

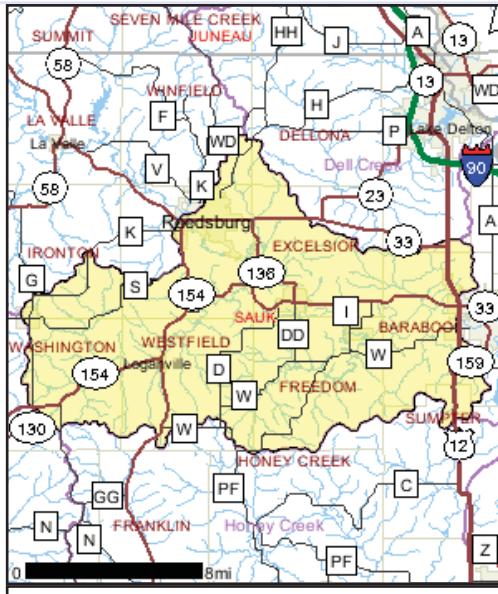
## 2011 Water Quality Management Plan Update

Lower Wisconsin Basin, Wisconsin

December 2011

The Narrows Creek and Baraboo River Watershed lies entirely within Sauk County. It includes the portion of the Baraboo River from Reedsburg to the west edge of Baraboo. Smallmouth bass fishing is considered a valuable asset to the watershed.

The majority of the watershed is agricultural. Dairy farming is the dominant agricultural activity. Other major land cover in the watershed includes broadleaf deciduous forest and grassland. There are a few wetland areas in the watershed.



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### Watershed Details

#### Population and Land Use

The overall population in the watershed for 2000 was estimated to be around 12,500 people, and population growth over the last decade was fairly high.

Agriculture is the dominant land use in the Narrows Creek and Baraboo River Watershed with over 60% of the total area covered in farmland. Forest is the second largest land usage in the watershed covering around 29% of available space. Open water and space claim a little over four percent of the watershed's total area and wetlands occupy over three percent. Suburban landscapes mark almost two percent of the watershed. Grassland and urban environments each cover less than one percent of the total area.

| Table 1: Narrows Creek and Baraboo River Watershed Land Use |            |                 |
|---|------------|-----------------|
| Land Use  | Acres      | Percent of Area |
| Agriculture   | 67,796.62  | 60.08%          |
| Forest  | 32,387.81  | 28.70%          |
| Open Water & Open Space                                     | 4,935.16   | 4.37%           |
| Wetland   | 3,859.88   | 3.42%           |
| Suburban  | 2,196.82   | 1.95%           |
| Grassland   | 896.03     | 0.79%           |
| Urban   | 733.24     | 0.65%           |
| Barren  | 36.25      | 0.03%           |
| Total Acres in Watershed                                    | 112,841.81 |                 |

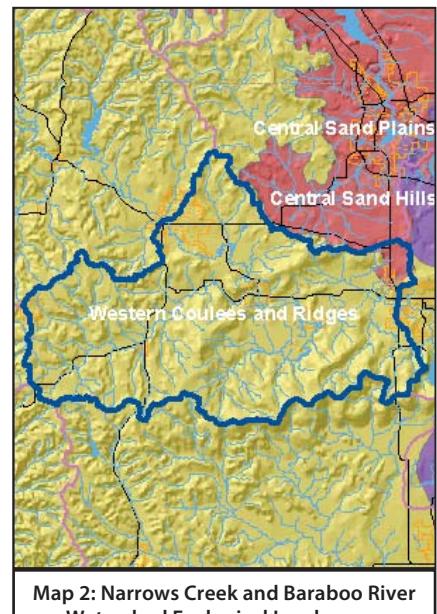
## Hydrology

Hydrology is the study of water - its occurrence, circulation, distribution and properties. Water in Driftless Area streams is ultimately derived from rainfall and snowmelt that either percolates into the ground or runs off the land. In the most basic sense, the condition of a stream is a reflection of the watershed it drains. This concept is especially true in Driftless Area streams due to steep gradient, small watershed size, and extremely steep hills. To determine the watershed of a Driftless Area stream, one need look no further than the hillsides on either side of a stream. The steep hills found throughout the Driftless Area can shed water very quickly; consequently the vegetative cover and soil condition of hillsides are vital to the health of adjacent streams. The trees and grasses that grow on these hillsides are what effectively retain water with their roots, leaves and ultimately the soil. This water then slowly moves through the underlying rock layers to become groundwater that is either pumped from wells for consumption or resurfaces as springs.

Some springs flow as if from an underground pipe while others gently bubble up out of the ground. This constant source of water that averages around 50 degrees Fahrenheit throughout the year is what keeps dissolved oxygen levels high in the summer and trout eggs developing properly throughout the winter. The greater absorption capacity within a watershed in the Driftless Area, the more water can percolate into the ground which slowly, but eventually, reaches a stream via clean cool springs. In a watershed with little or no absorptive capacity, for example one with acres of concrete, rooftops or soil devoid of vegetation, rainfall moves quickly over these surfaces to the nearest stream causing flash flooding.

Streamflow trends in southwestern Wisconsin were recently analyzed by comparing stream flow data to precipitation data. The study concluded that baseflow (stream flow during dry periods) has increased and peak flood flows have decreased over the last century in the Driftless Area of southwestern Wisconsin (Gebert, Warren A., William R. Krug. August 1996. Streamflow Trends in Wisconsin's Driftless Area. Water Resources Bulletin, American Water Resources Association. Vol. 32, No. 4.) Land management practices which allow more rainwater to infiltrate the ground rather than runoff to the nearest stream have been suggested as the primary reason for the discovered increase in baseflow and decrease in flood peaks.

Since most baseflow of Driftless Area streams is derived from groundwater, an increase in the amount of groundwater would intuitively be reflected in increased baseflow. Alternately, more water soaking into the ground results in less water running off to the nearest stream thus reducing flood levels. That's not to say that floods don't occur in the Baraboo River Basin, but rather that they are less frequent and less severe than in the past.



