IMPLEMENTATION OF PASSIVE TREATMENT OF ACID MINE DRAINAGE (AMD) IN THE MID-CONTINENT REGION: THE LE BOSQUET CLEAN STREAMS PROJECT[1]

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Abstract. Several new passive treatment systems have been constructed to treat acid mine drainage (AMD) in the Mid-Continent Region. This poster discusses the construction and preliminary results of one new site—LeBosquet 064 2004 Clean Streams Reclamation Project. As a part of ongoing technical assistance with the Oklahoma Conservation Commission's (OCC) Abandoned Mine Lands Program, the Office of Surface Mining (OSM), Mid-Continent Region (MCR) assisted in the design and evaluation of the treatment system. The project site was an artesian seep located 4 miles (5 km) west of the town of Fanshawe, in LeFlore County, Oklahoma. Preliminary water quality results indicated that the combination of an anoxic limestone drain system and a surface flow treatment wetland has been effective at mitigating the adverse impact associated with the AMD.

Additional Key Words: anoxic limestone drain, surface flow treatment wetland.

Problem. An artesian AMD seep, located approximately 4 miles (5 km) west of Fanshawe, Oklahoma, (Fig. 1) discharged into Cedar Creek resulting in adverse water quality impacts. OSM-MCR and OCC collected pre-construction water quality data (Table 1) that showed that the discharge was characterized by elevated iron (34 mg/L), decreased pH (5.11 S.U.), and net acidic (90 mg/L as $CaCO_3$) conditions. Once the seep discharged reached the receiving environment, the AMD oxidized resulting in a 0.5 acre "kill zone" devoid of vegetation (refer to Fig. 2). The runoff also adversely affected Cedar Creek. Cedar Creek is considered a warm water aquatic community and is used for agricultural purposes. The seep discharge has impaired the beneficial uses of the creek, and may be contributing to degradation of the downstream reservoir – Lake Wister.

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[1] Poster paper presented at the 7th International Conference on Acid Rock Drainage (ICARD), March 26-30, 2006, St. Louis MO. R.I. Barnhisel (ed.) Published by the American Society of Mining and Reclamation (ASMR), 3134 Montavesta Road, Lexington, KY 40502

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7th International Conference on Acid Rock Drainage, 2006 pp 86-89
DOI: 10.21000/JASMR06020086
https://doi.org/10.21000/JASMR06020086

Table 1 – Preliminary Water Quality Data for the LeBosquet Clean Streams Project.

Parameter	OSM/OCC Baseline (median values)	ALD Inlet	ALD Outlet	Oxidation Pond Outlet	Wetland System Outlet	Units
Date	12/2000 – 5/2003 (n= 13)	5/24/2005	5/24/2005	5/24/2005	5/24/2005	
Distance from Artesian Seep	0	0	190	340	500	ft
pH	5.11	5.45	6.78	6.94	6.83	S.U.
SC	278	280	290	480	500	mg/L
Total Fe	34	36.50	47.50	4.50	3.05	mg/L
Dissolved Fe	35.4	30.50	31.30	NT	0.07	mg/L
Total Al	0.2	NT	NT	NT	NT	mg/L
Dissolved Al	0.57	0.060	<0.050	NT	<0.050	mg/L
Total Mn	1.45	NT	NT	NT	NT	mg/L
Dissolved Mn	1.7	1.38	1.47	NT	1.28	mg/L
Sulfate	104	117.0	113.0	NT	79.3	mg/L
Total Acidity*	101.6	67.4	81.1	NT	2.8	mg/L **
Total Acidity (lab)	NT	50.00	50.00	NT	<1.00	mg/L **
Total Alkalinity (Field)	11	NT	159.0	126.0	167.5	mg/L **
Total Alkalinity (Lab)	NT	<2.50	122.0	NT	172.0	mg/L **
Net Acidity	NT	48.75	-72.0	NT	-169.2	mg/L **

Note: There is insufficient data to present a technically sound water quality summary at this time; water measurement and sampling are ongoing.

SC = specific conductance, NT = not tested; Data in bold are below the detection limit shown.

* Acidity formula: Total Acidity = $50*(2*Fe^{2+}/56+3*Fe^{3+}/56+3*Al/27+2*Mn/55+1000*10^{-pH})$

** Reported as mg/L as $CaCO_3$ equivalent.

Treatment. A treatment system was implemented that used, in series, an anoxic limestone drain (ALD), an oxidation treatment cell, and a surface flow treatment wetland (Figure 3). Preliminary OSM-MCR water quality data indicated that the discharge has been ameliorated. The treatment system is generating 170 mg/L (as $CaCO_3$) alkalinity of which the ALD is generating 150 mg/L, and has a discharge pH of 6.9 S.U. Dissolved iron and sulfate are also reduced to lower levels (0.1 mg/L and 79 mg/L, respectively).

