Cessna Run Abandoned Mine Drainage Treatment System Operations, Maintenance, and Replacement Plan

By:

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ATTACHMENTS

Introduction

Cessna Run (AKA The North Branch of Little Mahoning Creek), a 14.23 square mile sub watershed, is not only the largest tributary of Little Mahoning Creek, it is also the tributary with the greatest pollution impact, the tributary with the greatest potential in terms of a sustainable trout fishery in the entire Little Mahoning Creek drainage (approximately 115 square miles), and the tributary that forms the 4.1 mile Delayed Harvest Fly Fishing Only (DHFFO) stretch of Little Mahoning Creek. Cessna Run is an impaired stream but does not have a TMDL developed yet.

The North Branch, the second largest of the three main tributaries that form Cessna Run, contains two areas of major abandoned mine drainage pollution impacts (Figure 1). The Phase I area consist of several surface mine discharges that contribute a majority of the acidity and aluminum loading input to the North Branch. The Phase II area consists of several alkaline deep and surface mining discharges that contribute a majority of the iron loading input to the North Branch.

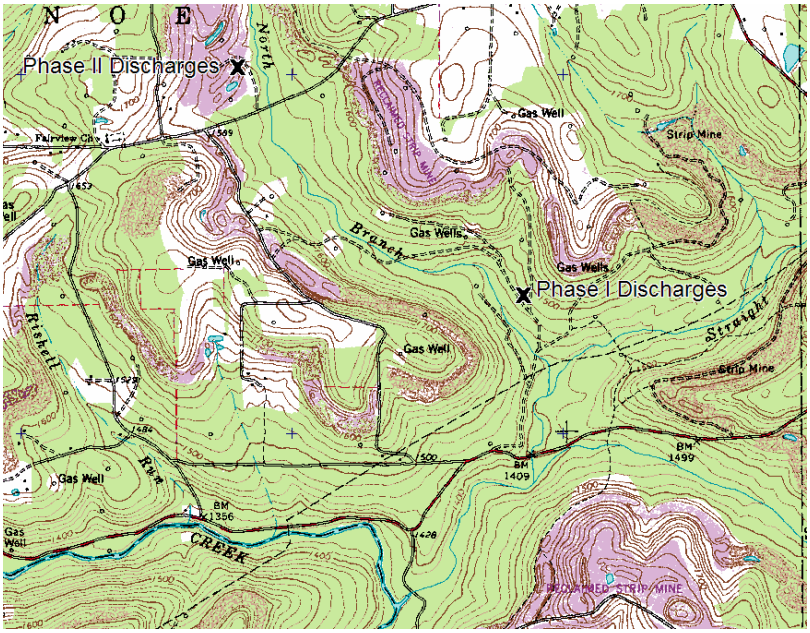


Figure 1. Phase I and Phase II project locations in the Cessna Run sub watershed of Little Mahoning Creek in Canoe Township, Indiana County.

Table 1. Average flow and water quality upstream and downstream of Phase I discharges

Location	pH	Cond	Acid	Alk	Fe	Mn	Al	SO_4
	Lab	uS/cm	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l
Upstream	7.25	242	0.00	44.80	0.51	0.23	0.28	105.20
Downstream	6.62	896	10.40	6.80	0.09	2.77	3.27	287.66

Table 2. Average water quality of the three Phase I discharges

	Flow	pH	Cond	Acid	Alk	Fe	Mn	Al	SO_4
	GPM	Lab	uS/cm	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l
D1	8.51	3.64	1394	79.87	0.00	1.31	20.35	2.91	748.0
D2	25.13	3.52	1451	100.10	0.00	1.96	28.03	4.36	778.0
D3	65.28	3.70	1690	117.90	0.00	0.67	30.33	7.09	1037.0

In 2003, the Indiana County Conservation District, in partnership with the Little Mahoning Creek Watershed Association, the Ken Sink Chapter of Trout Unlimited, the Indiana County Chapter of the Pennsylvania Senior Environmental Corp and the Pennsylvania Game Commission, obtained grant funding from the Pennsylvania Department of Environmental Protection Growing Greener Initiative and the Federal Office of Surface Mining and a monetary donation from TJS Mining Company to design and construct two passive abandoned mine drainage treatment systems for three surface mining discharges (Phase I) that contribute a majority of the acidity and aluminum loading to Cessna Run (Figure 2).