Map 2: Narrows Creek and Baraboo River Watershed Ecological Landscapes

## Ecological Landscapes

The Western Coulee and Ridges Ecological Landscape in southwestern and west central Wisconsin is characterized by its highly eroded, driftless topography and relatively extensive forested landscape. Soils are silt loams (loess) and sandy loams over sandstone residuum over dolomite. Several large rivers including the Wisconsin, Mississippi, Chippewa, Kickapoo, and Black flow through or border the ecological landscape.

Historical vegetation consisted of southern hardwood forests, oak savanna, scattered prairies, and floodplain forests and marshes along the major rivers. With Euro-American settlement, most of the land on ridgetops and valley bottoms was cleared of oak savanna, prairie, and level forest for agriculture. The steep slopes between valley bottom and ridgeline, unsuitable for raising crops, grew into oak-dominated forests after the ubiquitous presettlement wildfires were suppressed. Current vegetation is a mix of forest (40%), agriculture, and grassland with some wetlands in the river valleys. The primary forest cover is oak-hickory (51%) dominated by oak species and shagbark hickory. Maple-

basswood forests (28%), dominated by sugar maple, basswood and red maple, are common in areas that were not subjected to repeated pre-settlement wildfires. Bottomland hardwoods (10%) are common in the valley bottoms of major rivers and are dominated by silver maple, ashes, elms, cottonwood, and red maple. Relict conifer forests including white pine, hemlock, and yellow birch are a rarer natural community in the cooler, steep, north-facing slope microclimates.

### Historical Note

One of the well known landmarks in the Narrows Creek and Baraboo River Watershed in Sauk County is the Van Hise Rock, which was designated a National Historic Landmark by the National Park Service in 1999. The Van Hise Rock is located in the Baraboo Range, which now contains hills 700 to 800 feet high, but once those hills may have risen 1,000 to 1,600 feet above the surrounding plain. The material of this rock was once sand on the sea bottom and has since hardened into quartzite. The ripple marks caused by wave actions are still visible on the surrounding cliffs. The Rock was tilted to the present position by a slow earth movement, and then separated from the adjacent cliff by erosion. The vertical light and dark bands represent the original layers. This rock is pictured in geology books as a type illustrating important principles of structural geology, and has been a point of special interest to many investigators in geology visiting this region.

The rock is named in honor of University of Wisconsin Professor Charles R. Van Hise (1857-1918), renowned geologist, conservationist, and President of the University of Wisconsin. In the 1890's, Van Hise used this outcrop to demonstrate the kinds of changes that occur in rocks during periods of mountain formation. Van Hise's observations of the Baraboo Hills would help to develop his ground-breaking concepts of structural and metamorphic geology. Later, these concepts would be universally accepted as the principles of structural geology.

## Watershed Condition

### Overall Condition

There are no known Exceptional or Outstanding Resource Waters for this watershed, nor have any streams or lakes been flagged as impaired. Five miles of Class I trout streams and three miles of Class II trout streams have been identified along Seeley Creek. Naturally reproducing sturgeon can be found along stretches of the Baraboo River and in La Valle Mill Pond and several unnamed lakes in the area. Narrows Creek, Seeley Creek, Hill Point Creek, and the Baraboo River all support populations of small mouth bass. These populations are reinforced by fish propagation efforts along Narrows Creek and Seeley Creek.

### River and Stream Condition

According to the WDNR's Register of Waterbodies (ROW) database, there are over 455 miles of streams and rivers in the Narrows Creek and Baraboo River Watershed; 168 miles of these waters have been entered into the WDNR's assessment database. Of these 168 miles, more than 75% are meeting Fish and Aquatic Life uses and are specified as in "good" condition; about one-fifth of stream miles are considered to be in "poor" condition and are listed as impaired. The condition of the remaining five percent of stream miles is not known or documented.

Additional uses for which the waters are evaluated include Fish Consumption, General Uses, Public Health and Welfare, and Recreation. As Table 2 shows, these uses have not been directly assessed for the watershed. However, a general fish advisory for potential presence of mercury is in place for all waters of the state.

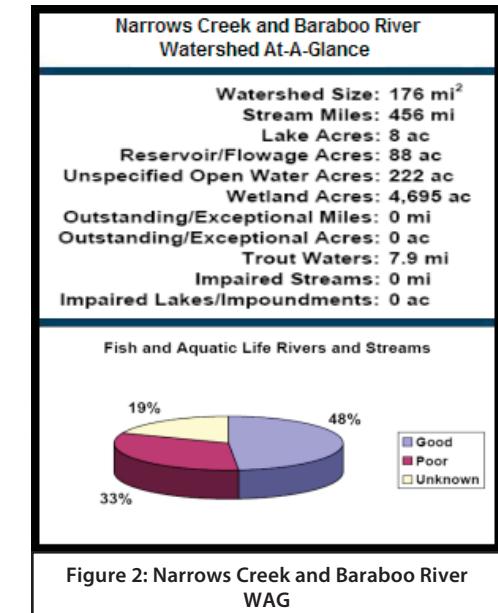


Figure 2: Narrows Creek and Baraboo River WAG

**Table 2: Designated Use Support Summary for Narrows Creek and Baraboo River Watershed Rivers and Streams  
(all values in miles)**

| Use                       | Supporting | Fully Supporting | Not Supporting | Not Assessed | Total Size |
|---------------------------|------------|------------------|----------------|--------------|------------|
| Fish Consumption          |            |                  |                | 167.53       | 167.53     |
| Fish and Aquatic Life     | 71.19      | 10.15            | 54.72          | 31.47        | 167.53     |
| General                   |            |                  |                | 167.53       | 167.53     |
| Public Health and Welfare |            |                  |                | 167.53       | 167.53     |
| Recreation                |            |                  |                | 167.53       | 167.53     |

