

INFORMATION AND EDUCATION:

GAMBLE GULCH CONSTRUCTED WETLAND PROJECT—PHYTOREMEDIATION EXPERIMENT

Conducted by: The Logan School for Creative Learning
On the Web: www.logan.pvt.k12.co.us/graphindex.htm
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Project Partners: River Watch, Colorado Division of Wildlife
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Matching Funds: \$2,615

Middle school students from the Logan School for Creative Learning in Denver participated in the creation, monitoring and analysis of a constructed wetland project intended to help treat mine waste discharge. The overall program was started in 1994.

NPS funding assisted in the final stage of the project, a phytoremediation experiment. Phytoremediation is the use of plants to mitigate the effects of heavy metal waste.

The project site is located in Gamble Gulch below the non-operating Tip Top Mine near Rollinsville in Gilpin County. Prior to the construction of the artificial wetland, acid mine drainage directly entered Gamble Gulch.

The wetland system diverts mine runoff through a limestone culvert to a settling pond. Water then enters a distribution manifold and is directed to one of four artificial wetland cells. Two of the cells are a manure substrate and two are a compost substrate.

During the first phases of the project, students monitored outflow for each cell and the drainage source itself, comparing pH as well as levels of copper, cadmium, zinc, manganese and iron. Samples were taken every other month for a year. Students plotted and analyzed this data to judge the effectiveness of the cells and to see if minimum standards for aquatic life were being met.

During the phytoremediation phase, students under the supervision of teacher Dan Kowal carried out the experiment and participated in sampling for the Resource Conservation and Recovery Act (RCRA) analysis of eight heavy metals (cadmium, chromium, mercury, silver, arsenic, barium, lead and selenium).

In June of 1999, students transplanted a variety of plants including cattails (*Typha*), slough grass (*Beckmannia syzigachne*) and mustard plant (*Brassica* spp.).

Prior to planting, plant and soil samples were

collected in sterilized glass containers. These samples were submitted to Evergreen Analytical Laboratory to establish baseline data.

In September of 1999, shoot, root and soil samples were taken. In addition to the transplanted vegetation, grasses that established themselves in the cells were tested as well as a background soil sample. Students noted that some of the plants, particularly the mustard plants, did not do well at this elevation. An inductively coupled argon plasma/mass spectrometer (ICP/MS) analysis was performed to measure absorption of heavy metals.

Students were divided into teams that were assigned one of the heavy metals to be studied. They researched the potential effects these metals had on the environment as well as compared the two sets of data. Each team provided a report about its findings including any conclusions that could be drawn from the experiment.

The results of the student work helped define the future course of action for the site. Levels of lead and chromium continued to cause some concern. A Toxicity Characterization Leaching Procedure (TCLP) was performed to see if the site met federal guidelines.

Students were able to see how wetlands can be used to mitigate heavy metals and that site issues remain once the system has done its job. Students also learned how excess levels of heavy metals can enter and damage the environment, potentially impacting their health and lives.

“Never again will a plant seem as simple to these students as a cattail growing in a wetland. The data inspired many questions. Hopefully, our River Watch students will continue to take their inquisitiveness on into high school.”

—Dan Kowal, Logan School for Creative Learning