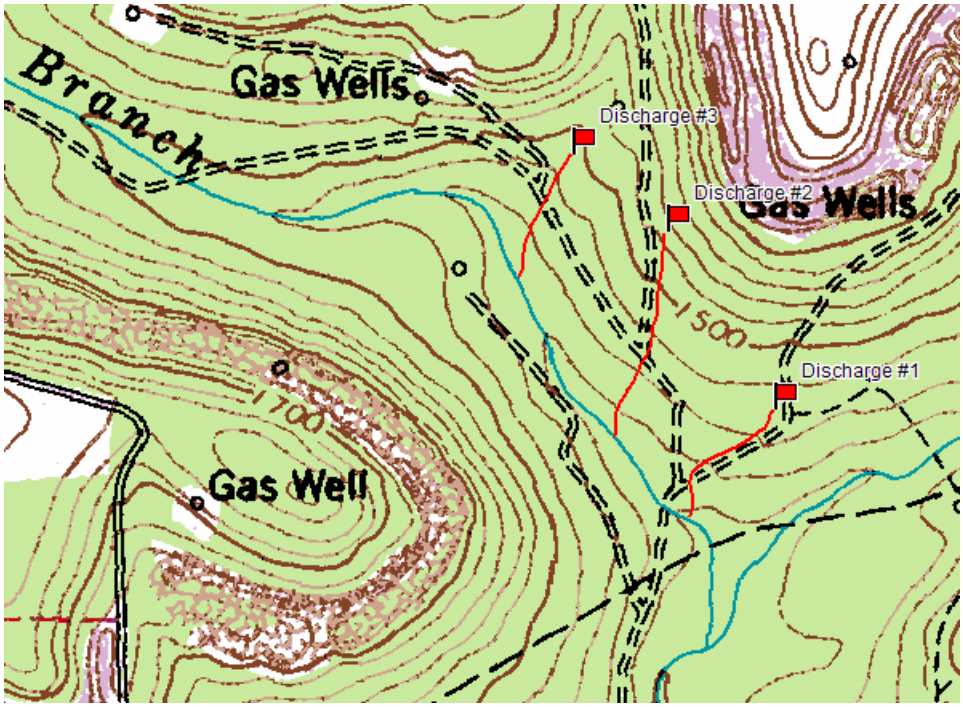


Figure 2. The three discharge locations of Cessna Run Phase I.

The construction of these two systems were completed in November 2005 and have been successfully treating an average of 175 gallon per minute (GPM) of AMD water since installation.

AMD Treatment System Water Quality

Discharge #1, the smaller flow of the three discharges, was treated with an oxic limestone channel (OLC). The effluent of the OLC was then allowed to precipitate its metal loading into a large forested area before it enters Cessna Run. Discharge #2 and #3 were captured and transported to the same treatment system, an oxic limestone drain (OLD) with two accompanying sedimentation ponds for metal precipitation. The system has automatic dosing siphons in the manholes, which flush the limestone cells when full.

The three Phase I discharges contribute on average 134 lbs/day of acidity, 9.18 lbs/day of aluminum and 39.19 lbs/day of manganese loading to Cessna Run. After treatment, the acidity concentration of the discharge water was totally eliminated and

50.98 lbs/day of alkalinity were added. In addition, aluminum and manganese loadings have been reduced 65% and 52% respectively (Table 3 and Figure 3, 4 and 5). Metal concentration reductions are great, but not ideal because of the amount of land available for sedimentation due to stream and wetland constraints.

Table 3. The water quality improvements of the two Cessna Run Phase I treatment systems.