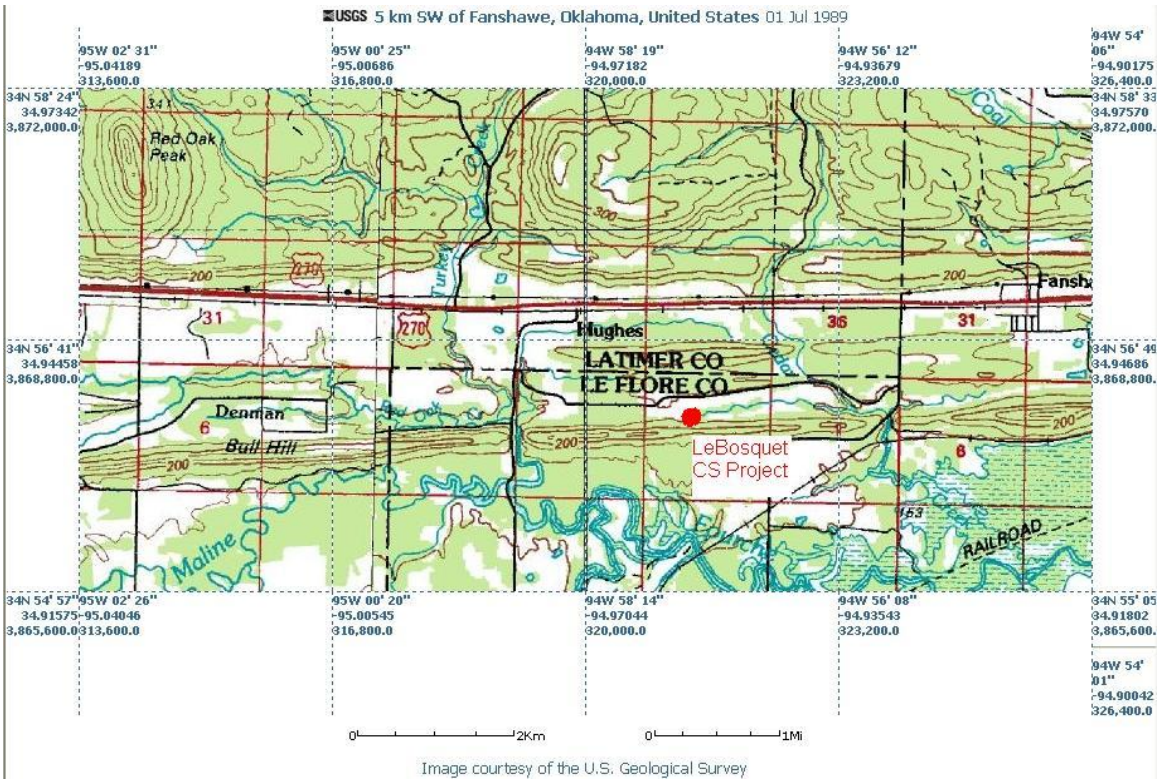

Figure 1 – Index map, Le Bosquet Clean Streams Project, Le Flore County, Oklahoma.


(Photograph by Dan Trout, Office of Surface Mining, February, 2004)

Figure 2 – AMD vegetation damage area, Le Bosquet Clean Streams Project, Oklahoma.

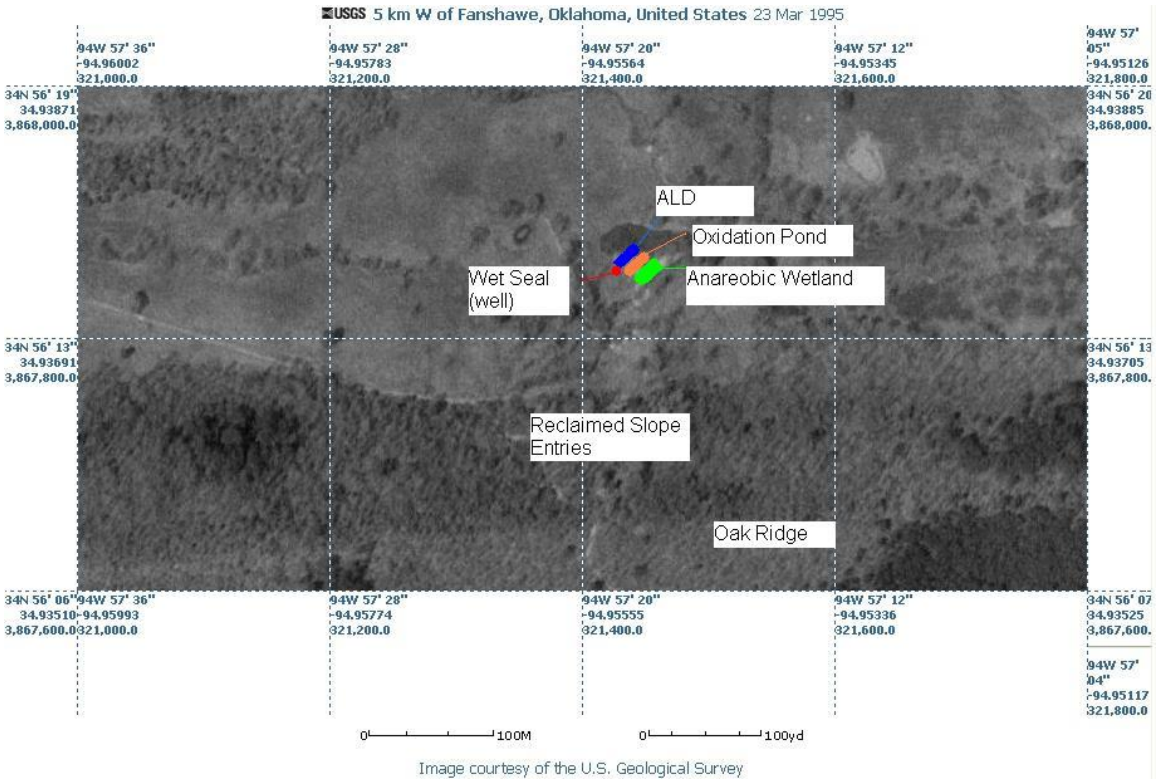

Figure 3 – AMD treatment facilities, Le Bosquet Clean Streams Project, Oklahoma.

(Photograph by Dan Trout, Office of Surface Mining, February, 2004)

Figure 4– ALD Construction, Le Bosquet Clean Streams Project (note sample wells).