### **Baraboo River**

Just over 33 miles of the Baraboo River are in this watershed. The river supports a warm water sport fishery, is a major tributary to the Wisconsin River, and is important as a smallmouth bass fishery. As a result of the habitat fragmentation and other problems caused by the dams on the river, the two miles of the river that flows through the City of Baraboo has been listed on the state's list of impaired waters. The final dam was removed in October of 2001. The water quality and fishery of this up-stream portion of the river is expected to improve as a result of the dam removals. Consequently, it is anticipated that this portion of the river will be able to be "de-listed." The river receives discharges from Foremost Farms, North Freedom, Reedsburg, and Rock Springs in the watershed. Despite the efforts of the nonpoint source priority watershed project, the river continues to be threatened by sources of nonpoint pollution. A rare aquatic species has been found in the river in past surveys.

### **Copper Creek**

Copper Creek is a seepage and spring fed tributary to the Baraboo River, although the water warms considerably before reaching the river. The stream is shallow with little aquatic habitat and is affected by nonpoint source pollution. Four fish collections and one macroinvertebrate collection occurred from 2007-2008 and the resultant IBI scores indicated that Copper Creek had fair water quality and supported its fish and aquatic life designated use.

### **Eli Valley Creek**

Eli Valley Creek is a very small tributary to Narrows Creek. The stream supports a warm water forage fish population. Due to the size of the stream it is easily influenced by nonpoint sources of pollution such as barnyard runoff and streambank pasturing. The creek has been known to have occasional low dissolved oxygen levels. The most recent fish collection, from 2008, indicated the Eli Valley Creek supported a healthy cool water fish community and good water quality.

### **Hillpoint Creek**

Hillpoint Creek is a seepage fed tributary to the headwaters of Narrows Creek. Smallmouth bass have been known to migrate from Narrows Creek to Hillpoint Creek. These fish constitute the sport fishery of Hillpoint Creek. The creek has sufficient habitat to support the bass. The creek does have some problems with streambank and cropland sources of nonpoint source pollution. The creek receives discharge from the Hillpoint Sanitary District. Baseline monitoring was conducted on the stream in 2001.

### **Narrows Creek**

Narrows Creek flows about 18 miles from its sources near Hillpoint and Lime Ridge to its junction with the Baraboo River at Rock Springs. The creek has been heavily impacted by agriculture, particularly dairy farming practices, and experiences heavy bank erosion and siltation during periods of rapid rainfall. As late as the early 1970's it supported a respectable smallmouth bass fishery, which has since declined. Recently the watershed has received attention from a priority watershed project administered by the Sauk County Land Conservation Department (LCD). By 2002, seven years into the project, which expired in 2004, 45% of the eligible landowners had signed up for improvement practices, such as new barnyards, the stabilization of streambanks, and installation of grassed waterways, with about 50% of the jobs completed. As of 2002, 65% of the phosphorus removal goal had been met and 60% of the sediment removal goal had been achieved. In addition, a few watershed and stewardship easements were purchased from landowners. This allowed at least 160 acres of wetlands to be restored. Also WDNR fish management has conducted smallmouth bass habitat improvement on approximately two miles of Narrows Creek. Early evaluation showed a three to nine times

increase in the bass population in one area compared to two control areas. With more streambank easement acquisition, more work can be accomplished. Fish analysis throughout the watershed typically ranks the stream as fair rating, which shows the need for further improvements. Low dissolved oxygen has been documented for short periods of time which probably reflects agricultural waste episodes. These have devastating consequences on aquatic life. It is anticipated that with the ongoing removal of the last remaining dams on the Baraboo River, the Narrows Creek fishery will benefit from summer migrations, particularly of catfish, smallmouth bass, and walleye species, which will utilize the habitat of Narrows Creek. Baseline monitoring was conducted on three tributaries to Narrows Creek in 2001. A rare aquatic species has been found in the creek in past surveys. Narrows Creek receives discharges from the communities of Lime Ridge and Loganville. Sauk County Health Care discharges to a tributary of Narrows Creek.

### **Pine Creek**

Pine Creek is a small spring fed tributary to Skillet Creek. The creek supports a warm water forage fishery and data collected in 1998 determined the quality of the stream to be fair to good.

### **Seeley Creek**

The upper four miles of Seeley Creek have been managed as stocked trout water. Three of these miles are Class I and one mile is a Class II trout fishery. Until the mid 1980's, the upper-most portion supported a little-known, outstanding natural brown trout fishery. Around that time, the water level dropped drastically. Locals feel this decline is due to heavy blasting in a quarry near Rock Springs. Regardless, the water level decline was associated with a major reduction in this trout fishery. During the 1990's, wild brown trout adults were transferred into this area and successful natural reproduction is once again occurring. Active farming of much of the upper watershed has disappeared and restricted land use easements (e.g. pasturing, cropping, logging, etc.) would now be appropriate on the surrounding land to preserve this "little gem." Downstream drift of natural reproduction of the upper area should increase the fishery downstream around Highway W. Farther down, the stream is impounded to create the 49-acre Seeley Lake, a eutrophic, weedy impoundment that supports a warm water sport fishery.

### **Skillet Creek**

Skillet Creek is a tributary to the Baraboo River. The creek supports a population of warm water forage fish. A fish survey conducted in 1998 indicated that the stream had fair water quality for warmwater fish (Source: The State of the Lower Wisconsin River Basin).

### **Spring Valley Creek**

Spring Valley Creek is a tributary to Narrows Creek. The creek is sandy and small pools have silted in. The creek supports a population of warmwater forage fish. The majority of the subwatershed has been cultivated and overall, the creek has problems with nonpoint sources of pollution. Baseline monitoring was conducted on the stream in 2001.

