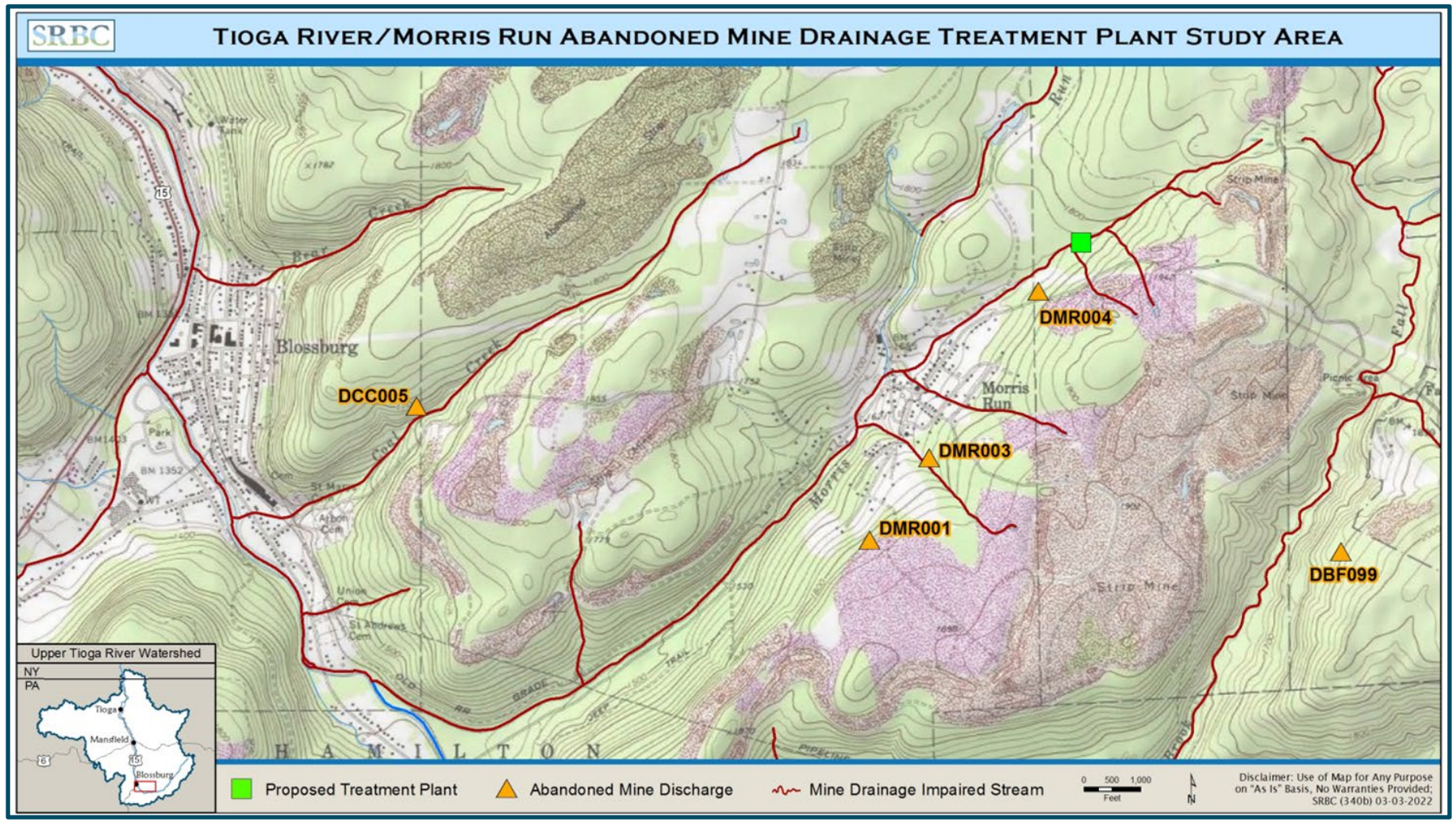
- 5.3-MGD (~20 MLD) containing
  - 246 mg/l acidity
  - 21 mg/l aluminum
  - 16 mg/l iron
- Free draining drift mines with no ability to control have caused measured flows to approach 12-MGD (~45.5 MLD)

Coal Creek Discharge #5 (DCC05)

Average Loading:

- 4,790 lbs/day acidity (2,173)
- 398 lbs/day Al (181)
- 403 lbs/day Fe (183)
- 874 tons/year acidity
- 73 tons/year Al
- 74 tons/year Fe

Solution: Centralized Lime/Clarifier ATP



Conveyance:

