Tanoma South Passive Treatment System
SRI O&M TAG Project #14 Request #3
OSM PTS ID: PA-60

Requesting Organization: Evergreen Conservancy
Requesting Organization Representative: John Dudash
Municipality/County: Rayne Township, Indiana County
Dates of O&M work performed: 7/15/2021 to 7/20/2021

Initial Request: On 7/2/2021, the Evergreen Conservancy (EC) reported concerns about erosion and other problems with several weirs at the Tanoma passive system. EC also requested an assessment of the system to determine and evaluate options to enhance treatment effectiveness.

Initial Site Visit, Observations, and Identified Needs: As Stream Restoration Incorporated (SRI) and BioMost, Inc. (BMI) were familiar with the system and understood the Conservancy's needs an initial site visit for the weir repair was not required.

Work Completed: Equipment was mobilized to the site in July 2021. Both outlet weirs (Pond 10 overflow and trompe outlet) showed signs of erosion. The trompe wetland weir appeared to have been compromised by muskrat activity. The Pond 10 overflow weir was eroding on the downstream side. Geotextile was placed and riprap was installed on the Pond 10 overflow weir outlet. Riprap was also placed up the sides of the weir to deter future muskrat activity. On-site clay and bentonite were used to repair the outlet weir before lining with geotextile and enforcing both sides of the weir with riprap. The staff gauges at Pond 1, Pond 10 overflow, and the trompe weirs were checked and adjusted as needed.

System Evaluation & Recommendations: After repairs to the weirs were completed, a site investigation was conducted on 8/25/21 including water sampling of the treatment system and water level measurements of the boreholes. Select water monitoring data from 8/25/21 is provided in the table below as well as elevation data.

Elevation Data from 8/25/21 Field Survey
During the 8/25/21 site investigation, a survey was conducted using a sub-centimeter GPS unit. The following elevations were collected:

Shaft/overflow (top of grate):	1137.76	Depth to Water: 5.70	Water Elevation: 1132.06
Top of casing (north well):	1143.54	Depth to Water: 12.15	Water Elevation: 1131.39
Top of casing (middle well):	1142.98	Depth to Water: 11.96	Water Elevation: 1131.02
Top of casing (south well):	1140.56	Depth to Water: 9.35	Water Elevation: 1132.06

Top of 10" Nozzles: North: 1131.47; Mid: 1130.96; South: 1130.96
Pond 1 Weir Crest (at center): 1129.47
Pond 3 Weir Crest (at center): 1129.41
Pond 10 Weir Crest (at center): 1127.44
Trompe Weir Crest (at center): 1123.00
Pond 3 outlet top of Z-pile: 1127.62
Top 15" N12 Pipe Outlet (into Pond 4): 1126.34 (east); 1126.24 (west)
Top 18" SDR35 PVC Outlet (into Pond 8): 1126.95
Bench Mark set at top of slope on east end between Pond 2 and Pond 3:
1142.62 1,607,783.82 East, 498,468.85 North (NAD83 PA South – Foot, NAV88)

Tanoma is a high flow, alkaline, iron discharge with low concentrations of manganese and aluminum. Dissolved oxygen increases through the system and should be at a sufficient concentration to remove the relatively low iron concentrations. Even though the discharge is alkaline, the pH of the raw discharge is <7 and tends to remain so through most of the system, which limits iron oxidation rates. Increases in pH through the system along with other previous testing indicates dissolved CO_2 is present in the water and is suppressing the pH. Hydrogen Sulfide (H_2S) gas can be detected by smell at the beginning of the system indicating reducing conditions. ORP values also indicate somewhat reducing conditions through the first several ponds. Both CO_2 and H_2S are likely contributing to inhibited iron oxidation rates within the first several ponds. Once the pH reaches ~7 and positive ORP values, iron concentrations decrease. Treating high flow, alkaline, iron discharge can be difficult, especially when the initial concentrations are moderate to low. SRI & BMI recommended taking efforts to increase aeration particularly at the beginning of the system and to make alternations to the system to increase retention and utilization of space within the ponds and wetlands. A conceptual design (See attached) and cost estimate were provided to EC.

