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Creating Web-based Nonpoint Source Monitoring/Reporting Tool

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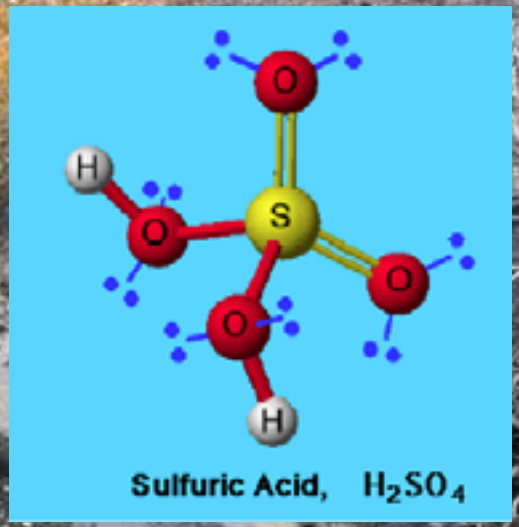
Acid Mine Drainage (AMD)

Iron Pyrite + Water + Oxygen = Sulfuric Acid

+

+

=



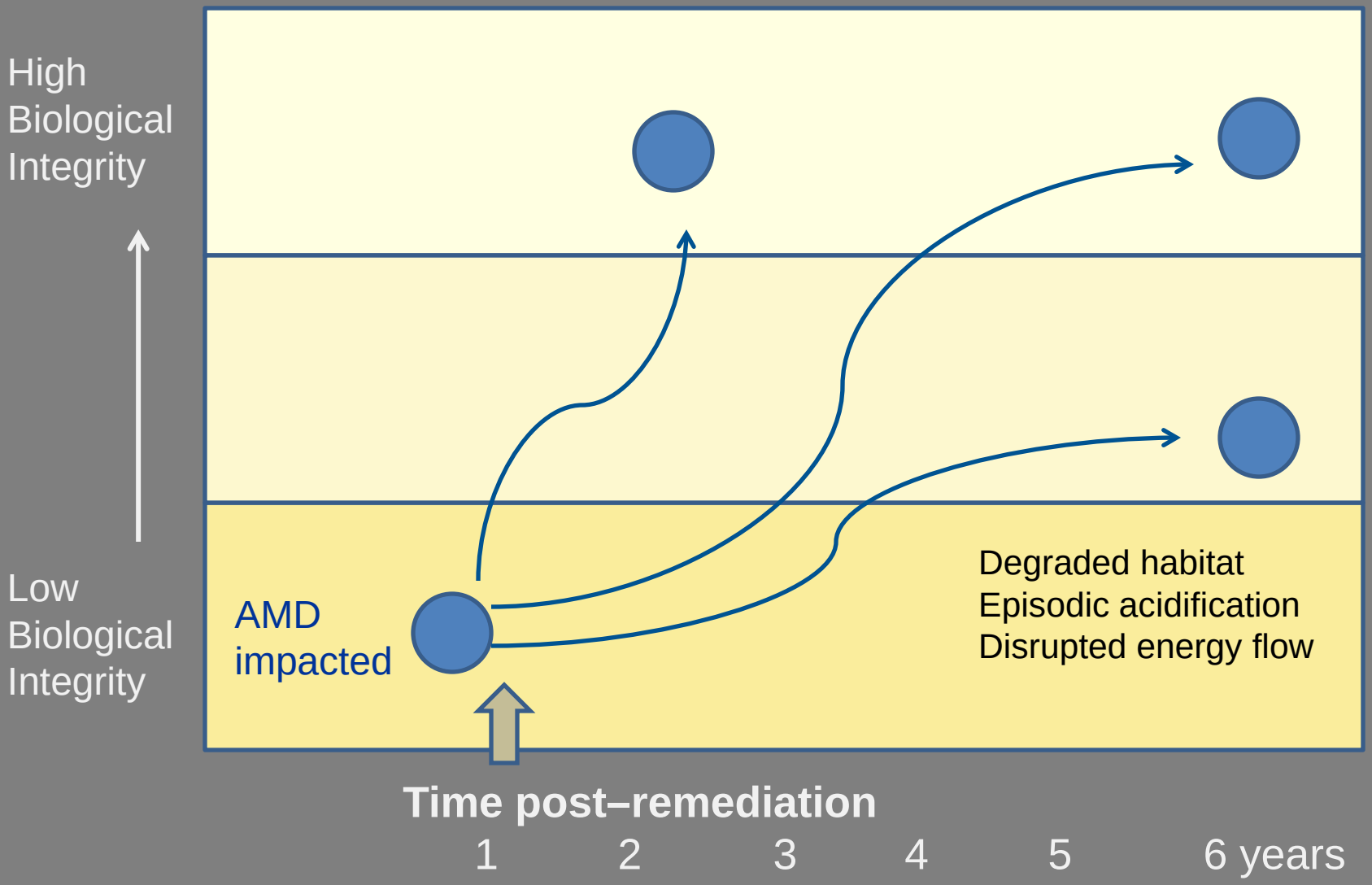
Acid Mine Drainage in Southeastern Ohio

- Abandoned underground mines (1900-70's)
- Acidity, high conductivity, SO_4^{2+} , Fe, Al, Mn
- $20 million spent in 3 watersheds (43 projects)
- Passive and active treatment of AMD inputs

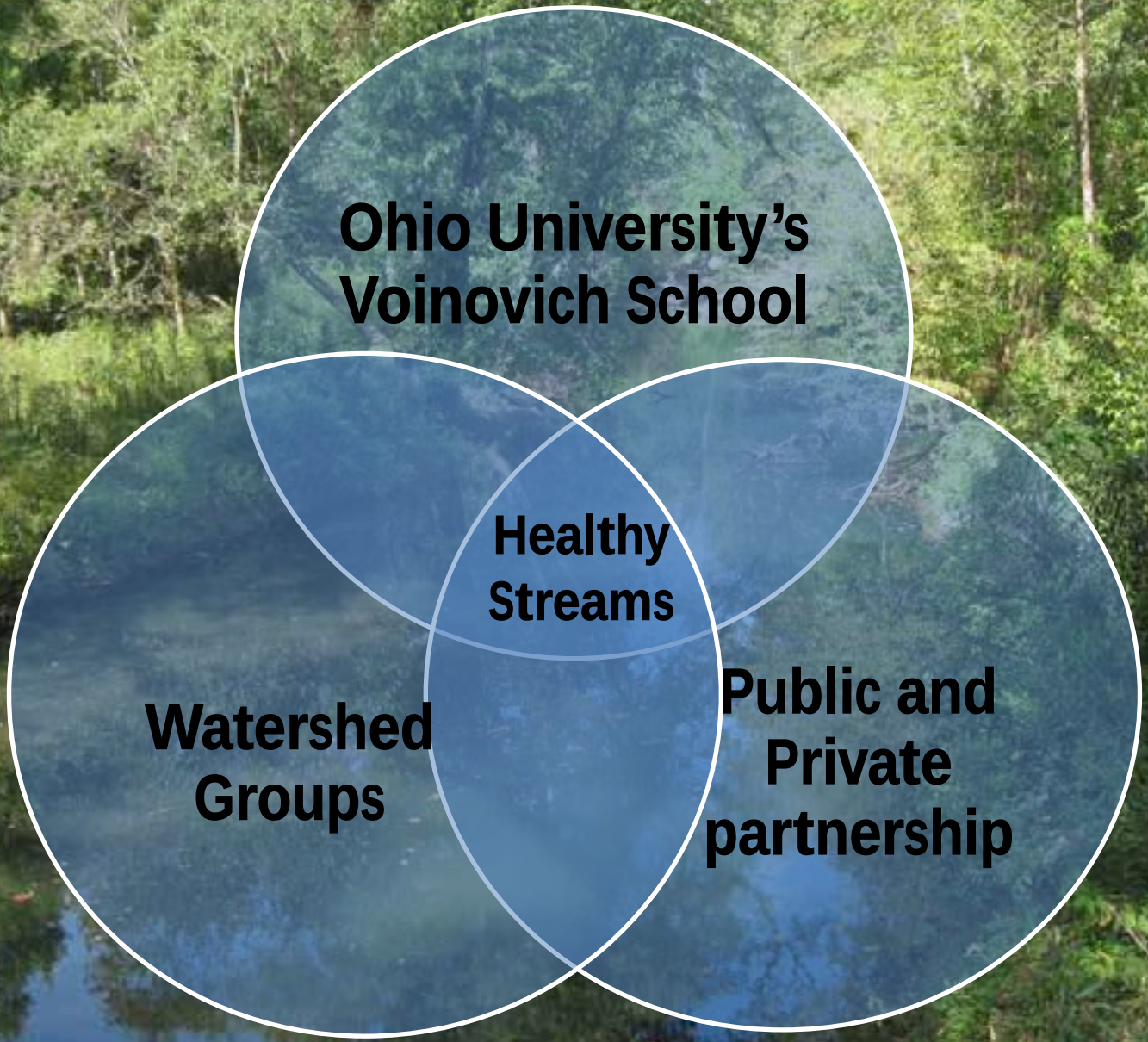
Reducing Input:
Capping gob piles
Closing subsidences
Surface reclamation