DCC05 ➡ATP

DMR01/03 ➡ATP

DMR04 ➡ATP

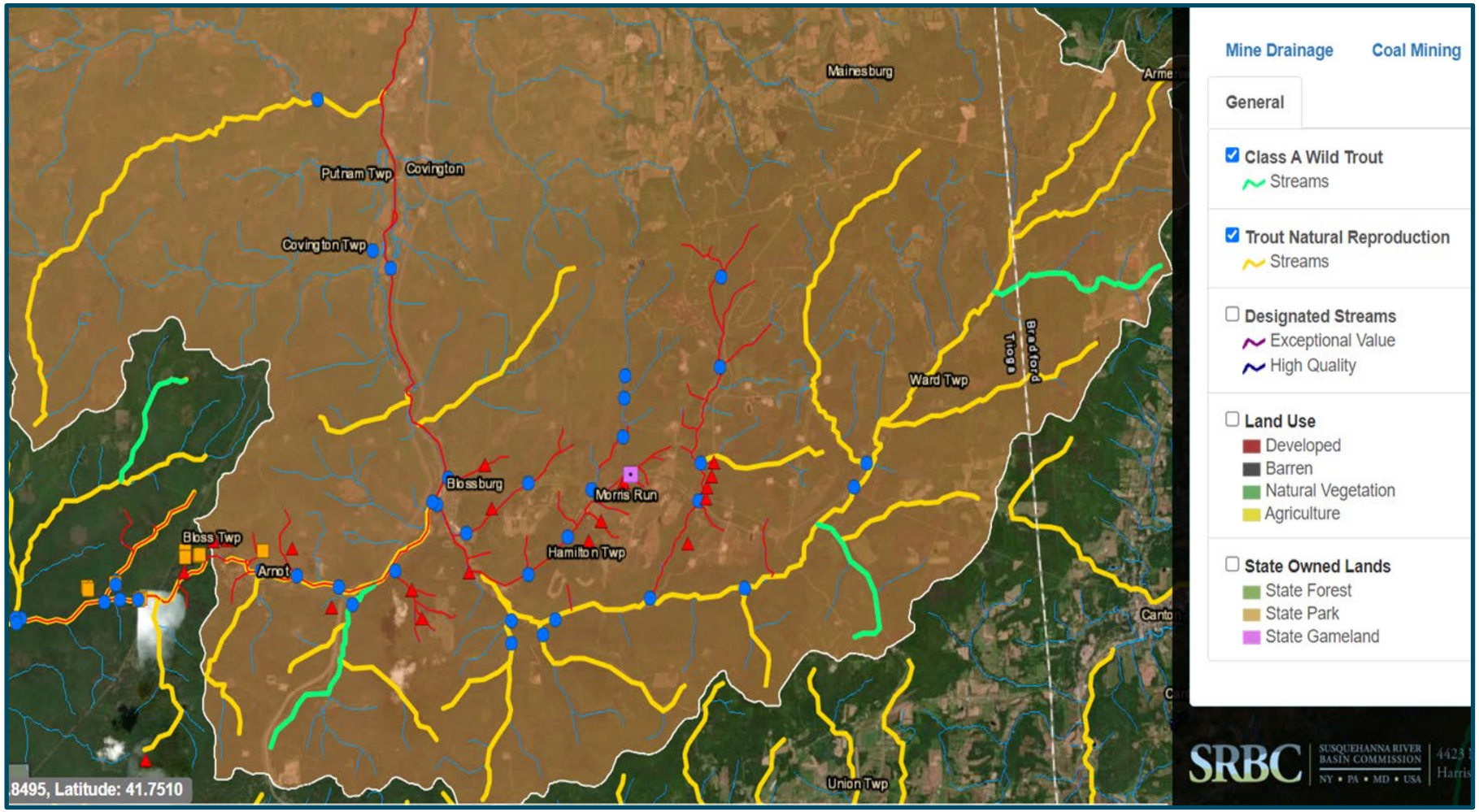
DFB099 ➡ATP

Treated Effluent:

