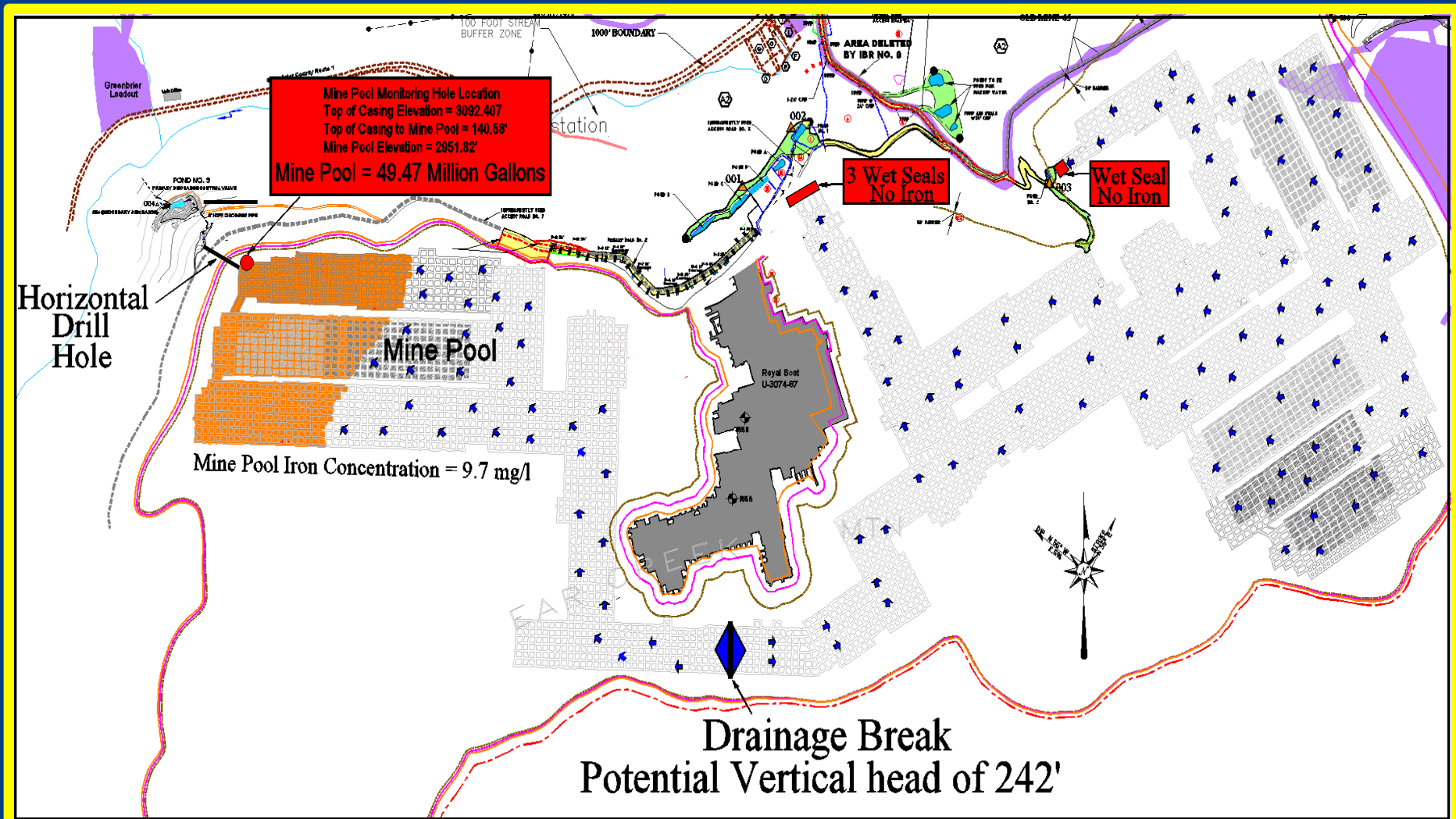