Location	Flow	Lab	Cond	Alk.	Acid.	Fe	Mn	Al	SO4	Alk Load	Acid Load	Fe Load	Mn Load	Al Load
	gpm	pH	uS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	lb/day	lb/day	lb/day	lb/day	lb/day
D3	87.50	3.90	1335.00	0.00	72.75	0.17	21.35	5.28	799.75	0.00	74.40	0.17	21.78	5.47
D2	52.39	3.68	1215.00	0.00	60.00	0.83	18.13	3.46	667.50	0.00	37.33	0.49	11.06	2.14
OLD Effluent	139.39	6.75	1202.50	26.75	-8.25	0.32	9.91	1.47	666.50	41.24	-9.09	0.50	16.43	2.59
									Improvement	41.24	-120.82	-0.17	-16.40	-5.02
D1	37.40	3.97	1017.00	0.00	48.67	0.49	14.60	3.56	550.67	0.00	21.79	0.22	6.35	1.57
OLC Effluent	37.40	6.77	787.00	22.00	-5.67	0.14	5.50	1.26	400.67	9.74	-2.30	0.07	2.46	0.58
									Improvement	9.74	-24.08	-0.15	-3.89	-0.98
									Total Improvement	50.98	-144.91	-0.32	-20.29	-6.01

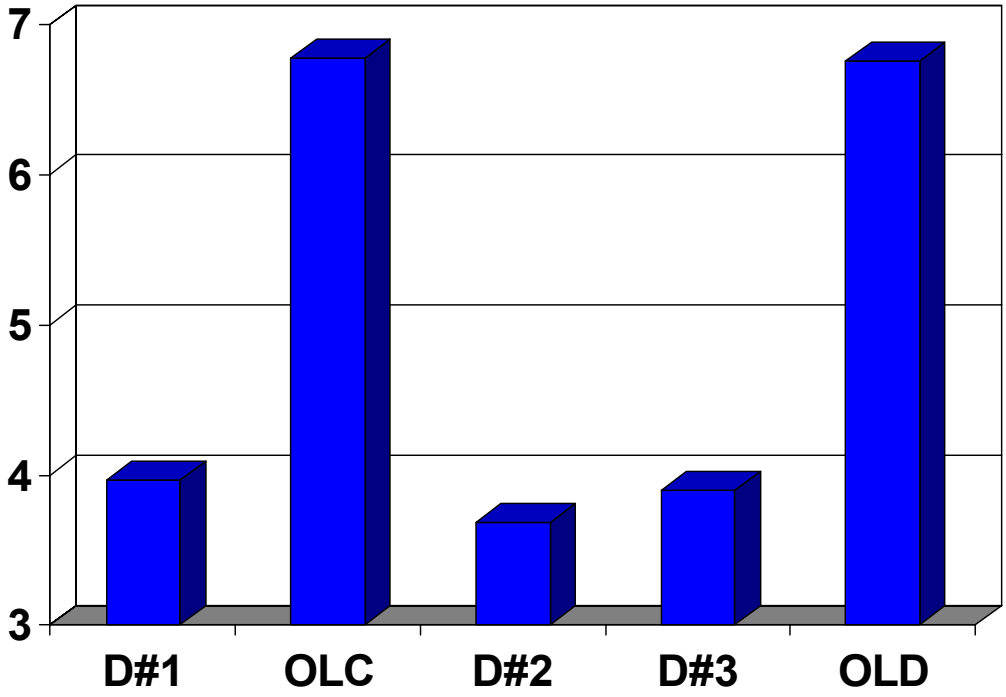


Figure 2. The influent and effluent pH values of the two Phase I Cessna Run treatment systems.