2,000 GPM to Fall Brook to restore cold water fishery. Balance to Morris Run

https://storymaps.arcgis.com/stories/51e8a9b3b8f14accaeb7bcb10252e622

Opportunities: Sources of Native Trout Re-Colonizers

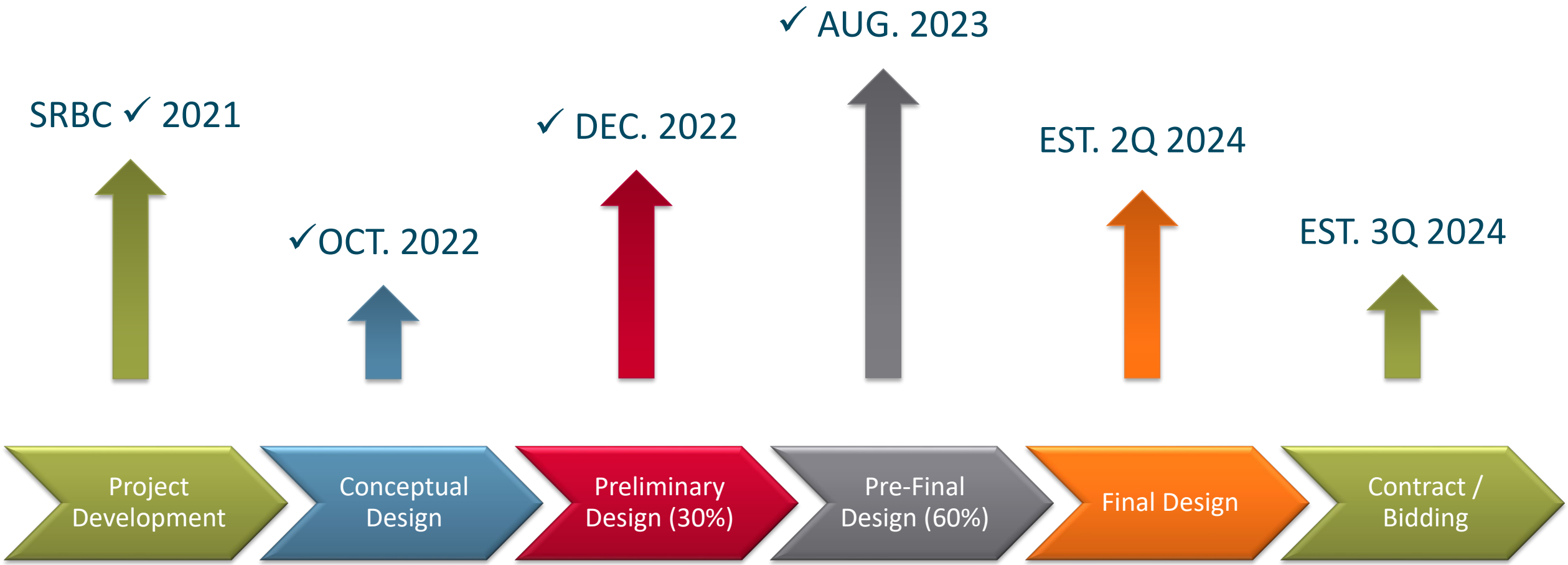


Wild Trout Designated Streams (mainly Brook Trout)

Class A Wild Trout Designated Streams (mainly Brook Trout)

https://www.srbc.net/minedrainageportal/Map

Design Solutions – Where are we now?