## **Lake Health**

The WDNR's ROW database shows that there are over eight acres of lakes and ponds and another 222 acres of unspecified open water in the Lower Kickapoo River Watershed. Of these, 167 acres are entered into the state's assessment database. Over one-fifth of the 167 acres are indicated as supporting Fish and Aquatic Life uses. The remaining lake acres within the watershed have not been assessed for Fish and Aquatic Life use support or any other use support. Of the 88 acres of reservoirs and impoundments in the watershed, only about four acres are entered into the state's assessment database; none of which have been assessed for Fish and Aquatic Life use support or any other use support. Seeley Lake and Virginia Lake are the only named lakes in the watershed and both are impoundments.

| Table 3: Designated Use Support Summary for Narrows Creek and Baraboo River Watershed Lakes (all values in acres) |            |                |              |            |
|---|------------|----------------|--------------|------------|
| Use   | Supporting | Not Supporting | Not Assessed | Total Size |
| Fish Consumption  |            |                | 166.5        | 166.5      |
| Fish and Aquatic Life   | 35         |                | 131.5        | 166.5      |
| General   |            |                | 166.5        | 166.5      |
| Public Health and Welfare   |            |                | 166.5        | 166.5      |
| Recreation  |            |                | 166.5        | 166.5      |

### **Seeley Lake**

Seeley Lake is a drainage-fed lake created by a dam with a 12-foot head on the lower reaches of Seeley Creek two miles south of North Freedom. The dam was constructed in 1955 and the pond was treated with chemicals the same year to eliminate the rough and forage fish population. Northern pike, largemouth bass and bluegills were stocked in 1956 by the Department of Natural Resources. The fishery prospered for several years and a good growth rate of all species was reported. At the present time, only a limited fishery of northern pike, largemouth bass, and panfish exists. Heavy siltation and subsequent abundant growth of aquatic vegetation has occurred due to severe erosion in the watershed. Stunted panfish are also a use problem at the present time. Ice fishing has been a popular activity for local people. Aquatic game assets include muskrat, mink, and migratory waterfowl. White-tailed deer, squirrels, fox, raccoon, and ruffed grouse inhabit the adjoining uplands. Public frontage totals 0.11 miles by a parking area at the dam. An unimproved boat launching ramp is also provided at this site. Additional access is possible from Seeley Creek and one bridge crossing. One dwelling is located on the northeastern shore.

### **Virginia Lake**

Virginia Lake is a 35-acre impoundment on a tributary to the Baraboo River located just east of Copper Creek. The lake was created by a real estate agency to promote private development in 1969. The lake contains largemouth bass and panfish. The lake experiences problems with aquatic plant management. To deal with this, the aquatic plants in the lake are harvested. There is a Lake Virginia Management District.

## **Wetland Health**

### **Wetland Status**

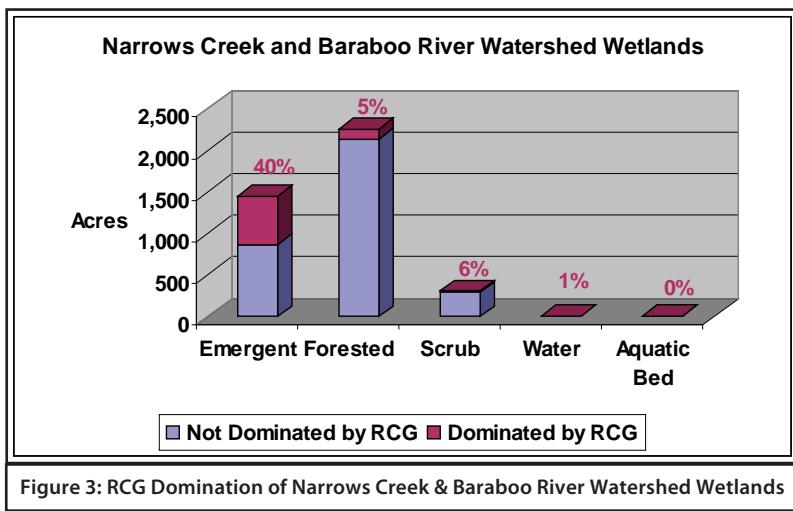
The Narrows Creek and Baraboo River Watershed is located entirely within Sauk County. An estimated 4% of the current land uses in the watershed are wetlands. Currently, about 42% of the original wetlands in the watershed are estimated to exist. Of these wetlands, the majority include forested wetlands (56%), and emergent wetlands (36%), which include marshes and wet meadows.

### **Wetland Condition**

Little is known about the condition of the remaining wetlands but estimates of reed canary grass (RCG) infestations, an opportunistic aquatic invasive wetland plant, into different wetland types has been estimated based on satellite imagery. This information shows that reed canary grass dominates 40% of the existing emergent wetlands and five percent of the remaining forested wetlands (See Figure 3). Reed canary grass domination inhibits successful establishment of native wetland species.

### **Wetland Restorability**

Of the 5,736 acres of estimated lost wetlands in the watershed, approximately 88% are considered potentially restorable based on modeled data, including soil types, land use, and land cover (Chris Smith, DNR, 2009).



## Groundwater

The following groundwater information is for Sauk County (from Protecting Wisconsin's Groundwater through Comprehensive Planning website, <http://wi.water.usgs.gov/gwcomp/>), which roughly approximates to the Narrows Creek and Baraboo River Watershed.

There are no municipal water systems that have developed wellhead protection plans within the Narrows Creek and Baraboo River Watershed. However, Sauk County has adopted an animal waste management ordinance.

From 1979 to 2005, total water use in Sauk County has increased from 10.5 million gallons per day to 26.4 million gallons per day. The increase in total water use over this period is due primarily to increases in industrial, irrigation, commercial, and domestic uses. Irrigation use increased significantly over this period while industrial declined slightly after 1995. The proportion of county water use supplied by groundwater has been consistently around 99% during the period 1979 to 2005.