Alkaline Addition:
Limestone channels
Anoxic limestone drains
Steel slag beds
Active dosers (CaO)

Biotic Recovery or Recovery Potential



Collaborative Partnership



Monitoring

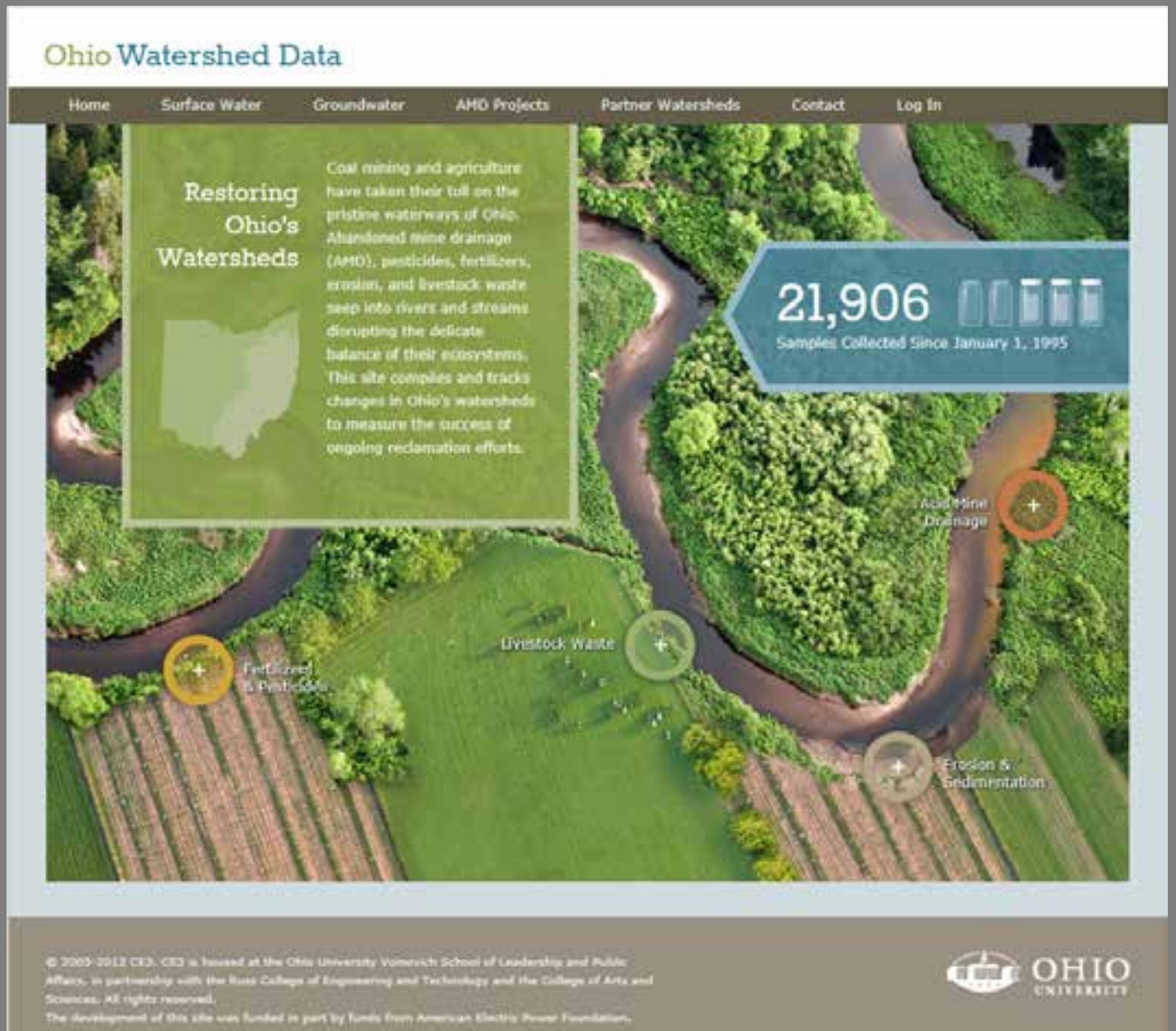
We use aquatic organisms as the ultimate indicator of healthy streams:

Chemical Water Quality

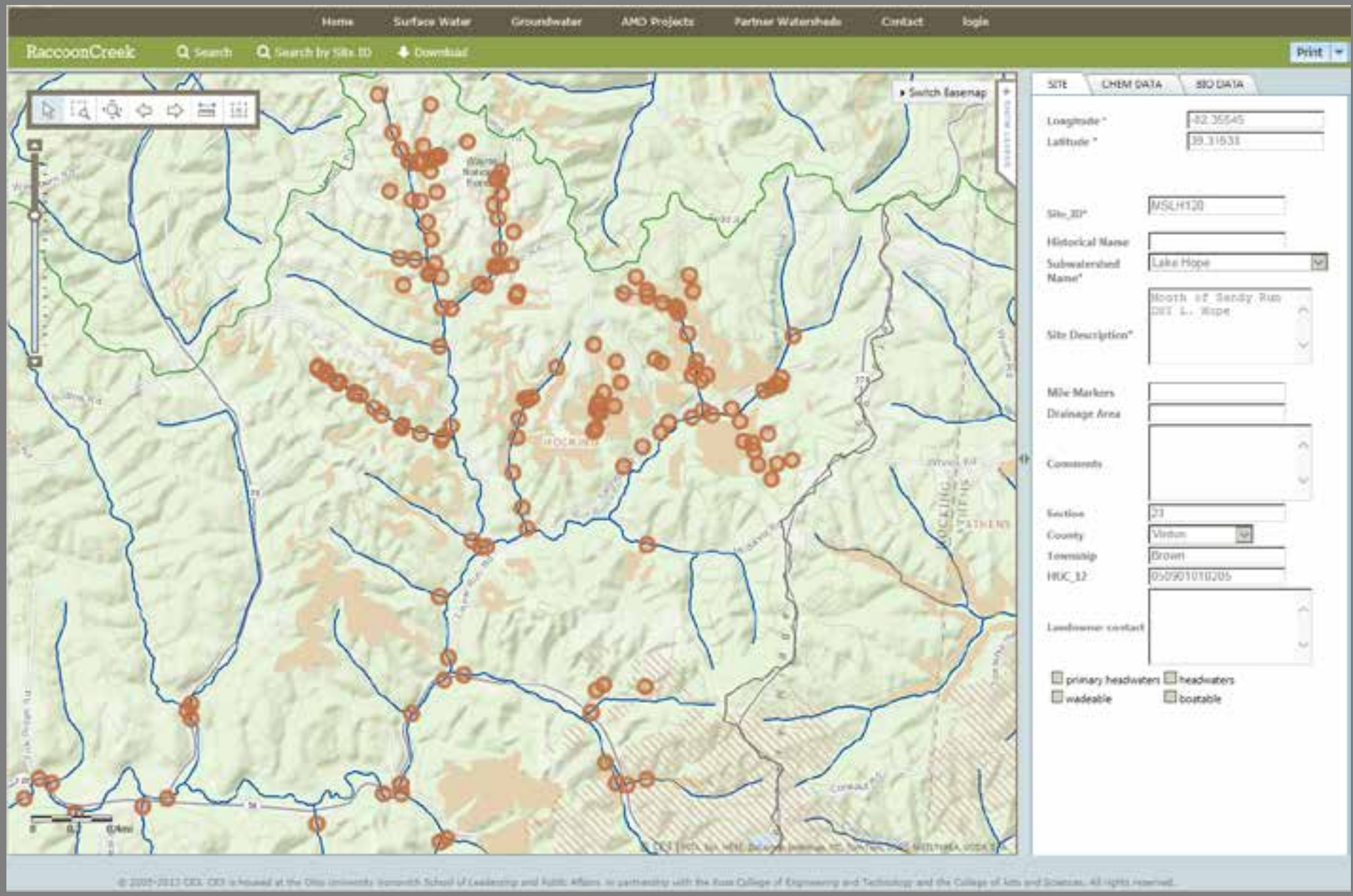
Fish

Macroinvertebrates

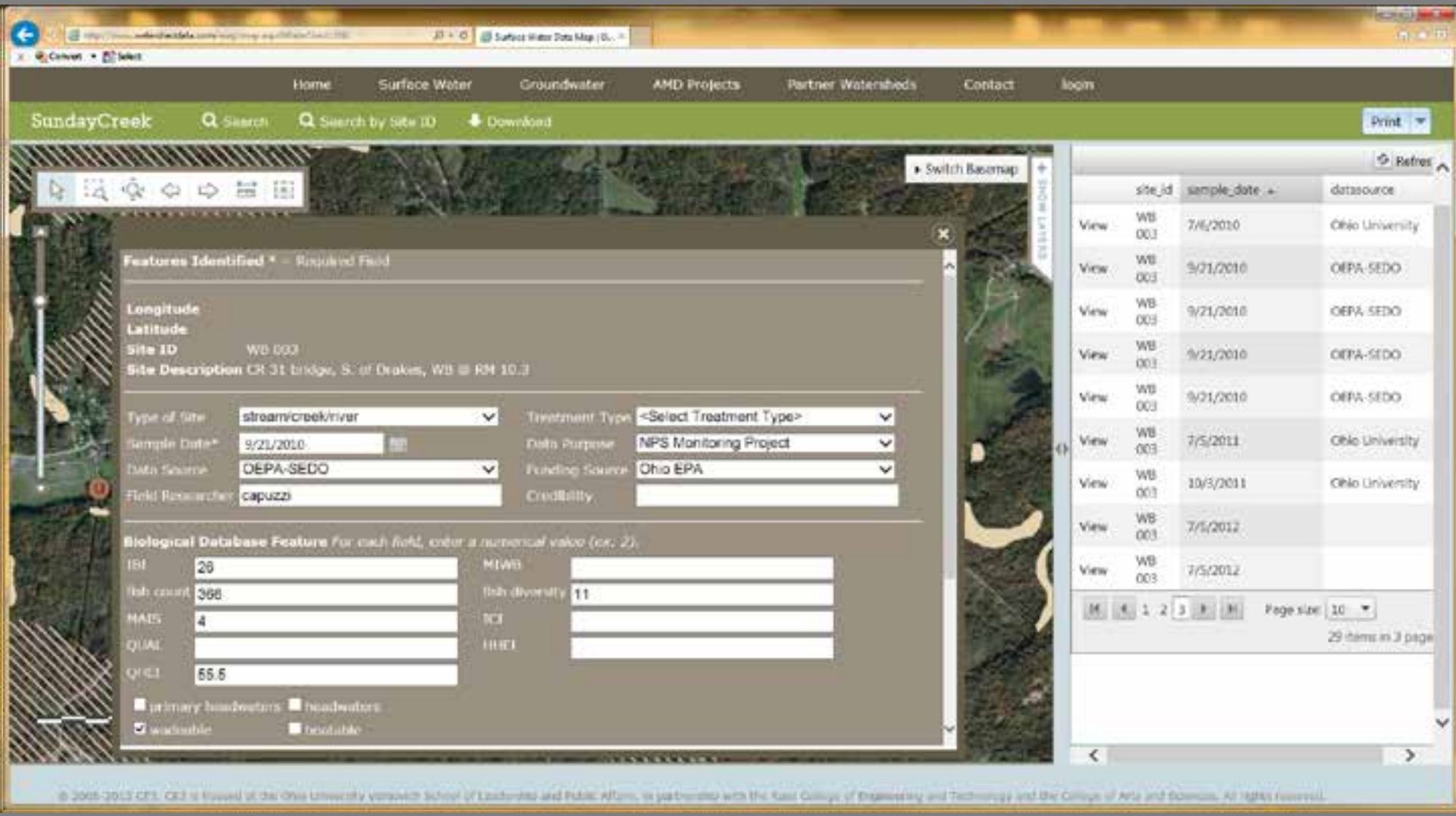
Visualize Data on a Map- Ohio Watershed Data