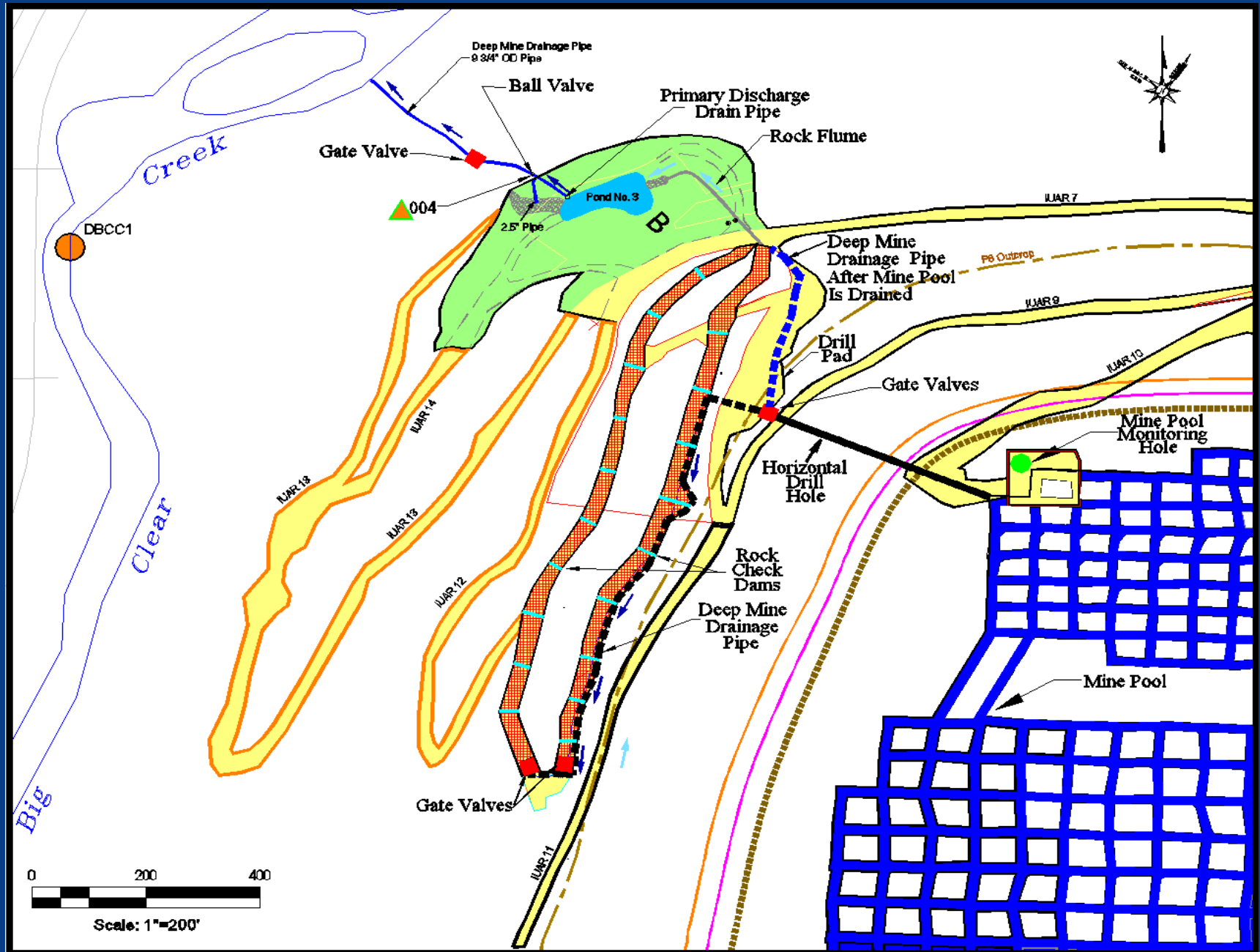