### Private Wells

Eighty-four percent of 1,012 private well samples collected in Sauk County from 1990 to 2006 met the health-based drinking water limit for nitrate-nitrogen. An analysis of over 35,000 Wisconsin drinking water samples found that drinking water from private wells was three times more likely to be unsafe to drink due to high nitrate in agricultural areas than in forested areas. High nitrate levels were also more common in sandy areas where the soil is more permeable. In Wisconsin's groundwater, 80% of nitrate inputs originate from manure spreading, agricultural fertilizers, and legume cropping systems.

A 2002 study estimated that 43% of private drinking water wells in the region of Wisconsin that includes Sauk County contained a detectable level of an herbicide or herbicide metabolite. Pesticides occur in groundwater more commonly in agricultural regions, but can occur anywhere pesticides are stored or applied. A total of 38,704 acres of land in Sauk County are in atrazine prohibition areas. All three private well samples collected in Sauk County met the health standard for arsenic.

### Potential Sources of Contamination

Three licensed landfills are located in the Narrows Creek and Baraboo River Watershed: the Reedsburg Foundry, a Sauk County operated landfill in the town of Excelsior, and a Construction and Demolition (C&D) landfill owned by the US Army Badger Ammunition Plant outside of Baraboo. The Badger Ammunition Plant is currently the site of demolition and remediation projects being conducted in preparation for property transfer. The landfill located in Excelsior is also designated as a Superfund site and is the only one within the watershed. No Concentrated Animal Feeding Operations (CAFOs) are located within the watershed.

WDNR's Remediation and Redevelopment (RR) Program oversees the investigation and cleanup of environmental contamination and the redevelopment of contaminated properties. The RR Program provides information about contaminated properties and other activities related to the investigation and cleanup of contaminated soil or groundwater in Wisconsin through its Bureau for Remediation and Redevelopment Tracking System (BRRTS) database (WDNR 2010e).

The database shows that there are 11 sites in the Narrows Creek and Baraboo River Watershed that are specified as "open", meaning "contamination has affected soil, groundwater, or more and the environmental investigation and cleanup need to begin or are underway." These sites include six Leaking Underground Storage Tank (LUST) sites and five Environmental Repair (ERP) sites; many of which are located in Reedsburg. A summary of these sites is included in the table below. There are at least a dozen more open-status sites in Baraboo that have contaminated groundwater and/or soil, which lie just outside the watershed area.

**Table 4: Open-status Bureau for Remediation and Redevelopment Tracking System (BRRTS) sites in the Narrows Creek & Baraboo River Watershed**

| WDNR<br>BRRTS # | Site Name, Location                               | Start Date | Activity<br>Type | Reme-<br>diation | Waste | Substance   |
|-----------------|---|------------|------------------|------------------|-------|---|
| 257549263       | Nuk USA LLC (Gerber Products Property), Reedsburg | 04/17/2007 | ERP              | 3                | 3     | Engine Waste Oil (Petroleum)  |
| 357207281       | Ray Zobel & Sons Inc. (Construction), Reedsburg   | 12/08/1998 | LUST             | 1                | 1     | Gasoline (Petroleum)  |
| 357002801       | Reedsburg Cleaners LLC, Reedsburg                 | 07/11/1996 | LUST             | 3                | 3     | Chlorinated Solvents (VOC)  |
| 257001682       | Reedsburg Cleaners LLC, Reedsburg                 | 10/23/1995 | ERP              | 3                | 3     | Chlorinated Solvents (VOC)  |
| 257547212       | Cropmate Co./Conagra, Reedsburg                   | 05/25/1995 | ERP              | 1                | 0     | Unspecified (Transferred to DATCP)  |
| 357002197       | Templin Property, Lime Ridge                      | 04/25/1994 | LUST             | 1                | 0     | Unspecified soil contamination  |
| 357001651       | Reedsburg Times Press, Reedsburg                  | 10/09/1992 | LUST             | 1                | 0     | Unspecified soil contamination  |
| 357001693       | Wards Corner Garage, Hillpoint                    | 10/05/1992 | LUST             | 1                | 0     | Unspecified soil contamination  |
| 257001454       | R & L Supply Ag Chemical Facility, Reedsburg      | 11/12/1991 | ERP              | 1                | 0     | Unspecified soil contamination (Transferred to DATCP)   |
| 357001103       | Spellman Monument, Reedsburg                      | 08/08/1991 | LUST             | 1                | 1     | Gasoline & Methyl Tertiary Butyl Ether (Petroleum)  |
| 257001004       | Sauk County Landfill (Old), Township of Excelsior | 09/03/1988 | ERP              | 1                | 2     | Unspecified groundwater contamination. Was tracked as superfund activity # 05-57-113296. Transferred to solid waste program |

The Petroleum Environmental Cleanup Fund Award (PECFA) program was created in response to enactment of federal regulations requiring release prevention from underground storage tanks and cleanup of existing contamination from those tanks. PECFA is a reimbursement program returning a portion of incurred remedial cleanup costs to owners of eligible petroleum product systems, including home heating oil systems. As of May 31, 2007, \$21,358,523 has been reimbursed by the PECFA program to clean up 194 petroleum-contaminated sites in Sauk County. This equates to \$367 per county resident, which is greater than the statewide average of \$264 per resident.

### Point and Nonpoint Pollution

The water quality and sport fisheries in the watershed are significantly affected by nonpoint sources of pollution. As a result, the watershed has been ranked as a high priority for nonpoint source pollution reduction. The primary sources of nonpoint pollution in the watershed are from barnyard runoff and manure spreading practices, and manure storage in the watershed has occasionally been a problem. As a result of the significant impact of nonpoint source pollution on the watershed, the watershed was selected for a nonpoint source priority watershed project. The project is jointly sponsored by the DNR, the Department of Agriculture, Trade and Consumer Protection, and the Sauk County Land Conservation Department. Watershed nonpoint source appraisal monitoring was completed in 1990 and 1991, and a plan detailing water quality and water resources goals of the project was approved in October 1992. So far, there has been a very high participation rate in the Narrows Creek priority watershed program.