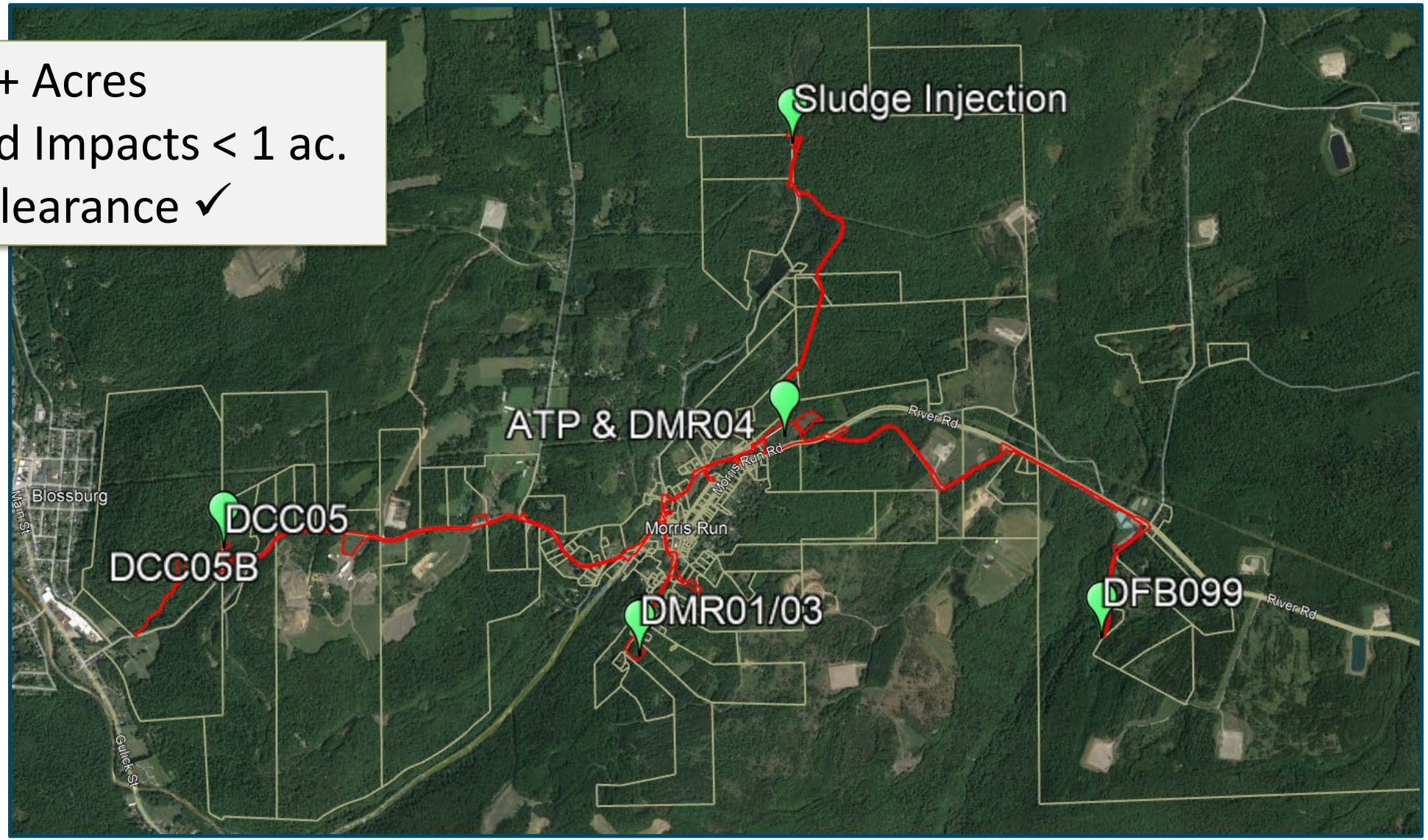


Design Considerations

- Min / Ave / Max Flow Conditions Incorporated
- Central Location for the ATP
- Minimize Impacts
- Collection of DCC05 – Coal Creek Conveyance, Gravity Discharge to DCC05 Pump Station
- Utility Coordination
- Redundancy & Operational Flexibility at ATP and Pump Stations
- Strategic placement of treated effluent (Morris Run and Fall Brook)

Overall Project

LOD 50+ Acres
Wetland Impacts < 1 ac.
SHPO Clearance ✓



DCC05 – Coal Creek

- Minimal area for collection structure
- Highly variable flows, design of system must accommodate
- Re-establishing haul road for access

Flows during Recent Weir Removal

Mine Opening – Haulage Entry

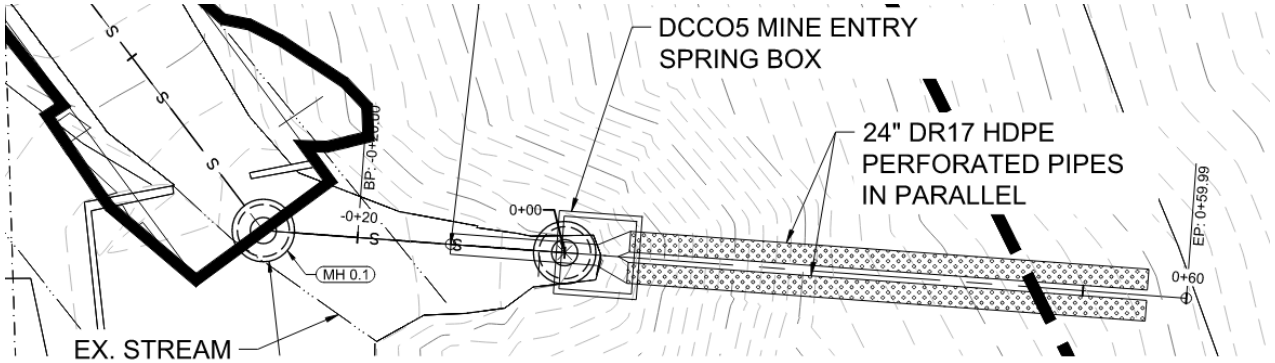
DCC05 – Difficult Access, Capture/Conveyance

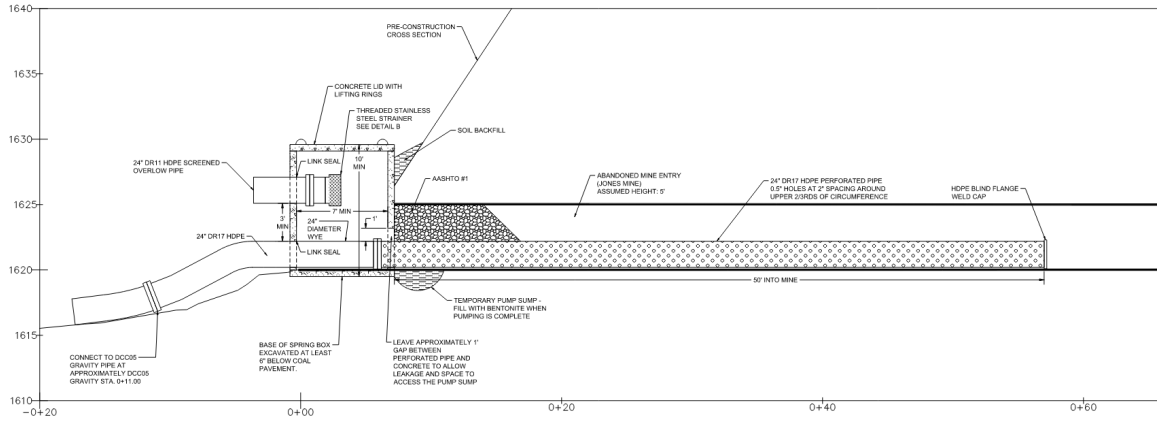
- Access DCC05 outfall via legacy mine access road that intersects Old Bloss Road.
- Arch crossing over Coal Creek.
- Important to note that Coal Creek is a loss-stream and is primarily composed of the flow from DCC05.
- Modified and redundant spring box for outfall capture.
- Conveyance to DCC05 Pump Station near Old Bloss Road on property obtained by North Central PA Conservancy to be transferred to DCNR BOF and added to Tioga SF.