Ohio Watershed Data

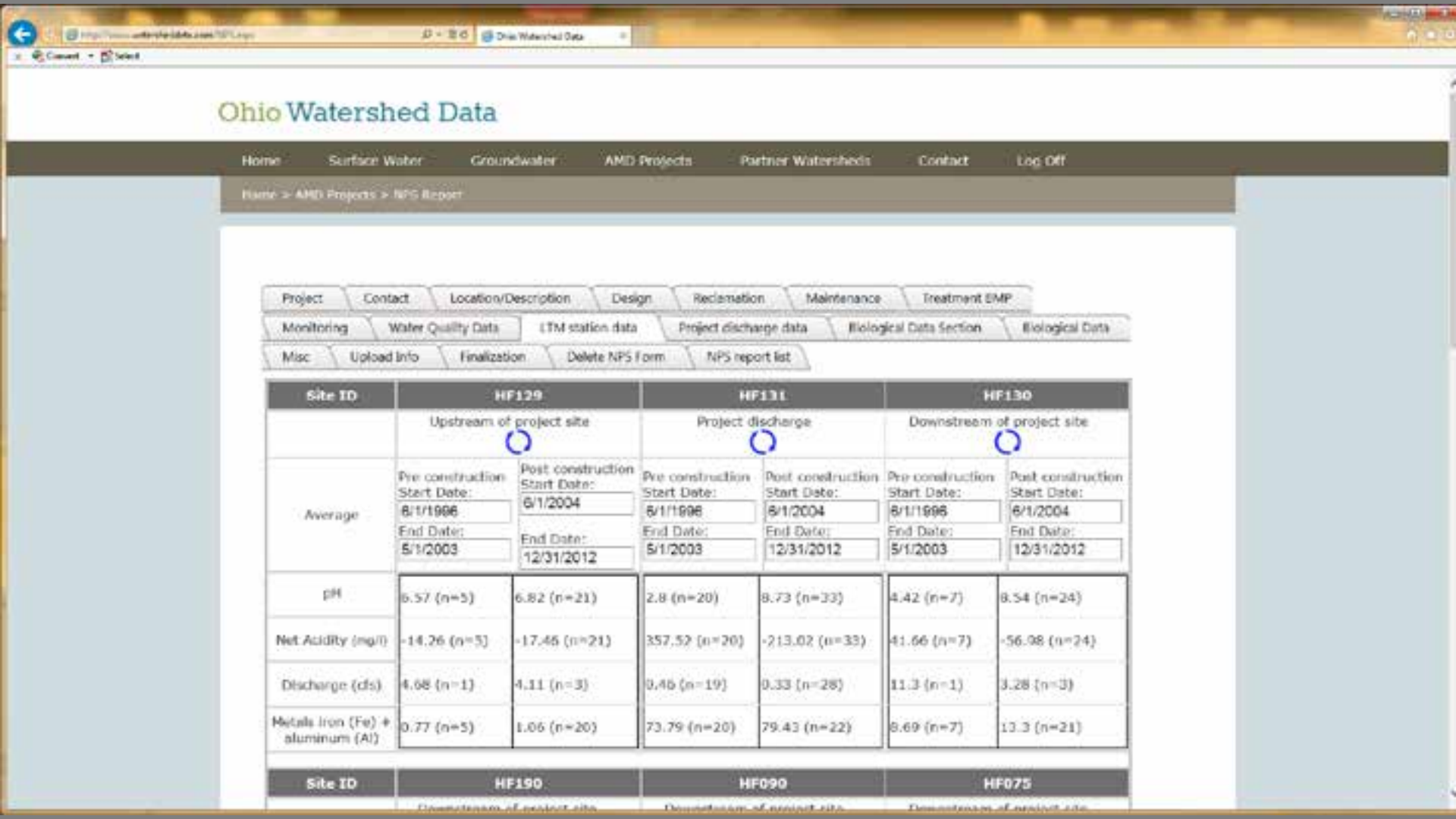


Data storage and results



www.watersheddata.com

Project information and results



Ohio Watershed Data

Home | Surface Water | Groundwater | AMD Projects | Partner Watersheds | Contact | Log Off

Home > AMD Projects > NPS Report

Project | Contact | Location/Description | Design | Reclamation | Maintenance | Treatment BMP

Monitoring | Water Quality Data | LTM station data | Project discharge data | Biological Data Section | Biological Data

Misc | Upload Info | Finalization | Delete NPS Form | NPS report list

Site ID	HF129		HF131		HF130	
	Upstream of project site		Project discharge		Downstream of project site	
Average	Pre construction Start Date: 8/1/1998 End Date: 5/1/2003	Post construction Start Date: 6/1/2004 End Date: 12/31/2012	Pre construction Start Date: 8/1/1998 End Date: 5/1/2003	Post construction Start Date: 6/1/2004 End Date: 12/31/2012	Pre construction Start Date: 8/1/1998 End Date: 5/1/2003	Post construction Start Date: 6/1/2004 End Date: 12/31/2012
pH	6.57 (n=5)	6.82 (n=21)	2.8 (n=20)	8.73 (n=33)	4.42 (n=7)	8.54 (n=24)
Net Acidity (mg/l)	-14.26 (n=5)	-17.46 (n=21)	357.52 (n=20)	-213.02 (n=33)	41.66 (n=7)	-56.98 (n=24)
Discharge (cfs)	4.68 (n=1)	4.11 (n=3)	0.46 (n=19)	0.33 (n=28)	11.3 (n=1)	3.28 (n=3)
Metals iron (Fe) + aluminum (Al)	0.77 (n=5)	1.06 (n=20)	73.79 (n=20)	79.43 (n=22)	8.69 (n=7)	13.3 (n=21)

Site ID	HF190	HF090	HF075

Annual Water Quality Report

2011 NPS Report - Raccoon Creek Watershed - Carbondale II Doser

Generated by Non-Point Source Monitoring System
www.waterbmpdata.com

Project Status: Complete: 2004 ODNR Project Number: AT-WI-05

Pre-construction

Carbondale East Seep, Photo by Brett Laverty

Post-construction

Carbondale II Project Dozer, Photo by JT Kraus

Carbondale II Wetland is located in Section 5.0 of Waterloo Township in Athens County and lies within the 14-digit HUC unit #05030101030016. The site is seven acres and located in the subwatershed Hewett Fork of Raccoon Creek Watershed. The majority of AMD in Hewett Fork originates from abandoned underground coal mines near Carbondale. ODNR-DMRM installed a passive wetland treatment system to reduce the acid and metal load from two mine portals in this area in the mid 1990's. This wetland was effective at reducing metal and acid loads but was not efficient enough to produce improvements in Hewett Fork. The Carbondale Doser was implemented as Phase II at the site to remediate the entire acid load from the mine discharge in 2004. The design was completed by ATC Associates for $48,005. The treatment approach for this site was to install an Aqua-fix lime-dosing unit. The major considerations in this design were the metal precipitates discharge into Hewett Fork because of the limited space for storage ponds on site. The goal of the design was to reduce 100 percent of the acid load discharging from the Carbondale mine seeps. One problem encountered at this site was the dosing material performance. Initially lime kiln dust was used, but the material bridges in the dosing unit. The material was switched to calcium oxide, a more expensive material but one with greater neutralizing potential. Therefore the doser now has the ability to over-treat and neutralize acid mine drainage from downstream sources. Construction was complete April 1, 2004, by Law General Contracting for a cost of $389,657. The major responsibility of the construction company was to remove existing metal retention wetlands and install the doser and a concrete mixing channel. The funding source for the project design was ODNR-DMRM, and for construction the sources were ODNR-DMRM, OEPA, and OSM-ACSI. Figures 3 and 4 (shown on page 3) estimate approximately 7.7 lbs/day of acid were reduced from entering into Hewett Fork as a result of this AMD reclamation project. In addition to the acid load reduction there is an addition of approximately 50 lbs/day of alkalinity to Hewett Fork both as dissolved and solid erased calcium oxide. Dissolved metal load reduction occurring at this site was approximately 197 lbs/day. The metals precipitate as a result of the high pH water and become part of the substrate in the receiving stream.

Site: HF131

Data derived using the Mean Annual Load Method (Rivers, 2004).