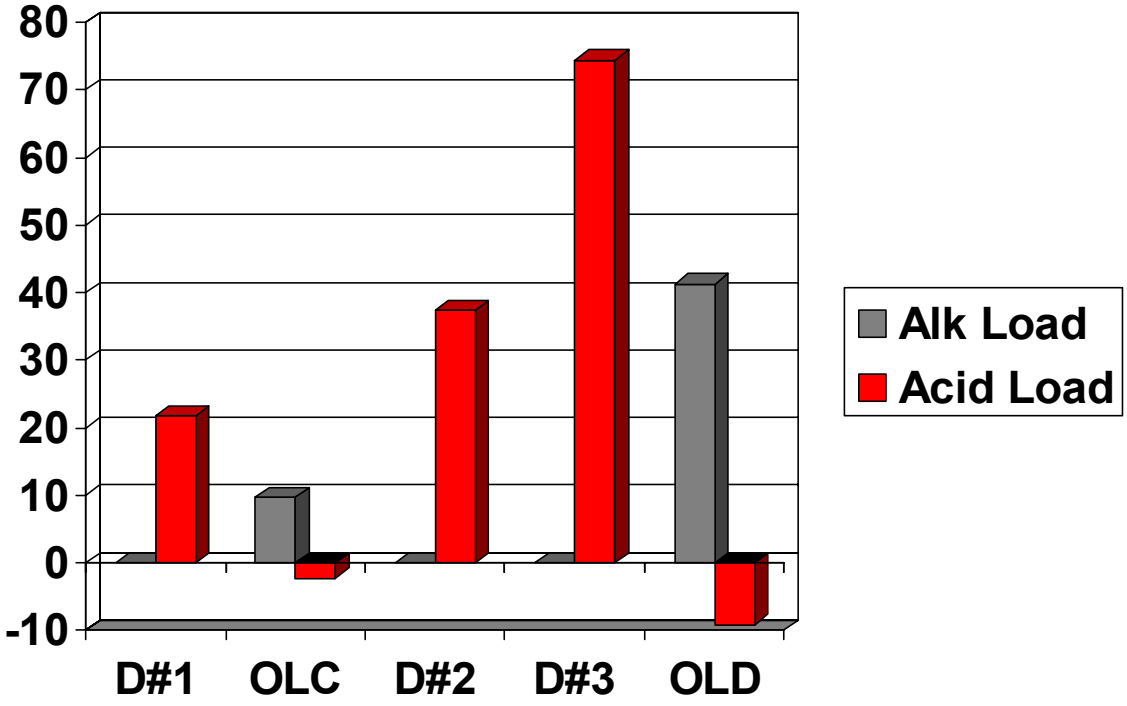


Figure 3. The influent and effluent alkalinity and acidity loadings of the two Phase I Cessna Run treatment systems.