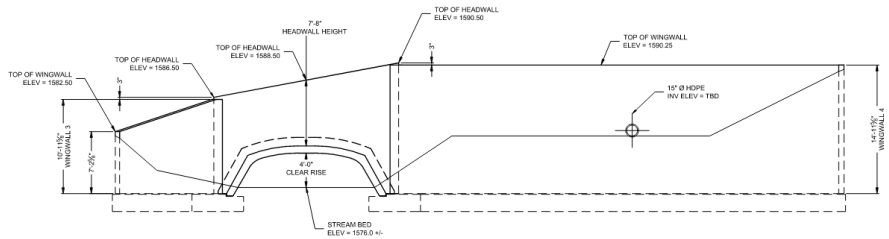
* Blue line designates actual Coal Creek route

DCC05 – Coal Creek Design

- Culvert Crossing for Coal Creek
- Modified Spring Box for Collection
- Redundancy into mine opening for long-term O&M
- Sized to account for Low, Normal and High Flow Conditions



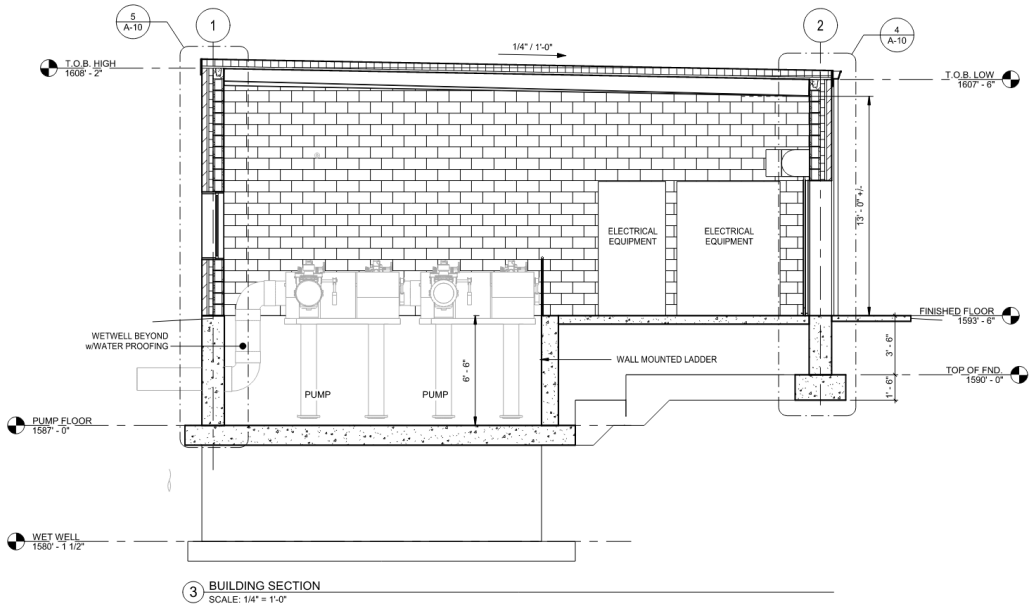