2011 NPS Report - Raccoon Creek Watershed - Carbondale II Doser

Generated by Non-Point Source Monitoring System
www.waterbmpdata.com

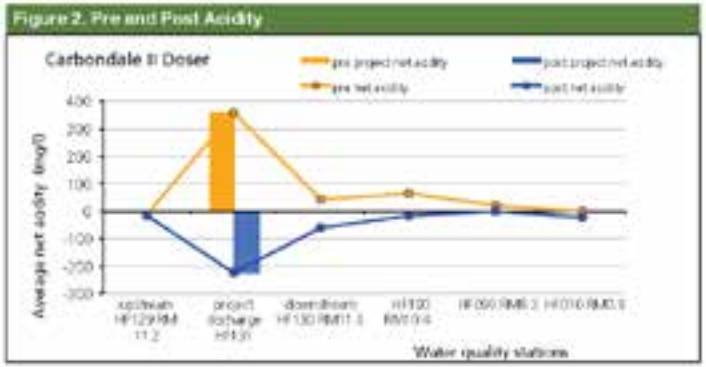
Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Carbondale II Doser project, the pH and net acidity has improved downstream of the reclamation site for 11 miles. Pre-construction data showed pH in the range of 2.8 – 5.9 downstream of the project. However, after installation of the Carbondale II Doser, post-construction data shows pH in the range of 6.1 – 9.0 downstream of the project discharge. The net acidity concentrations decreased, showing net alkaline conditions continuing for 11 miles downstream to station HF010.