There are several permitted point source discharges in the watershed. The communities of Reedsburg, North Freedom, and Rock Springs discharge to the Baraboo River. The Hillpoint Sanitary District discharges to Hillpoint Creek and the Lime Ridge facility discharges to Narrows Creek. The Sauk County Health Care center discharges to a tributary of Narrows Creek. The one industrial discharge, Foremost Farms, discharges to the Baraboo River. Overall, The lower Kickapoo River watershed is ranked as a high priority for nonpoint source (NPS) pollution due to high rankings for susceptibility to NPS pollution for both groundwater and stream water. Lakes in the watershed have not yet been ranked for NPS pollution.

## Waters of Note

### Trout Waters

Class I trout streams are high quality trout waters that have sufficient natural reproduction to sustain populations of wild trout, at or near carry capacity. Consequently, streams in this category require no stocking of hatchery trout. These streams or stream sections are often small and may contain small or slow-growing trout, especially in the headwaters. Class II trout streams may have some natural reproduction, but not enough to utilize available food and space. Therefore, stocking is required to maintain a desirable sport fishery. These streams have good survival and carryover of adult trout, often producing some fish larger than average size.

Five miles of Class I trout streams and three miles of Class II trout streams have been identified along Seeley Creek. The table below lists the stream segments (starting from the mouth at mile 0) where these trout waters can be found.

| Table 5: Narrows Creek and Baraboo River Watershed Trout Waters |                         |                      |         |            |          |             |          |
|---|-------------------------|----------------------|---------|------------|----------|-------------|----------|
| WADRS ID  | Official Waterbody Name | Local Waterbody Name | WBIC    | Start Mile | End Mile | Trout Class | Trout ID |
| 18423   | Seeley Creek            | Seeley Creek         | 1275300 | 15.9       | 21.05    | CLASS I     | 804      |
| 12991   | Seeley Creek            | Seeley Creek         | 1275300 | 13.12      | 15.9     | CLASS II    | 2048     |

### Outstanding and Exceptional Resource Waters

No Exceptional or Outstanding Resource Waters are listed for this watershed.

### Impaired Waters

No Impaired Waters are listed for this watershed.

### Fish Consumption

Currently, there are no specific fish consumption advisories in effect for this watershed. However, a general fish consumption advisory for potential presence of mercury is in place for all waters of the state.

### Aquatic Invasive Species

Three aquatic invasive species have been documented within this watershed. Curly-leaf pondweed have been found in Virginia Lake. Freshwater Jellyfish were discovered in an unnamed Skillet Creek Farm pond. And Rusty Crayfish have been verified and vouchered in Hill Point Creek.

| Table 6: Narrows Creek and Baraboo River Watershed Aquatic Invasive Species |                         |                      |                        |         |
|---|-------------------------|----------------------|------------------------|---------|
| Database Key  | Waterbody Name          | Bio. Common Name     | Status                 | WBIC    |
| 22220796  | Virginia Lake           | Curly-Leaf Pondweed  | Verified and Vouchered | 1278700 |
| 22556406  | Skillet Creek Farm Pond | Freshwater Jellyfish | Verified and Vouchered | 5569785 |
| 22584673  | Hill Point Creek        | Rusty Crayfish       | Verified and Vouchered | 1277700 |

### Species of Special Concern

A full list of special concern plants and animals for this watershed can be found on the state's Natural Heritage Inventory (NHI). The following table contains federally-listed Threatened, Endangered, Proposed, and Candidate species found in Sauk County, in which the Narrows Creek and Baraboo River Watershed is located.

Table 7: Federally-Listed Threatened, Endangered, Proposed, and Candidate Species in Sauk County

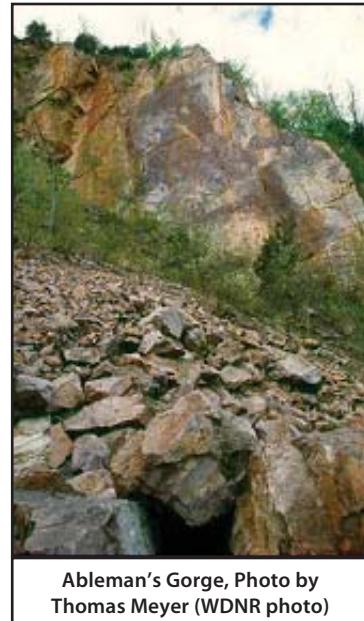
| Species   | Status                                  | Habitat  | Taxa  |
|---|---|--|-------|
| Whooping crane ( <i>Grus americanus</i> )             | **Non-essential experimental population | Open wetlands and lakeshores                   | Bird  |
| Northern monkshood ( <i>Aconitum noveboracense</i> )  | Threatened                              | North facing slopes                            | Plant |
| Prairie bush-clover ( <i>Lespedeza leptostachya</i> ) | Threatened                              | Dry to mesic prairies with gravelly soil areas | Plant |

\*\*Whooping Crane - On June 26, 2001, a nonessential experimental population of the whooping crane was designated in a 20-state area of the eastern United States. The first release of birds occurred in Wisconsin in 2001, and the counties listed are those where the species has been observed to date. It is unknown at this time which counties the species will occupy in the future, as the birds mature and begin to exhibit territorial behavior. For purposes of section 7 consultation, this species is considered as a proposed species, except where it occurs within the National Wildlife Refuge System or the National Park System, where it is treated as a threatened species (<http://www.fws.gov/midwest/endangered/lists/wisc-spp.html>).

