Demonstrating a Market-Based Approach to the Reclamation of Mined Lands in West
Virginia

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ABSTRACT

This is the third quarter progress report of Phase II of a three-phase project to develop and evaluate the efficacy of developing multiple environmental market trading credits on a partially reclaimed surface mined site near Valley Point, Preston County, WV. Construction of the passive acid mine drainage (AMD) treatment system was completed but several modifications from the original design had to be made following the land survey and during construction to compensate for unforeseen circumstances. We continued to collect baseline quality data from the Conner Run AMD seeps to confirm the conceptual and final design for the passive AMD treatment system.

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EXECUTIVE SUMMARY

This is the third quarter progress report of work accomplished to develop and evaluate the efficacy of developing multiple environmental trading credits on mined land to encourage enhanced reclamation more quickly and at less public cost. Project objectives are to develop hypothetical carbon sequestration and water quality trading credits by reforesting a 12-hectare area with five species of commercial hardwood tree seedlings and designing and constructing a passive AMD treatment system to improve water quality. The project site is located on a partially reclaimed surface mine near Valley Point, Preston County, WV.

Landowner desire to relocate the proposed passive AMD treatment system to Conner Run drainage necessitated collection of additional baseline AMD quality data that is included in this report.

Construction of the passive AMD treatment system commenced on August 25, 2005 and was completed on September 29, 2005. The project budget for the AMD treatment system (\$51,000) was based on an open limestone channel in Sovern Run. When the Connor Run site was selected, a conceptual design was developed as described in the quarterly report number 2. However, several unforeseen circumstances were incurred during the survey and construction that required modifications to the final system configuration to accommodate site conditions. These modifications resulted in an AMD treatment system cost of \$74,000 (Table 1).

Modifications included reconfiguring the Alkaline Recharge Trench (ART) and upper retention pond (Impoundment A) to accommodate weak soil conditions and a shallow bedrock crop respectively. Additionally, the elevation of the springs feeding the pond were determined to be at the same elevation of Impoundment A. Therefore, the drainage channel conveying the pond springs to the treatment system was shifted to Impoundment B requiring a deeper soil cut. Also, due to the elevation of the pond springs additional excavation was required to properly construct and compact the limestone foundation drain. The final design is given in Figure 1. Table 1 shows the as built dimensions and materials for each of the treatment units.

Table 1 As Built Dimensions and Costs

Item	Length	Width	Depth	Tons Limestone	Tons CKD	Cost
Mobilization/Demobilization						\$ 3,000
LS 1	18	18	3		25	\$ 2,000
ART 1	200	4	4	150	550	\$ 26,711
OLC 1	160	6	4	170		\$ 6,800
OLC 2	150	5	4	127		\$ 6,000
FD 1	50	6	6	40		\$ 5,463
Imp "A"	50	15	2	35	15	\$ 5,086
Imp "B"	100	50	3			\$ 5,086
Excavation (3,958 cy @3.50cy)						\$ 13,854
TOTAL				522	590	\$ 74,000

EXPERIMENTAL

Baseline AMD quality sampling was conducted at both the sedimentation pond and an AMD seep using methodologies described in the first quarter report. The remainder of the work entailed contract and construction management.

RESULTS AND DISCUSSION

Construction of the AMD passive treatment system was completed on August 25, 2005. Figure 1 shows a schematic depicting the final passive AMD treatment system constructed on Conner Run drainage. Figures 2-6 are photos taken during construction and Figures 7 and 8 are post construction photos.

Figure 1 Schematic Depicting Final Passive AMD Treatment

Construction Photos

Figure 2 Backhoe Breaching Dike of Former Sedimentation Pond

Figure 3 Backfilling and Compacting Sedimentation Pond

Figure 4 Construction and Compaction of Impoundment B Dike

Figure 5 Location of Impoundment A and ART

Figure 6 Backfilled Sediment Pond and Open Limestone Channel

Post-Construction

Figure 7 Completed Impoundment B and OLC Conveying AMD from Former Pond

Figure 8 AMD Discharge from Impoundment A Showing Fe and Al Precipitation

The construction of the AMD passive treatment system commenced on August 25, 2004 and was completed on September 29, 2004. The construction of the AMD passive treatment design utilized a buried trench of limestone and cement kiln dust to intercept the mine water flowing subsurface through the mine soil and treating it by adding alkalinity. The existing pond was also drained and backfilled in order to convey, via an open limestone channel, the AMD seeps feeding it into a shallow impoundment at the bottom end of the AMD treatment system (Impoundment B). This impoundment, which collects the drainage from the trench, as well as the backfilled pond, then discharges into Connor Run.

Several site conditions were incurred during the survey and construction phase that were not anticipated in the conceptual design requiring modifications to the final system configuration. The springs feeding the pond were determined to be at the same elevation as Impoundment A. In order to achieve positive flow the open limestone channel had to be shifted into Impoundment B requiring additional excavation. Moreover, due to the elevation of the springs, additional excavation was required to properly construct and compact the limestone foundation drain. Additional modifications included reconfiguring the Alkaline Recharge Trench (ART) and upper retention pond (Impoundment A) to accommodate weak soil conditions and a shallow bedrock crop respectively. These factors increased construction costs due to the additional amount of soil that was required to be moved to properly construct the limestone foundation drain and open lime stone channel.

Water quality sampling was undertaken prior to construction of the AMD passive treatment system, and is shown in Table 2. Post-construction water quality sampling will take place next quarter. No water quality sampling was conducted during August, as the seep dried up. In July and September flow volumes were too low to measure.

Table 2 3rd Quarter Water Quality Data

Sampling Station		July, August, September Sampling				
		Pond	Seep	Downstream	Pond	Seep
date		7/21/2004	7/21/2004	7/21/2004	9/16/2004	9/16/2004
Flow	gpm	NM	0.5	3.1	NM	2.82
Flow	L/Min	NM	1.89	11.73	NM	10.67
Field pH		3.7	3	3.3		3
pH		3.7	2.9	3.2	3.7	2.9
acidity	mg/l	134	366	123	151	219
est. acidity	mg/l	146.30	659.76	117.04	101.3	301.79
alkalinity	mg/l	0	0	0	0	0
acid-alk	mg/l	134	366	123	151	319
acid load	tons/yr	NM	1.52	3.18		
Mg	mg/L	20.4	63.5	24.7	16.4	81.2
Ca	mg/L	22.2	61.8	64	20.9	80.6
Fe	mg/L	0.62	31.1	6.68	0.32	25.8
Al	mg/L	17	80.9	9.15	15.6	19.4
Mn	mg/L	43.1	18.6	7.33	3.61	25.3
SO4	mg/L	250	901	436	202	735
Cond.	µs/cm					2080

The pond sample location was collected along the perimeter of a pond that collects drainage from several subsurface seeps. The seep sample was collected at a point in the upper drainage in which all the surface and subsurface seeps were combined

CONCLUSIONS

Construction of the passive AMD treatment system was completed on September 29, 2005. The conceptual design was modified to accommodate geologic, soil and AMD seep elevation conditions revealed during the survey and construction. These modifications resulted in an AMD project that cost \$23,000 more than the originally planned open limestone channel in Sovern Run. The project was completed on schedule (Sept. 30, 2004).

APPENDIX A
Final Engineering Design