Figure 1. Pre and Post pH

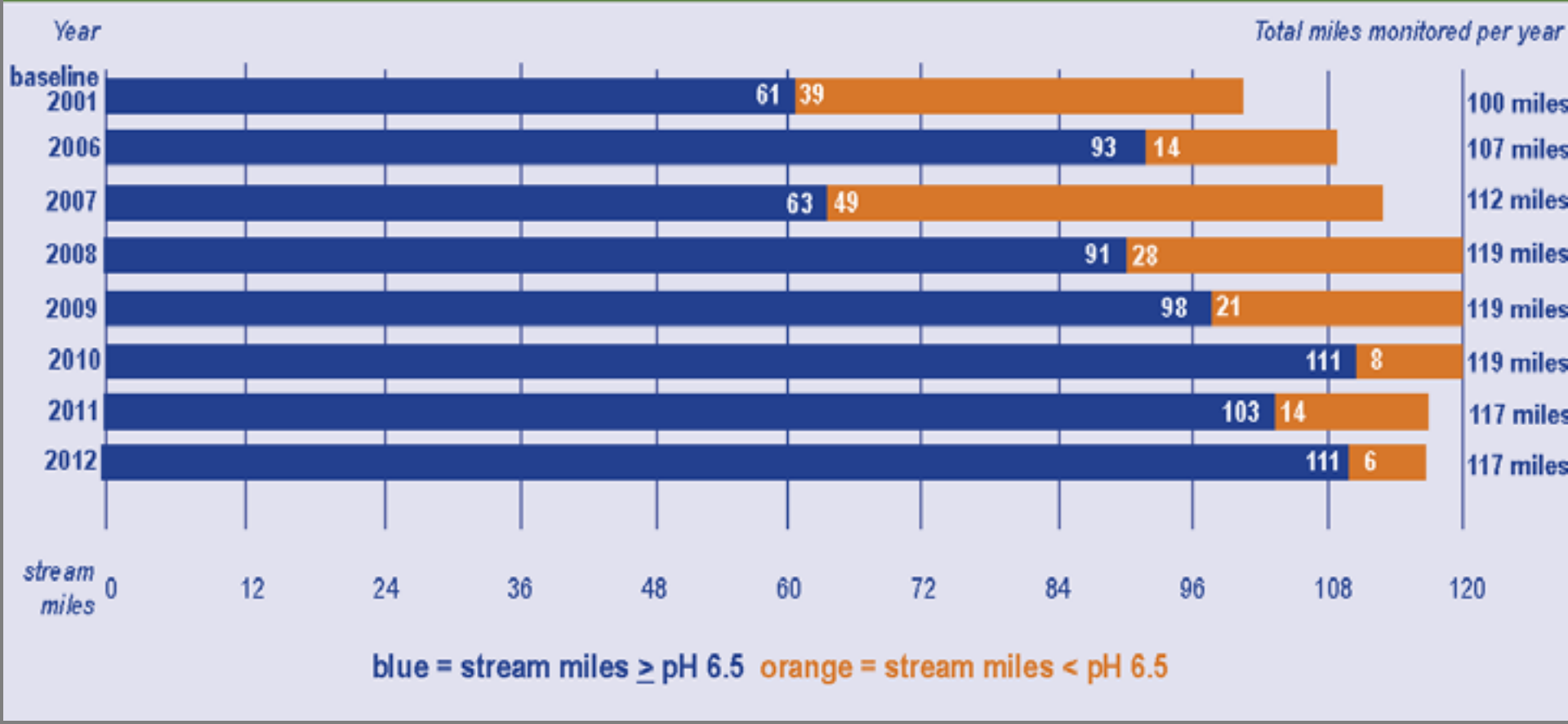
Figure 2. Pre and Post Acidity



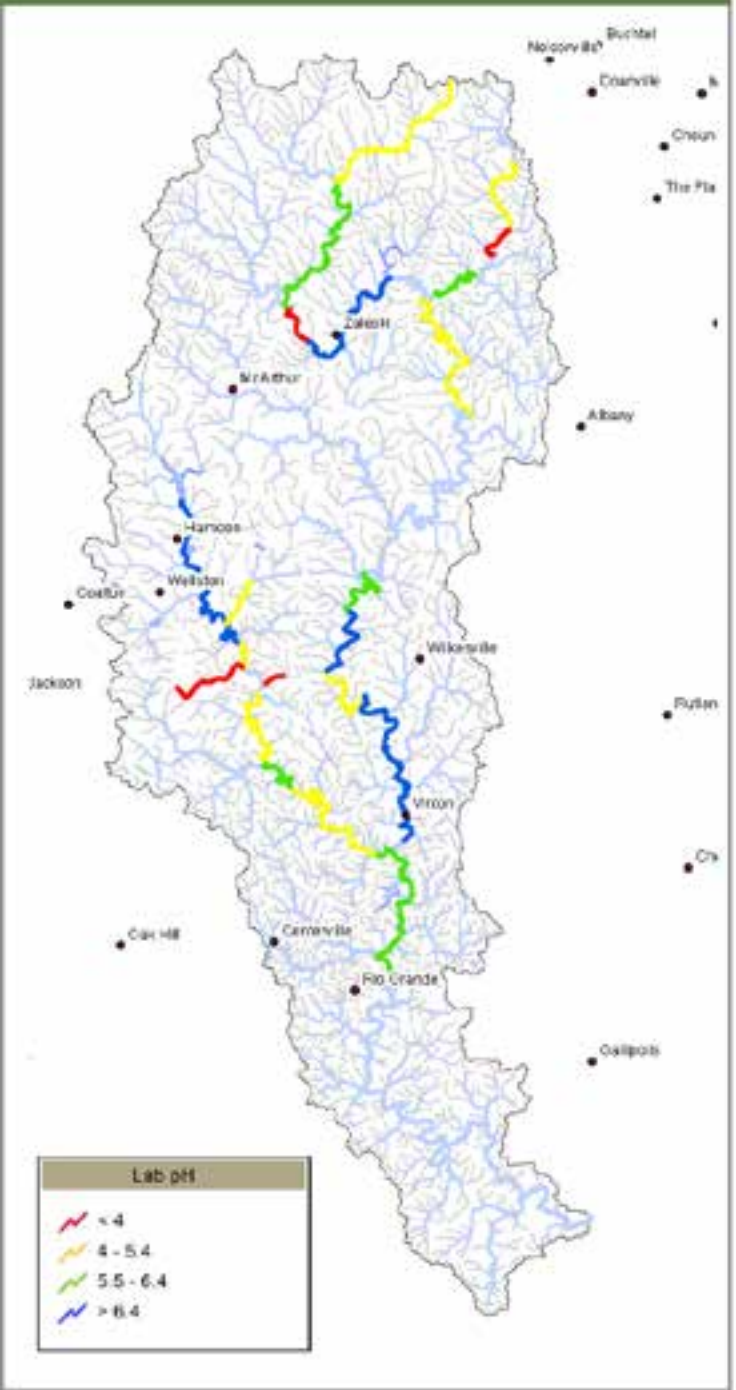
Successful Results

Raccoon Creek - pH

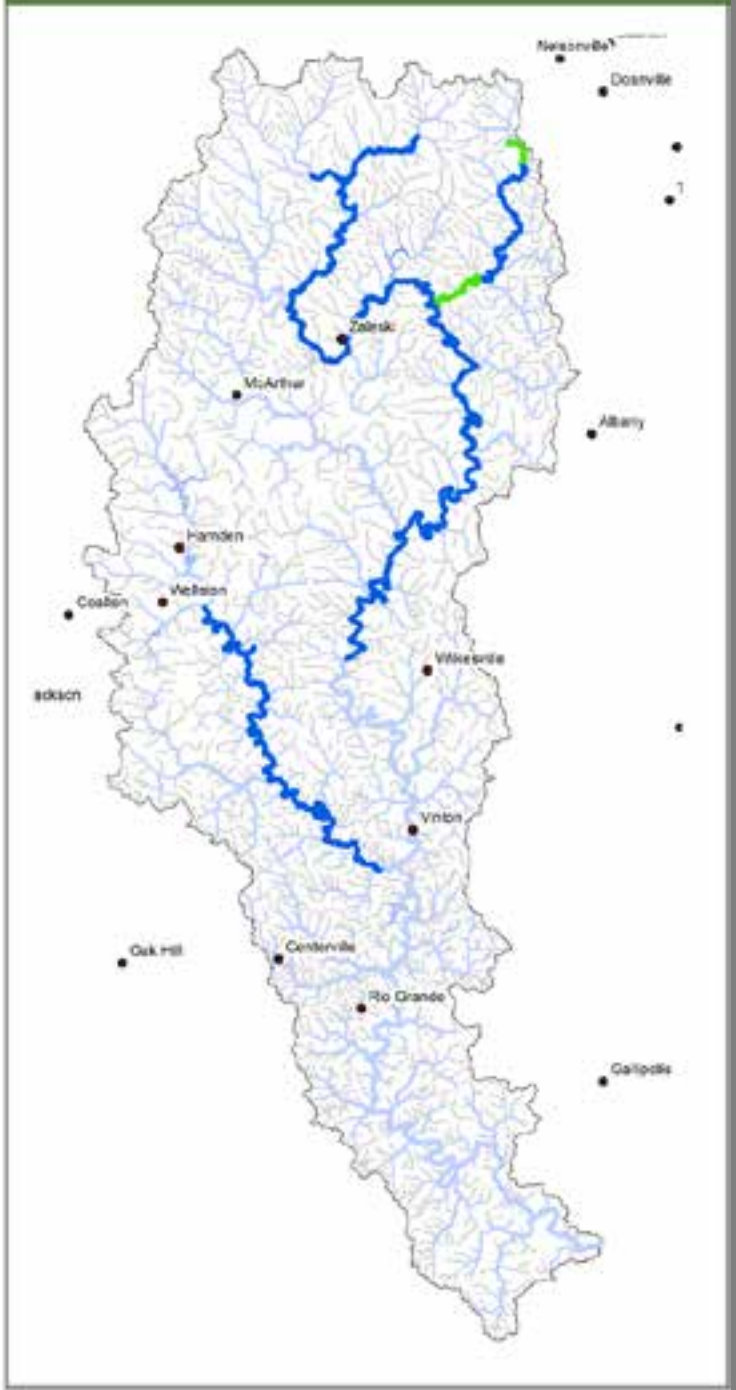
Figure 1. Raccoon Creek total stream miles monitored for pH through time