Pocahontas Mine—Passive Treatment System

The Pocahontas Mine is in the Pocahontas 6 seam and was purposely permitted for up-dip mining based on 4 previous down dip mines permitted in the late 1970's and early 1980's that produced alkaline iron water and are still being treated for such present day. All water discharging East of the Drainage Break is free of iron. The water West of the Drainage Break became impounded and like the 4 down dip mines, contains 9.7 mg/l of iron.



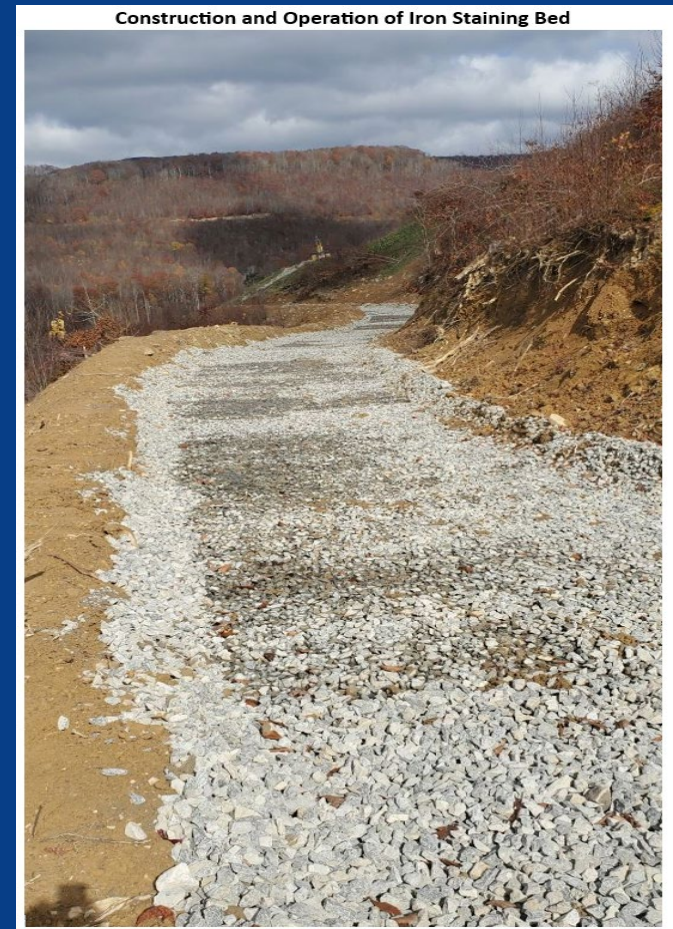
PLAN VIEW OF THE POCAHONTAS MINE IRON STAINING BED PROJECT



Construction of an Iron Staining Bed (ISB)

The Iron Staining Bed in the picture below was constructed to remove alkaline iron from 50,000,000 gallons of water contained in the Pocahontas Mine underground Mine Pool. Such a bed simply takes advantage of iron staining that takes place during the transition of Ferrous iron to Ferric Iron. The initial Ferrous Iron concentration was 9.7 mg/l. The Mine Pool is nearly drained now and the Total Iron leaving the Iron Staining Bed rarely exceeded 0.15 mg/l, with a Dissolved iron less than 0.06 mg/l. No chemicals whatsoever were used in the process, which instead relied on Distribution of Flow to maximize Contact Time.

Construction of the ISB's utilized 2 skid roads from previous timbering operations. Each bed was 1,000' long and 15' wide. A 6" layer of stone was placed in each bed. The most important design parameter was to ensure that the beds were level side to side to enhance distribution of flow to maximize contact time.