The conceptual design proposed:

- Plumbing the three inlet pipes together and installing an aeration manifold and rock level spreader to aerate the AMD at the beginning of the system to help degas CO_2 and H_2S.
- Installing several directional and windowed baffle curtains throughout the system to improve utilization and retention within Pond 1 and Pond 4.
- Replace earthen baffles within the wetland with rock level spreaders to improve utilization and retention within the wetland.
- Remove the 18" SDR35 pipe with Agri Drain box between Pond 7 & and Pond 8 and replace with a wide rock spillway.

Tanoma Water Monitoring 8/25/21 (Select Parameters – full data on www.datashed.org)

Sample Point	Flow	Field pH	Temp (C)	Field Alk.	DO	ORP	Acidity	T. Fe	D. Fe	SO4	TSS
RD (Raw)	N.M.	6.6	13.2	222	3.54	-25	-158	5.45	5.07	277	10
Pond 1	1220	6.7	18.5	212	4.85	-15	-146	5.67	5.17	259	<5
Pond 3	N.M.	6.8	18.5	203	5.03	-4	-152	4.92	4.35	263	<5
Pond 7	N.M.	6.9	17.7	197	5.51	57	-161	0.82	0.33	263	<5
AW2 (Out)	1270	7.2	18.5	198	7.99	126	-167	0.53	0.11	254	<5

Units in mg/L except: Flow in gpm, pH, Temperature in Celsius, and ORP in mvolts

Tanoma Water Monitoring 11/30/22 (Select Parameters)

Sample Point	Flow	Field pH	Temp (C)	Field Alk.	DO	ORP	Acidity	T. Fe	D. Fe	SO4	TSS
RD (Raw)	N.M.	6.9	11.4	192	0.28	-123	-79	8.83	4.72	345	10
Pond 1	1268	6.8	11.1	205	6.14	-15	-82	6.94	5.76	342	19
Pond 3	N.M.	7.0	10.4	294*	7.43	-22	-79	10.72	<0.10	337	40
Pond 7	N.M.	6.9	10.0	196	8.10	52	-80	1.88	0.72	324	<5
AW2 (Out)	1374	6.9	9.6	218	9.35	100	-74	0.67	<0.10	343	<5

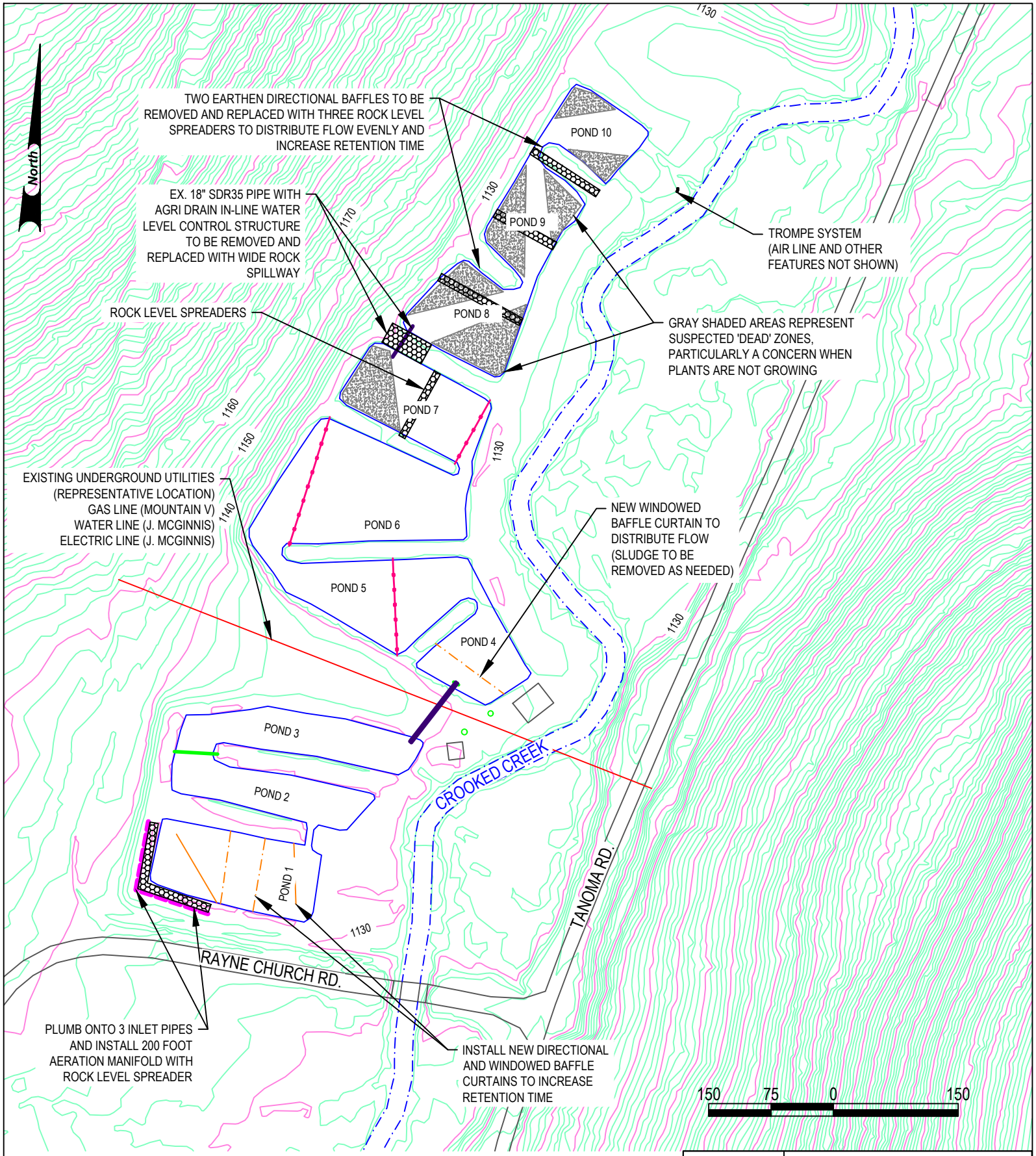
Units in mg/L except: Flow in gpm, pH, Temperature in Celsius, and ORP in mvolts, *294 alkalinity likely spurious and actual may be 194.