Raccoon Creek baseline pH



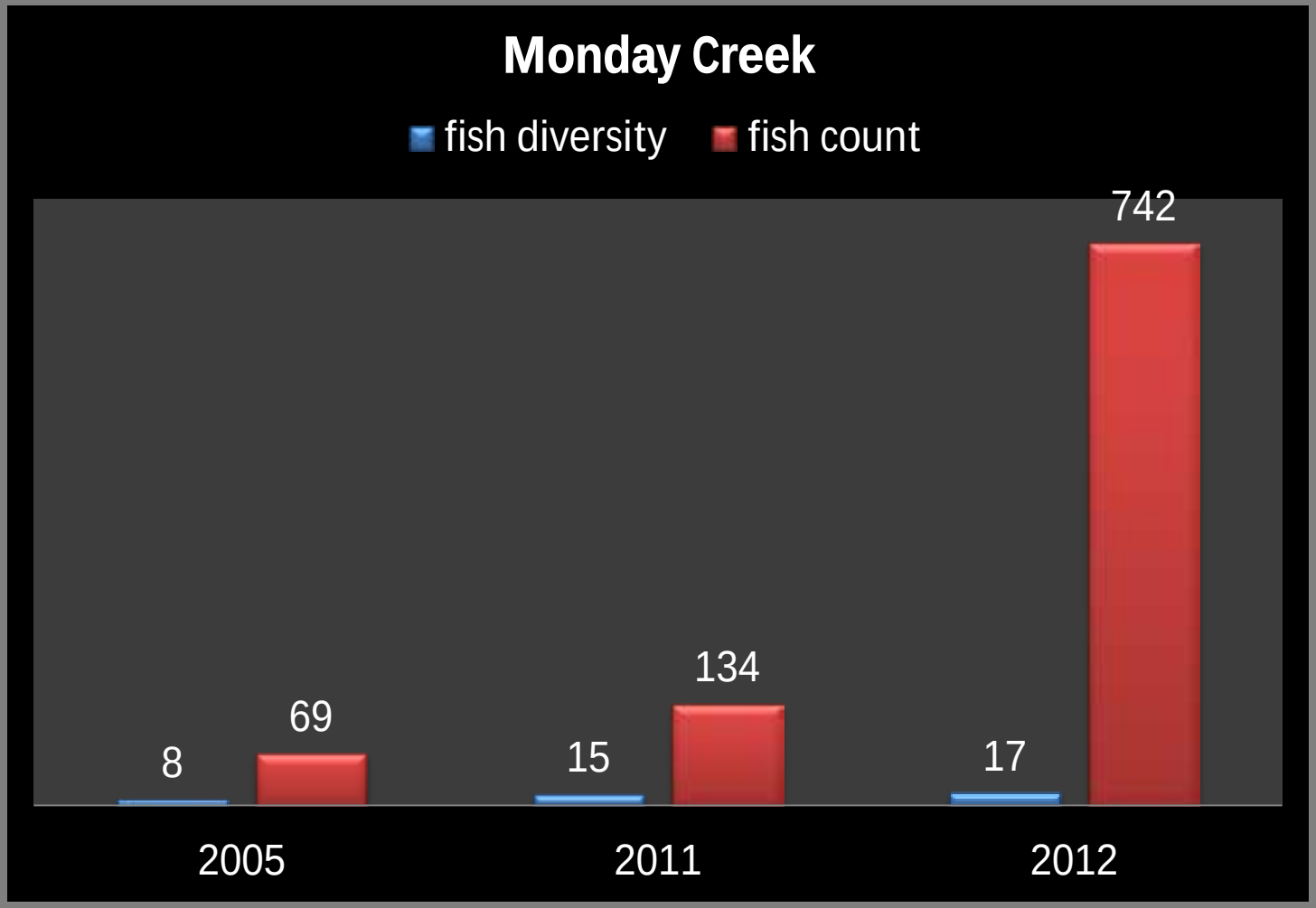
Raccoon Creek 2012 pH



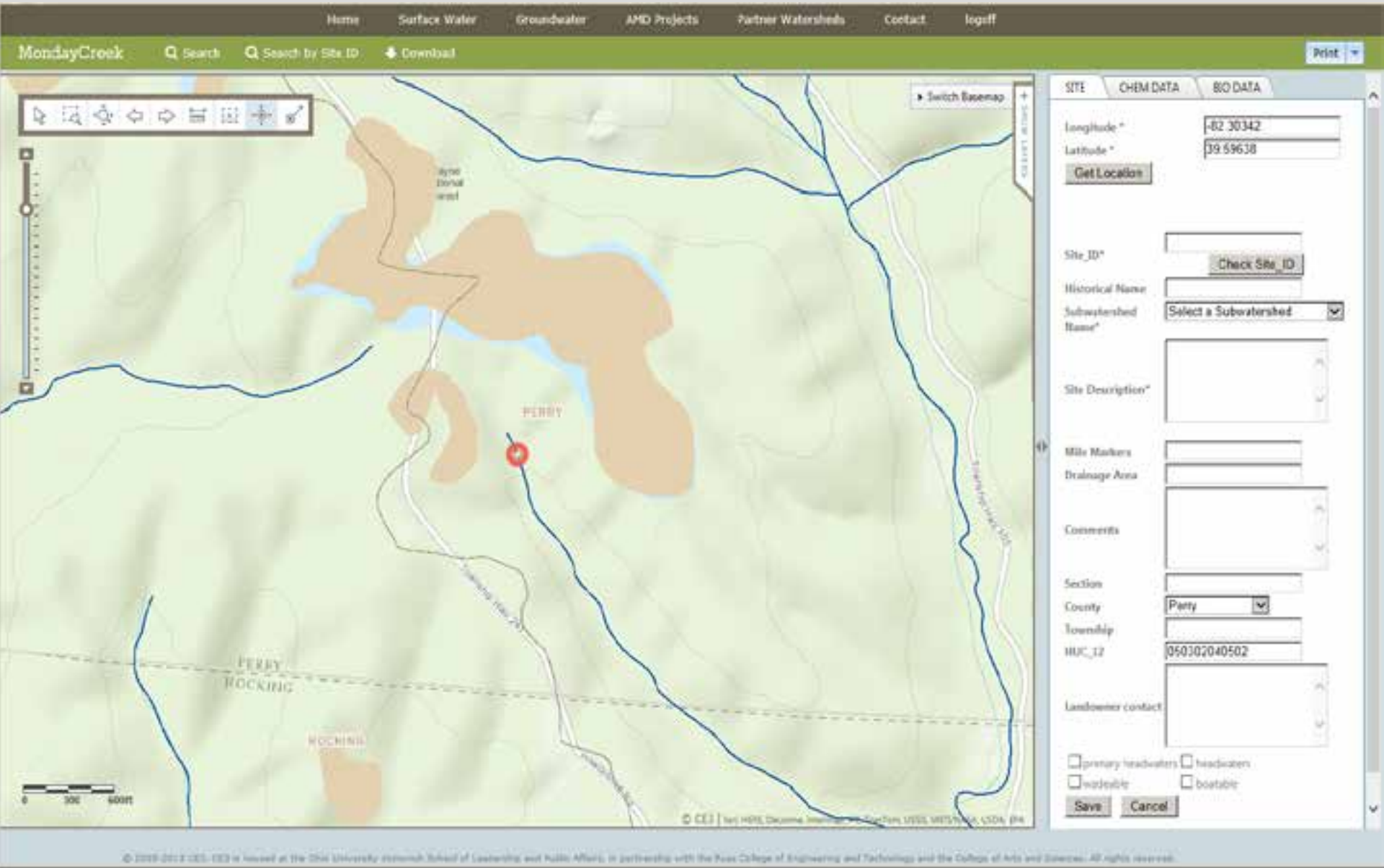
Raccoon Creek

pH

Incremental changes



Built an evaluation system using GIS and web mapping technology to visualize information and analyze data



Creating High Performance Spatial Databases with SQL Server 2008 and ArcGIS Server 10

An interactive web map using a .NET-based web entry form and ArcGIS API for JavaScript, SDE, and SQL databases.

System Requirements

- SQL Server 2008 or higher
- ArcGIS server 10.1 or higher
- .NET Framework 3.5 or higher
- ArcGIS API for JavaScript
- Dev Tools
  - Visual Studio 2008 or higher
  - SQL Management Studio 2008
  - ArcMap 10.1

SQL Server 2008

- Points, Linestrings, Polygons
- Accurate calculations
  - Ellipsoid model (geography)
  - Flat plane (geometry)
- Full complement of spatial methods
  - Intersects, Contains, Crosses, Touches
  - Distance, Length, Area
  - DE-9IM

SQL Server Spatial Data Types

- Creating Spatial Data- **Geography- Geometry**

Type of Object	Well-Known Text	Well-Known Binary	Geography Markup Language
Point	STPointFromText()	STPointFromWKB()	GeomFromGml()
LineString	STLineFromText()	STLineFromWKB()	GeomFromGml()
Polygon	STPolyFromText()	STPolyFromWKB()	GeomFromGml()
MultiPoint	STMPointFromText()	STMPointFromWKB()	GeomFromGml()
MultiLineString	STMLineFromText()	STMLineFromWKB()	GeomFromGml()
MultiPolygon	STMPolyFromText()	STMPolyFromWKB()	GeomFromGml()
Geometry Collection	STGeomCollFromText()	STGeomCollFromWKB()	GeomFromGml()
Any supported type	STGeomFromText() Parse()	STGeomFromWKB()	GeomFromGml()