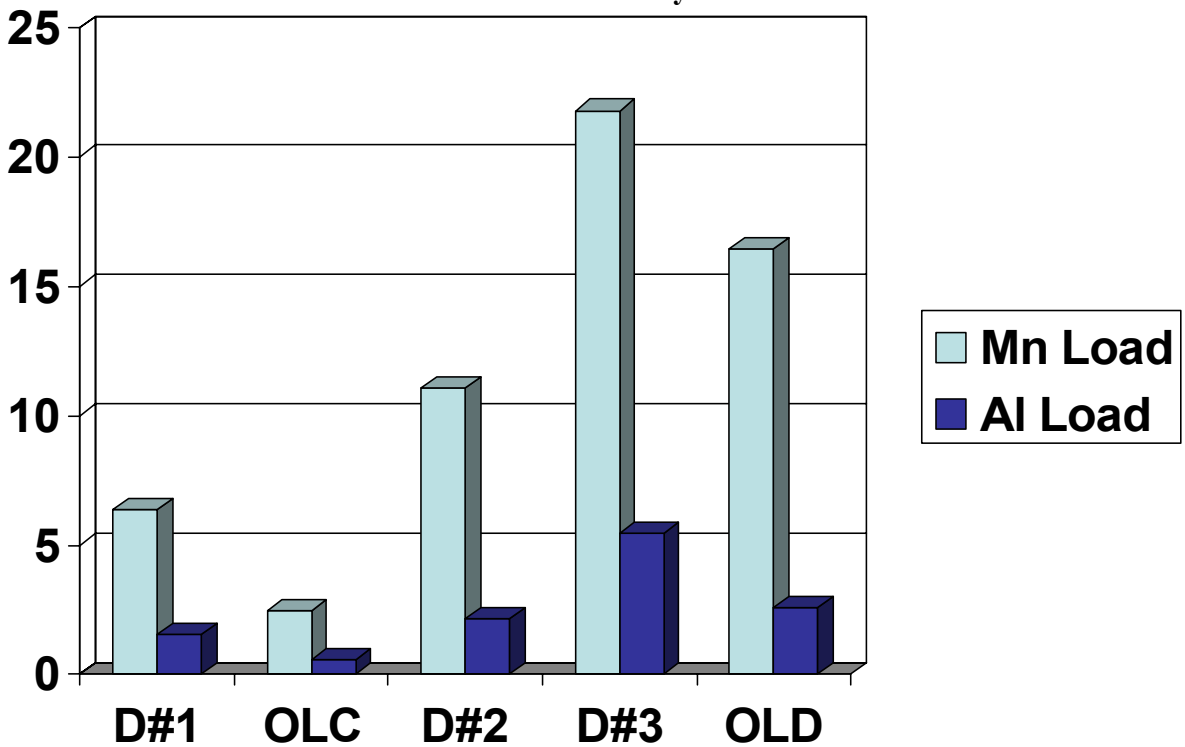


Figure 4. The influent and effluent aluminum and manganese loadings of the two Phase I Cessna Run treatment systems.

Operations, Maintenance, and Replacement Details

All operations and maintenance responsibilities for the treatment system fall primarily on the Indiana County Conservation District and secondarily on the other project partners. The paid staff of the Conservation District sees to routine operations and maintenance as described below. There is not a planned funding source for replacement of the system.

The system should be inspected on an annual basis and after 100 year storm events. The following is a list of items to consider in the annual inspection:

- Vandalism
- Condition of access roads
- Erosion, subsidence, leaks of on berms
- Vegetation for Pest damage
- Debris in inlets and outlets
- Analysis of flows and chemistry samples from previous years

Oxic Limestone Channel

Operation – Water quality analysis, particularly flow, field alkalinity and pH testing, should be completed every quarter of the year to document system functionality. The Indiana County Conservation District owns a flow meter. Water quality samples will be paid for through grants and may be conducted by Conservation District staff or trained volunteers.

Maintenance – Leaf and tree debris fall will be cleared at least once a month (more often in the autumn) from the two inlets, the outlet and channel.

Replacement – Once alkalinity and pH values are seen to be decreasing (estimated at approximately year 2025), more limestone will need to be added to the system. Limestone with $CaCO_3$ concentrations greater than or equal to 90% should be used. Since metals of Discharge #1 are relatively low and a huge forested area is utilized for metal precipitation, no removal of metals is foreseen with this system.

Oxic Limestone Drain

Operation – Water quality analysis, particularly flow, field alkalinity, and pH testing, should be completed every quarter of the year to document system functionality. Flows will be measured with a properly calibrated flow meter owned by the conservation district. Water quality samples will be paid for through grants and may be conducted by Conservation District staff or trained volunteers. The automatic dosing siphons should be checked quarterly as well to make sure they are functioning properly. If not functioning properly, manual valves must be utilized to flush on a constant basis until repaired or replaced. These manual flushes should at least occur twice/month.

Maintenance –Leaf and tree debris fall will be cleared at least once a month (more often in the autumn) from the two system inlets, the two settling pond outlets and the total system outlet. Methods were implemented in the two system inlets and the two settling pond outlets to reduce the impact of leaves clogging the system; however, leaves can still cause a problem and need to be cleaned weekly during autumn.

Once every spring when stream flows are high, the manual flush needs opened for a short period of time (an hour is sufficient) because the holes in the plastic plumbing underneath the limestone shrink over time. It is suspected that this is due to iron or manganese

buildup or leaves. The manual flush should never be used stream flows are low because the increased acidity cannot be diluted.

Replacement – Once alkalinity and pH values are seen to be decreasing, which is estimated to happen in year 2025, more limestone will need to be added to the system. Limestone with $CaCO_3$ concentrations greater than or equal to 90% should be used. Metals will eventually have to be removed from the two settling ponds for use, quality permitting, or disposal in an accepting landfill.