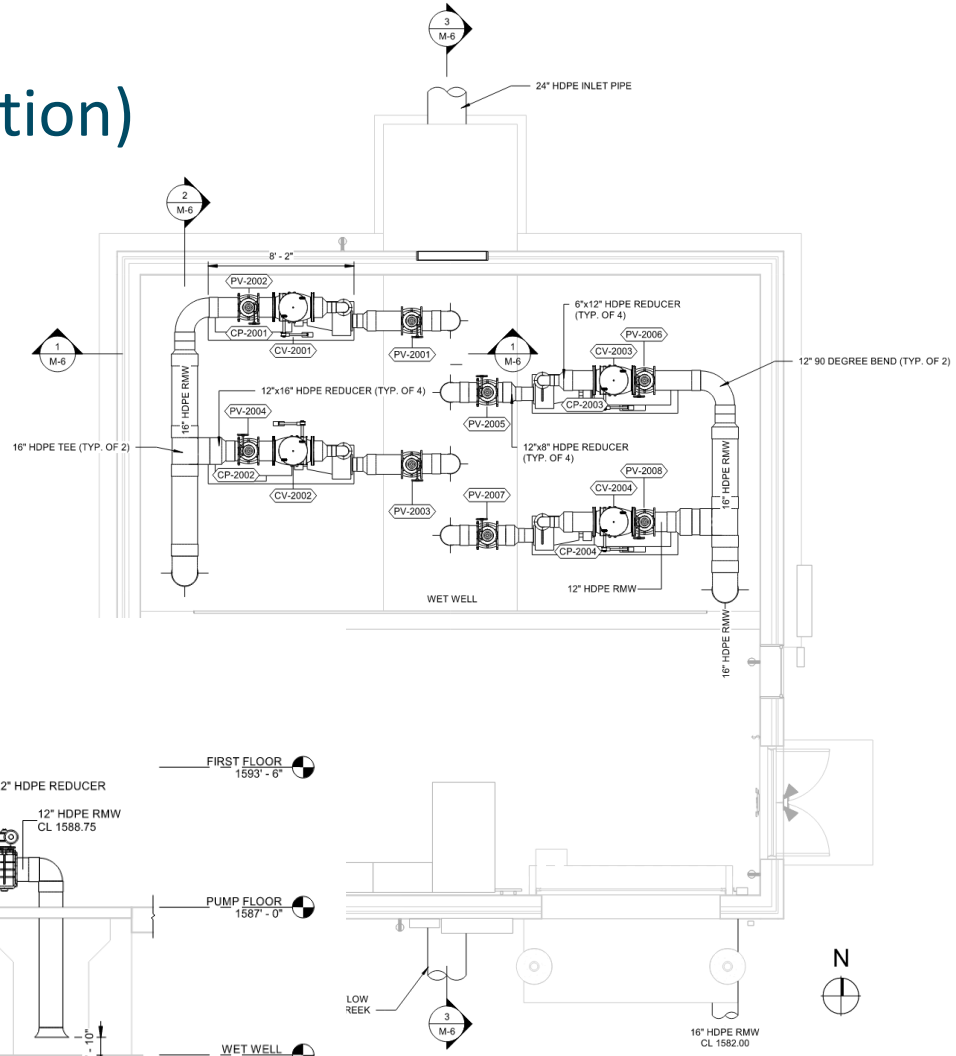


DOWNSTREAM END ELEVATION

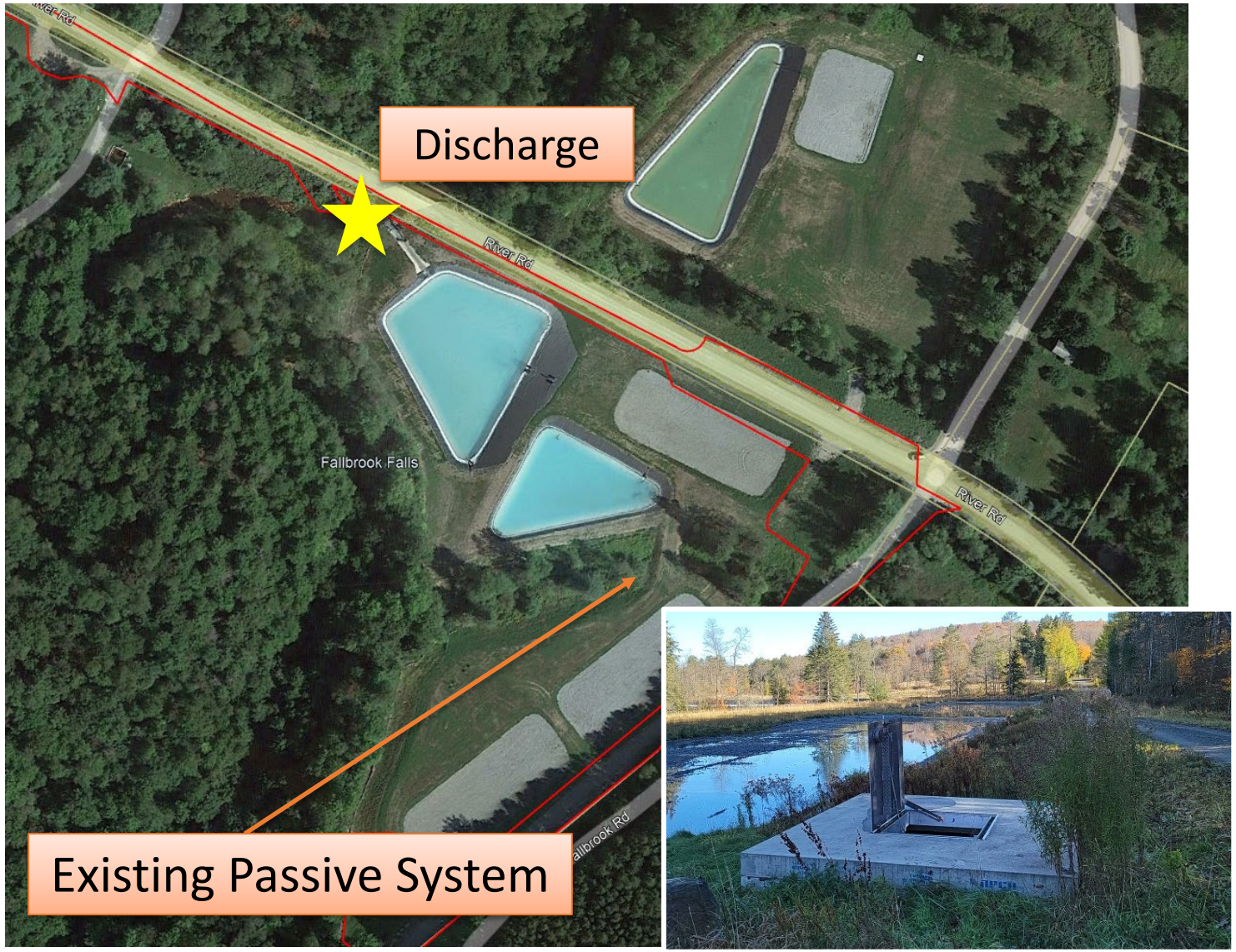
DCC05 – Coal Creek Pump Station

- Fully Redundant System
- Remote Operation (Fiber Optic for 24/7/365 Operation)
- VFD Installation for Flexibility in Operations
- Emergency Generator for Added Redundancy