Creating Spatial Data

- The use of spatial data

  ü Management of spatial data

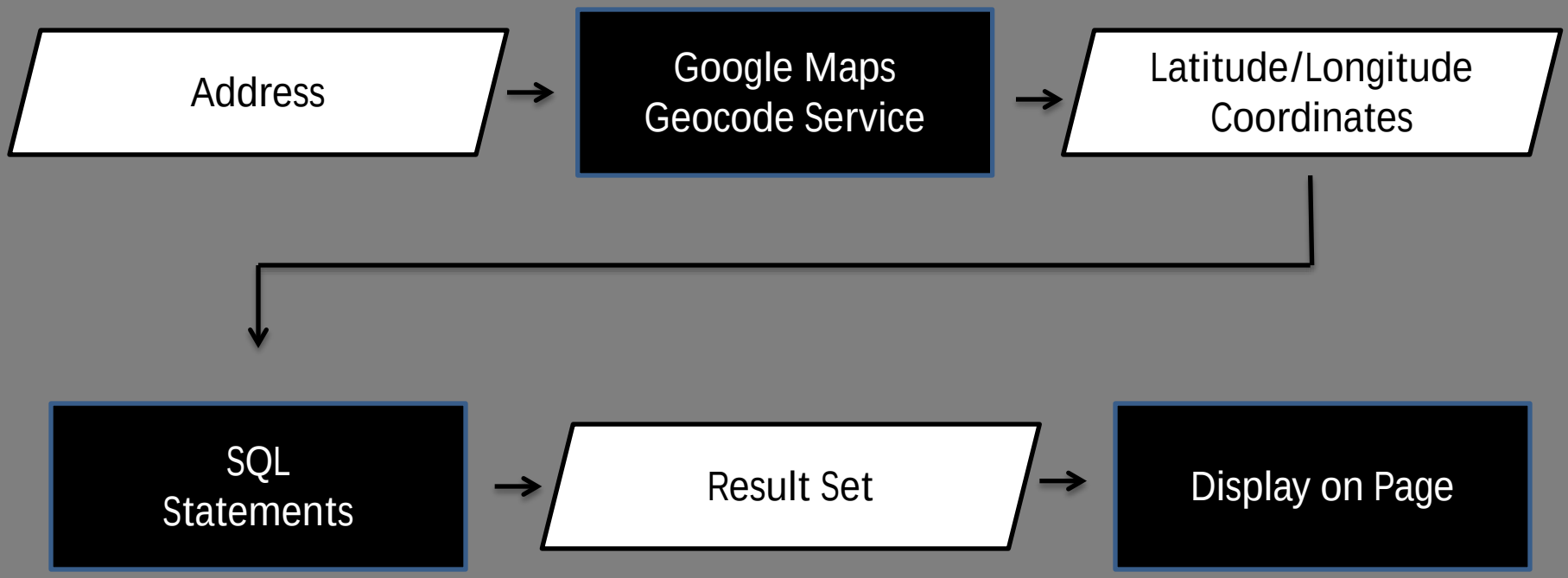
```
CREATE TABLE SpatialTable
    (Id int IDENTITY (1,1),
    GeomCol1 geometry,
    GeomCol2 AS GeomCol1.STAsText ());
GO

INSERT INTO SpatialTable (GeomCol1)
VALUES (geometry :: STGeomFromText ('LINESTRING (100 100, 20 180,
180 180), 0));
geometry::STPointFromText('POINT(258647 665289)', 27700)
```

Import Spatial Data in SQL Server

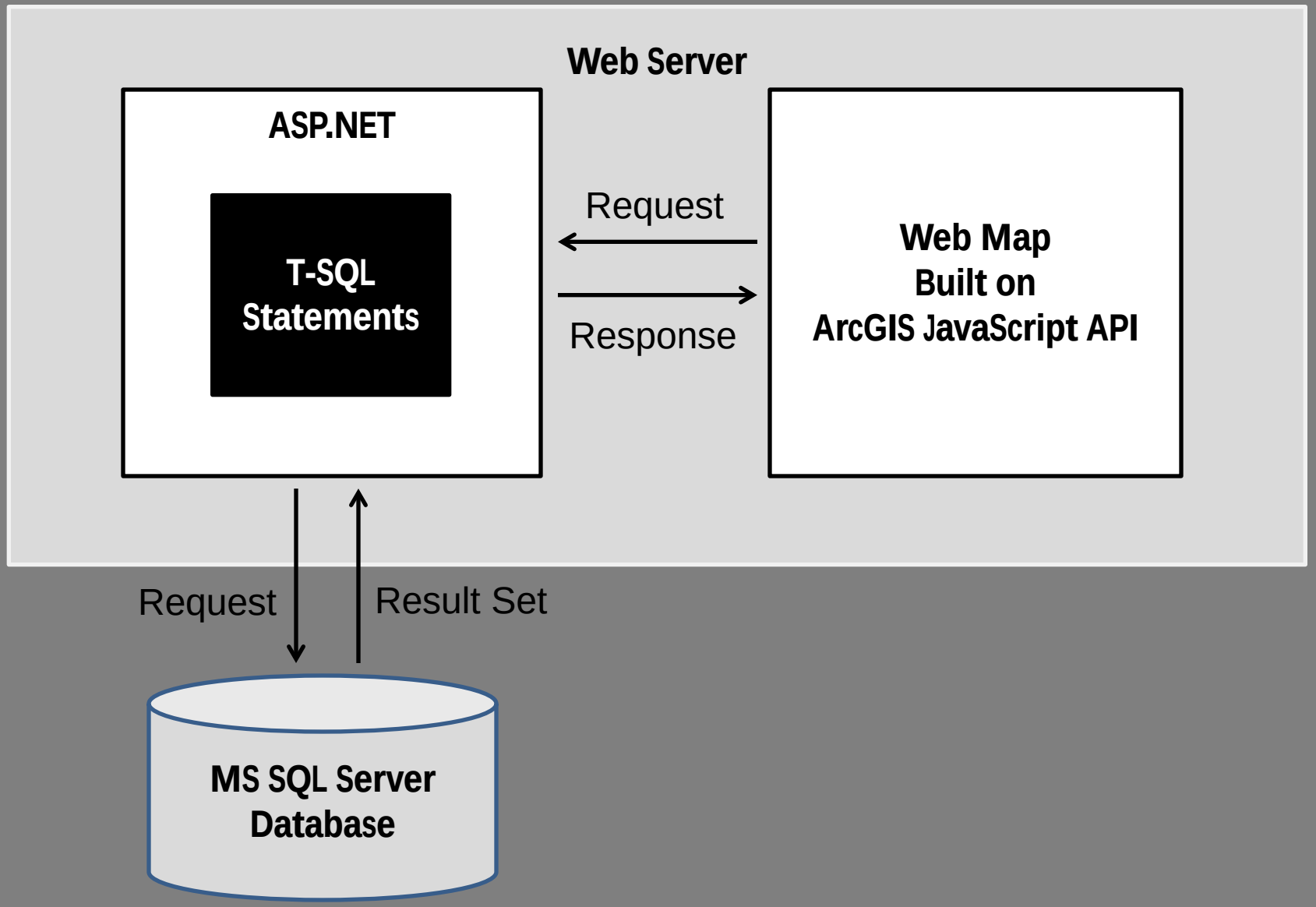
ü Conversion Utilities:

- ShapeToSQL: www.social.msdn.microsoft.com
- Shp2text: www.obviously.com
- FME : www.safe.com
- Manifold: www.manifold.net

SQL Solution: Application Process

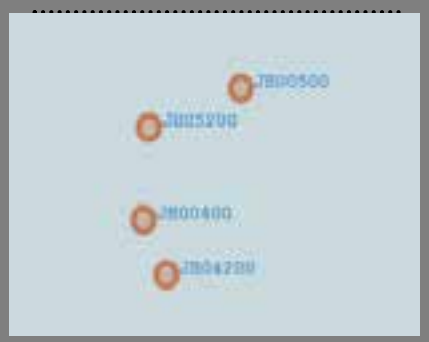


T-SQL Script Implementation:



Geospatial Features

- Points
- Polylines
- Polygons



Points

Polylines

Polygons

For more information about water related projects contact Jen Bowman, Senior Project Manager at the Voinovich School at Ohio University

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www.watersheddata.com

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