## State Natural Areas

### Ableman's Gorge

Ableman's Gorge is a classic gorge cut by the Baraboo River through Baraboo quartzite, Cambrian sandstone, and conglomerate. The cliffs and rocky slopes rise about 200 feet above the river to form a wall nearly three-fourths of a mile long, oriented east-west, which then abruptly turns south for a similar distance. The latter portion is 250 to 450 feet wide and is composed of irregular quartzite cliffs. Spectacular unconformable contacts with younger Cambrian sandstone can be seen on both the north and south sides of the Precambrian Baraboo quartzite. The exposures of the unconformity between the ancient quartzite and the overlying sandstone are world famous. The site tells a fascinating geological story of changing conditions in an ancient sea that first rose quietly against a cliff of quartzite and then, as layers of sediments gradually decreased the relief between sea floor and land, surged against the top of the cliff, wearing away quartzite and depositing a layer of cobbles and boulders across its upturned edge. Erosional forces and a former quarrying operation in the southern part of the natural area have re-exposed these long buried layers. Nowhere in the Midwest is such a sequence of events so displayed. The cool, moist, north-facing slopes shelter plants more typical of northern Wisconsin, including hemlock, yellow birch, mountain maple, and Canada yew. The groundlayer contains numerous ferns and includes species such as Virginia water-leaf, Canada mayflower, and the rare Allegheny-vine (*Adlumia fungosa*). The area is widely used for geology research and a plaque honors researcher Charles Van Hise, who formulated some of his principles of structural deformation and metamorphism here. Ableman's Gorge is owned by the DNR and the University of Wisconsin and was designated a State Natural Area in 1969.



Ableman's Gorge, Photo by Thomas Meyer (WDNR photo)

### Baxter's Hollow

Baxter's Hollow features a scenic gorge cut through Baraboo quartzite by Otter Creek, a fast, clear, nearly undisturbed stream flowing over the large quartzite boulders. Although it supports trout, Otter Creek is better known for its diverse and unique aquatic insect fauna including at least 78 species of caddisfly. Cold air drainage has permitted a white pine dominated forest to persist near the stream. Understory species on the boulder-strewn slopes are large-leaved aster, marginal wood fern, partridgeberry, sweet cicely, witch hazel, and squawroot. Most of the site, though, contains a significant portion of the Big Woods, the largest intact contiguous southern dry-mesic forest in Wisconsin with red and white oak, hickory, and basswood. In spring, the forest floor is blanketed with a wide variety of colorful flowers including spring-beauty, Jacob's-ladder, trillium, hepatica, shooting-star, dog-tooth violet, and marsh marigold. The large expanse of woods provides critical habitat for many rare bird species that require large forested tracts including the state endangered worm-eating warbler (*Helmitheros vermivorus*) and state threatened Kentucky (*Oporornis formosus*)

and hooded warblers (*Wilsonia citrina*). The combined effects of microclimate and different communities have allowed a wide diversity of species to flourish here: 39 mammals, 92 breeding birds, 13 amphibians, and 18 reptile species. Baxter's Hollow is owned by The Nature Conservancy and was designated a State Natural Area in 1970.

### Cady's Marsh

Cady's Marsh contains dry sandy prairie grading into loamy mesic and wet-mesic prairie with sedge meadow and shallow emergent aquatic marsh also present. Deep-soil loamy prairies are one of the rarest natural plant communities in Wisconsin with nearly all having fallen to the plow. The site contains an interesting assemblage of plant species. Characteristic plants include blue-joint grass, big blue-stem, mountain mint, prairie blazing-star, and culver's-root. Uncommon species are lesser purple fringed orchid, Michigan lily, glaucous white lettuce, Riddell's goldenrod, Kalm's St. John's-wort, and Clinton's bulrush. Cady's Marsh is of historic interest in that it served as one of the last strongholds of prairie chickens (*Tympanuchus cupido*) in Sauk County. Cady's Marsh is owned by the DNR and was designated a State Natural Area in 1998.

### McGilvra Woods

McGilvra Woods is one of the richest southern mesic forests in southwestern Wisconsin and is noted for its display of spring wildflowers. The forest is situated on a gentle to moderate northwest slope at the edge of the Baraboo Hills with a knob of exposed sandstone bedrock found near the southeast corner of the site. Sugar maple and basswood dominate the woods with black cherry, red oak, white ash, yellowbud hickory, bigtooth aspen, and white oak. The trees are medium-aged, but the site is intact and with protection could become an old mesic forest. The sparse shrub layer contains eastern prickly gooseberry, common elderberry, and alternate-leaved dogwood. The groundlayer flora is rich in spring ephemerals and contains more than 110 species, including the rare cuckoo flower (*Cardamine pratensis*) along with uncommon plants, such as leatherwood and putty root orchid. Showy species include spring-beauty, toothwort, woodland phlox, wild geranium, hepatica, May-apple, Virginia waterleaf, bellwort, nodding trillium, and several orchids. McGilvra Woods is owned by the DNR and was designated a State Natural Area in 1986.

### Pewits Nest

The dominant feature at Pewits Nest is a 30- to 40-foot-deep gorge formed during the retreat of the last glacier. Associated with it are Skillet Creek, shaded cliffs, and a northern dry-mesic forest. When Glacial Lake Baraboo drained, Skillet Creek cut a narrow canyon through the Cambrian sandstone, forming a series of potholes and waterfalls. The layers of Cambrian sandstone show that a finer-grained sediment was laid down by the Cambrian seas "inside" the syncline, a process different from that at Parfrey's Glen where coarser Cambrian conglomerates and sandstones are found in layers. Skillet Creek has a gradient of 38 feet per mile and an average flow of 0.8 cubic feet per second. Forest cover includes red cedar, white pine, hemlock, and yellow birch.

H.E. Cole wrote of the area: "At one time the jaws at the mouth of the nest supported a great iron shaft, a cumbersome overshot waterwheel. . . . Before the building of the mill, an individual lived in the solid sandstone, like a gnome in a cavern. His abode was some ten feet above a deep pool of water. This dwelling resembled the nest of a phoebe (or peewit, an earlier name for this bird), hence dubbed by early settlers the 'Peewit's Nest.'"