Construction and Operation of Iron Staining Bed

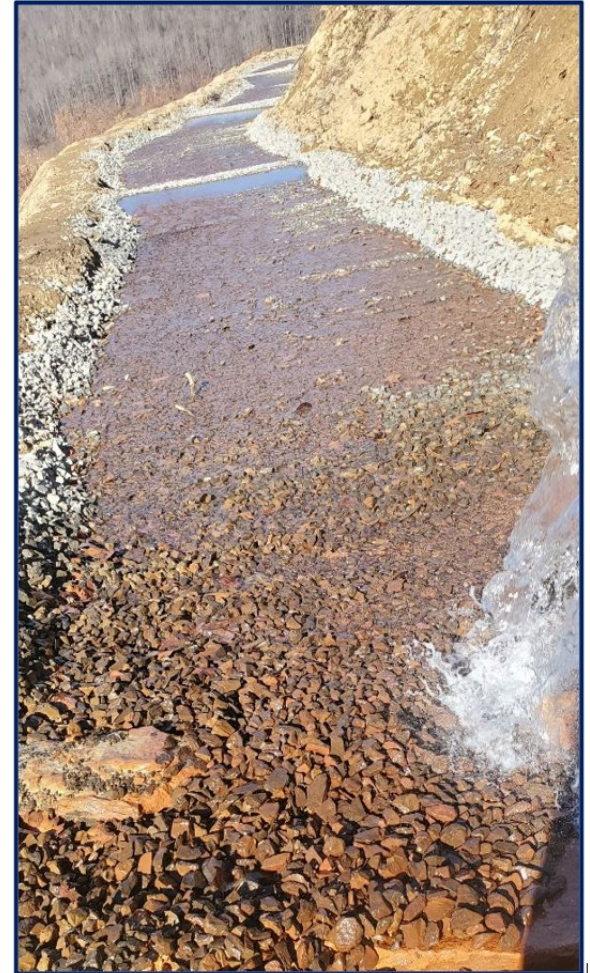
Construction of an Iron Staining Bed (ISB)

The ISB's began treatment October 25, 2023. Because of the initial vertical head of the Mine Pool, flow from the mine was measured to be 341.52 gallons per minute, which was split evenly between the two ISB's. It took less than an hour for the water to make it through both beds. Iron removal was immediately accomplished reducing the Mine Pool iron concentration from 9.7 mg/l to 0.1 mg/l in the Upper Bed and 0.08 mg/l in the Lower Bed.

To enhance distribution of flow, stone check dams 8"-10" high were placed across the beds every 100'. As seen in the pictures, water backed up and formed a small pool behind each check dam, eliminating specific flow paths in favor of ditch wide flow (Maximizing Contact Time).



Notice how the water spreads out across the entire width behind the rock barriers.



CONTROLLING DOF—Passive Treatment System

Distribution of Flow in an Iron Staining Bed
Using Small Rock Check Dams Every 100'



Pocahontas Mine--Mine Pool Dewatering Project Facts and General Information on the Iron Staining Beds

- Free flowing water in the Eastern up-dip portion of the mine was absent of iron.
- Impounded water in the Western down-dip portion of the mine contained 9.7 mg/l of dissolved ferrous iron.
- Due to the vertical head of the Mine Pool, flow was measured to be 341.52 gallons per minute.
- Upon draining the Mine Pool free flow from infiltration/recharge has averaged 76 gallons per minute.
- Fluctuations in flows are directly tied to precipitation events with the onsite rain gauge.
- After 4 months of draining the Mine Pool and achieving free flow status the raw iron concentration is 0.3 mg/l.
- Mine Pool iron concentration to date has stabilized at an average of 0.21 Total Iron and a Dissolved Iron of 0.1.
- In excess of 60 million gallons of water was put through the Iron Staining Beds.
- Although the Raw mine water (0.21 mg/l) is well below the NPDES effluent limit of 0.95 mg/l and could be discharged, we still allow it to run through 1 of the ISB's, further reducing the iron concentration to 0.04 mg/l.
- Again, no chemicals were used in the staining process and gravity was responsible for all flow movement.
- As the iron in the beds is inert, no further disposal is necessary and the outside berms of the beds will be pushed over the stone and seeded for final reclamation.
- The Passive Treatment (chemical free) used here for iron removal produced a much more environmentally friendly effluent for the Micro/Macro communities in the receiving stream versus using Active Treatment (chemicals-sodium hydroxide).
- In comparison to Active Treatment (chemicals), the ISB's resulted in lower dissolved solids, a lower conductivity, and a lower osmotic pressure.
- Use of the Iron Staining Beds versus using chemical treatment/sludge disposal reduced the project cost by approximately \$ 100,000.00.