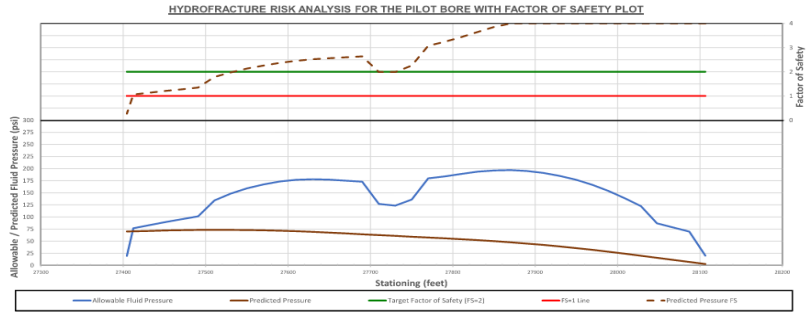
DFB099 – Fall Brook

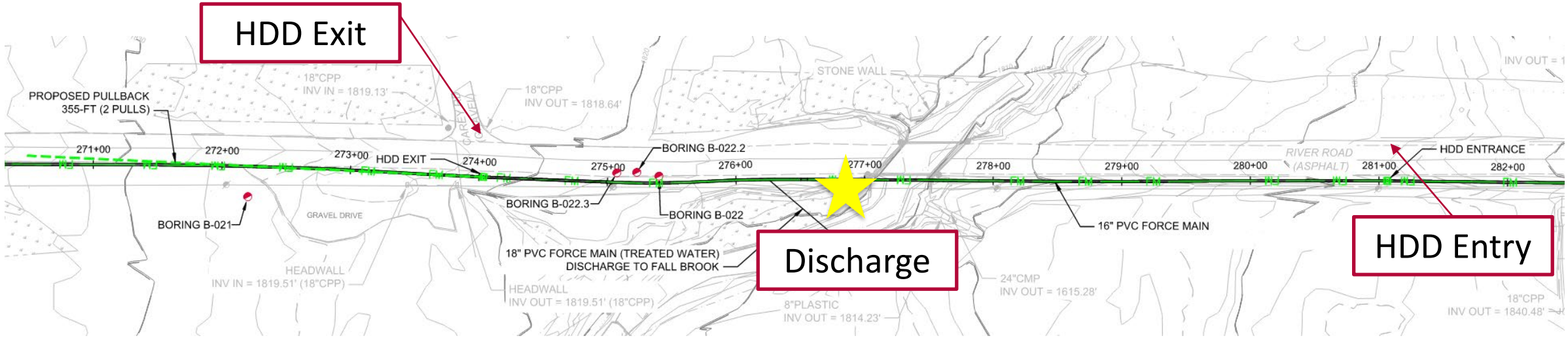


- Existing passive treatment system overloaded, increased O&M.
- Flow Control at seep diminished from low-pH water.
- Utility infrastructure avoidance.
- Flow management for stream, water withdrawal point immediately downstream.