Results: The weirs were repaired and flow measurements can continue. The Evergreen Conservancy used the conceptual design and cost estimate to obtain an $85,000 US Office of Surface Mining, Reclamation, and Enforcement (OSMRE) Watershed Cooperative Agreement Program (WCAP) grant to make improvements to the system which were completed in the fall of 2022. Water monitoring conducted before and after system improvements is provided in the tables above. With similar flow conditions in 2021 and 2022, a notable difference is the dissolved iron concentrations at the outlet of Pond 3. Prior to the 2022 improvements, the total and dissolved iron at Pond 3 were within 0.6 mg/L. After 2022, the total iron was elevated (possibly due to suspended particulate iron), and the dissolved iron was below detection limits. It is noted that the flow typically increases through the system and there are numerous seeps present along the east (cut slope) side of the passive treatment system that may cause the increase in dissolved iron between Pond 3 and Pond 7. The initial data collected in November 2022 indicates improvements in water quality; however, further testing is recommended to assess the level of improvement.

Additional Recommendations & Future Considerations: Continue monitoring the treatment system to evaluate the success of new improvements to the system. Conduct maintenance as needed. If the desired level of treatment is not obtained, additional evaluations should be conducted and other system improvements considered. It may be possible to expand the size of the system. While not ideal, a chemical oxidizer such as hydrogen peroxide could potentially be utilized to achieve desired water quality if EC's goals cannot be achieved passively.

Photo Log

Top Left: Pond 10 overflow weir eroded on downstream side (7/2/21).
Top Right: Geotextile and riprap placed at Pond 10 overflow weir to prevent erosion (7/20/21).
Bottom Left: Trompe outlet weir eroded around side of weir (7/2/21).
Bottom Right: Trompe outlet weir repaired with riprap placed to prevent erosion (7/20/21).



LEGEND

- EX. CONTOUR (INDEX)
- EX. CONTOUR (INTERMEDIATE)
- EX. ROAD (PAVED)
- EX. POND
- EX. STREAM

SHEET 1 of 1	PRELIMINARY CONCEPTUAL DESIGN

PLAN VIEW

TANOMA TREATMENT IMPROVEMENT PROJECT
EVERGREEN CONSERVANCY

Rayne Township
Indiana County, Pennsylvania
Scale: 1" = 150' September 2021

BioMost, Inc., Mars, Pennsylvania
Mining and Reclamation Services

2690/2021OSMancpt