ANNUAL INSPECTION FORM

Date:

Inspector Name/Affiliation/Title:

Reason for Inspection (circle one): Annual Storm Event Other: _____

1. Vandalism Notes:

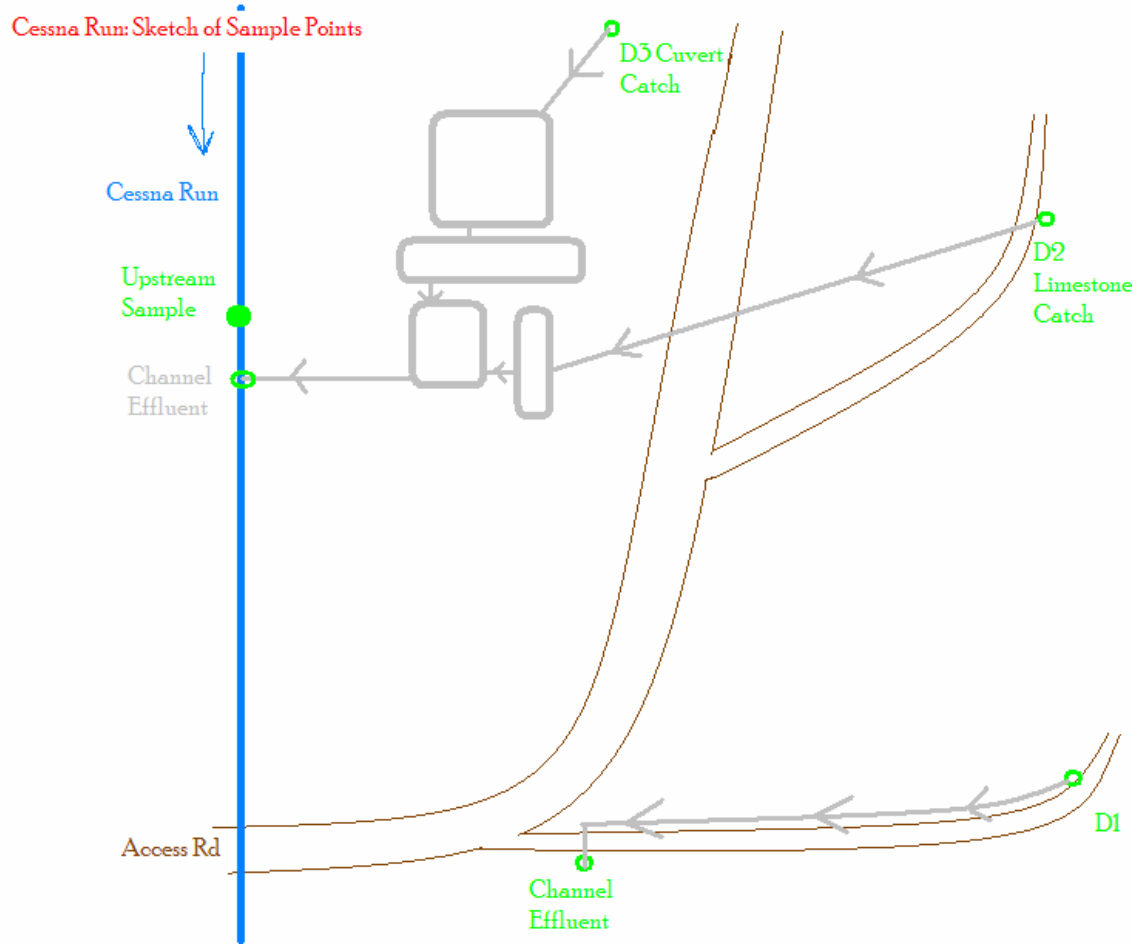
2. Condition of access roads Notes: (consider eroded ditches and passability)

3. Erosion, subsidence, leaks of on berms

4. Vegetation for Pest damage (consider bare spots or holes in berms)

5. Debris in inlets and outlets (leaves or vegetation in channels or pipe inlets that impairs flow)

6. Analysis of flows and chemistry samples from previous years: (use Datashed water quality database to analyze if the pH or Alkalinity has fallen over the years relative to the flow)


Cessna Run: Sketch of Sample Points
D3 Culvert Catch
Cessna Run
Upstream Sample
Channel Effluent
D2 Limestone Catch
Access Rd
D1
Channel Effluent