DFB099 – Fall Brook Design

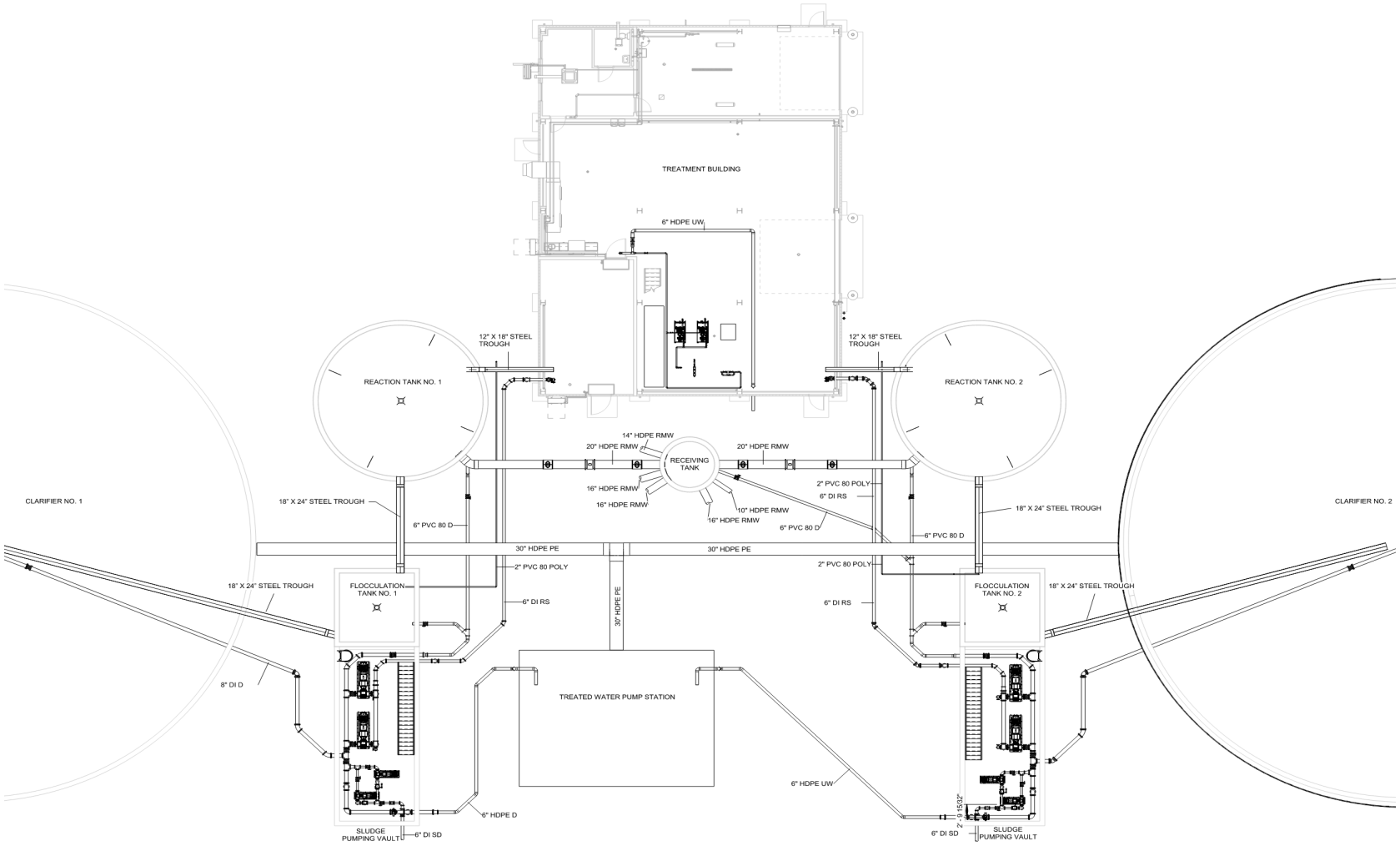
- Passive System redundancy (0-300 GPM & >2,000 GPM)
  - 0-1,136 LPM & >7,571 LPM
- Removal of flow control structure at outfall
- HDD to avoid utility infrastructure
- Discharge of effluent at same location upstream of water withdrawal
- Sized to allow flexibility in flow control during seasonal variations in stream flow.





ATP – Site Layout and Process Design

- Redundancy Key to Operational Assumptions
- Dual Clarifier Design 112’ (34-m) Diameter
- Streamlined Sludge Recirculation & Conveyance System



Capture/Conveyance/Treatment Key Points

- Energy / equipment redundancy at all pump stations.
- Added capture and conveyance redundancy at DCC05.
- Ability to bypass extreme flows at DCC05 and DFB099 so that the plant capacity is not exceeded.
- Utilizing the DFB099 passive system as additional treatment / bypass.
- Strategic treated water effluents to Fall Brook and Morris Run.

Capture/Conveyance/Treatment Key Points Cont.

- Dual clarifiers allowing average to be treated on one side, the ability to switch sides and complete maintenance, and the ability to accommodate high flow events (15 MGD or 57 MLD).
- Open troughs where possible in ATP to improve access and ease maintenance.
- No polishing pond/wetland to keep treated water cold.
- The ability to add soda ash silo if needed to achieve effluent alkalinity goals.
- Sludge batch conveyance directly from clarifier to injection boreholes.

Tioga/Hammond Lake: Low Flow Augmentation

https://www.visitpottertioga.com/wp-content/uploads/2023/04/Tioga-Hammond-Dam-1024x768-1.jpg

- Tioga-Hammond Lake are USACOE Flood Control Dams on the Tioga River as it flows north into Corning and Elmira, NY.
- Hammond Lake (right) is stored 5-ft (1.5-m) higher than Tioga to offer water quality mitigation water.
- If Tioga Lake is restored, that 5-ft of water could be used as low flow augmentation to protect against drought impacts. That equals about one-billion gallons.

Acknowledgments

- OSM – Rich Beam and Brent Means
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- Tioga County CD – Erica Tomlinson
- Mansfield University of PA – Dr. Greg Moyer and Dr. Jen Demchak

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