This person used the water to turn lathes for repairing or manufacturing equipment. No evidence of this remains. Pewits Nest is owned by the DNR and was designated a State Natural Area in 1985.

### Pine Hollow

Pine Hollow features a narrow, heavily wooded stream gorge with sheer cliffs and rock outcroppings of sandstone and quartzite cut into the Baraboo Hills. Differential erosion has cut a ravine about 300 feet deep with cliff walls up to 80 feet high. The complex slope and variety of exposures have resulted in a rich flora of more than 500 species. Hemlocks of all size classes occupy the steep, moist ravine walls; while yellow birch and red maple are found on the lower slopes. A few large white pines grow on the near vertical sandstone cliffs. On the rocky uplands grow red and white oaks with black oaks present near the drier bluffs and a prairie opening is found on top of a west-facing bluff with columbine, yellow star-grass, and shooting-star with abundant Pennsylvania sedge and early oak sedge near rocks. On the upper slopes grow various ericads (plants of the Heath family) including huckleberry and trailing arbutus with an abundance of moccasin flower in late spring. Also present are moist shaded cliffs that harbor a wide variety of ferns, moss, and liverworts, including the rare sword moss, pincushion moss, and Sullivant's coolwort. Toward the lower, south end of the hollow is an open sedge meadow with turtlehead, manna grass, ferns, and the state-threatened drooping sedge

(*Carex prasina*). A diverse breeding bird community is present including Canada warbler, Louisiana waterthrush, and golden-winged warbler. Pine Hollow is owned by the Wisconsin Chapter of The Nature Conservancy and was designated a State Natural Area in 1966.

### **South Bluff/Devil's Nose**

South Bluff/Devil's Nose encompasses a huge expanse of the forested southern flank of the Baraboo Hills and provides habitat for numerous rare plants and animals. The majority of the site is southern mesic and dry-mesic forest of sugar maple, red oak, white oak, basswood, and hickories. Within the site is Pine Glen, a deep spectacular gorge cut into the Baraboo quartzite. On its south slope is a small cedar glade and dry prairie that have unusual floras including rare species such as tubercled orchid (*Platanthera flava*), slender bush-clover (*Lespedeza virginica*), and purple milkweed (*Asclepias purpurascens*). Cold air drainage at the lower end of Pine Glen harbors northern plant species such as white pine, oak fern, yellow blue-bead-lily, and rosy twisted stalk that thrive in the cool ravine. Also in the area is spring-fed Messenger Creek, which occupies an ancient valley, cut into the Precambrian Baraboo quartzite. The rich wooded area contains yellow birch, eastern hop-hornbeam, and ironwood and is rich in mosses and uncommon ferns. One of the primary features of the natural area is the presence of several uncommon to rare plant species including drooping sedge (*Carex prasina*), Hooker's orchid (*Platanthera hookerii*), nodding pogonia (*Triphora trianthophora*), and one-flowered broomrape (*Orobanche uniflora*). The site also harbors many rare birds including worm-eating (*Helmitheros vermivorus*), hooded (*Wilsonia citrina*), and cerulean warblers (*Dendroica cerulea*), and Acadian flycatcher (*Empidonax virescens*). Also present is the rare arrowhead spiketail (*Cordulegaster obliquus*). South Bluff/Devil's Nose is owned by the DNR and was designated a State Natural Area in 1972.



Pewits Nest, Photo by Rick Livingston (WDNR photo)

### **Watershed Actions**

#### **Grants and Projects**

NPS Grant - City of Reedsburg: Storm Water Planning 10/01/2004 – Complete Development of a storm water management plan, including an analysis of stormwater flows and pollutant loading, creation of stormwater, erosion & illicit discharge control ordinances, mapping, assessment of alternative practice installations, and evaluation of alternative funding mechanisms.

Lake Planning Grant - Lake Virginia Hydrologic and Water Budgets 10/11/1991 – Complete

1) Prepared a generalized hydrologic budget. Reviewed historical and recently collected water quality data. Developed a lake water quality model for dissolved oxygen to compare to historical oxygen depletion in lake. 2) Inspected dam to identify leaks or potential leaks and conduct flow measurements to see if this contributes to low lake levels. 3) Developed water budget to identify potential lake water losses. 4) Generated report summarizing findings and made management recommendations. 5) Disseminated information to the public by newsletter mailing.

#### **Monitoring**

##### **Lakes Baseline and Trends Monitoring**

River Monitoring to comply with Clean Water Act implementation - water quality standards: use designations, criterion, permit issuance and compliance, assessments, and impaired waters management. Fisheries projects include a wide variety of "baseline" monitoring and targeted fieldwork to gain specific knowledge related to Wisconsin's fish communities.

In close cooperation with UW Extension and Wisconsin Sea Grant, education efforts focus on working with resource professionals and citizens statewide to teach boaters, anglers, and other water users how to prevent transporting aquatic invasive species when moving their boats. Additional initiatives include monitoring and control programs.

## **Volunteer Monitoring**

The Citizen Lake Monitoring Network, the core of the Wisconsin Lakes Partnership, involves over 1,000 citizen volunteers statewide. The goals are to collect high quality data, to educate and empower volunteers, and to share this data and knowledge. Volunteers measure water clarity, using the Secchi Disk method, as an indicator of water quality. This information is then used to determine the lakes trophic state. Volunteers may also collect chemistry, temperature, and dissolved oxygen data, as well as identify and map plants, watch for the first appearance of Eurasian water milfoil near boat landings, or alert officials about zebra mussel invasions on Wisconsin lakes. Monitoring work in this watershed consists of lake monitoring and surveys for water quality, aquatic plants, aquatic invasive species, and ice observations.

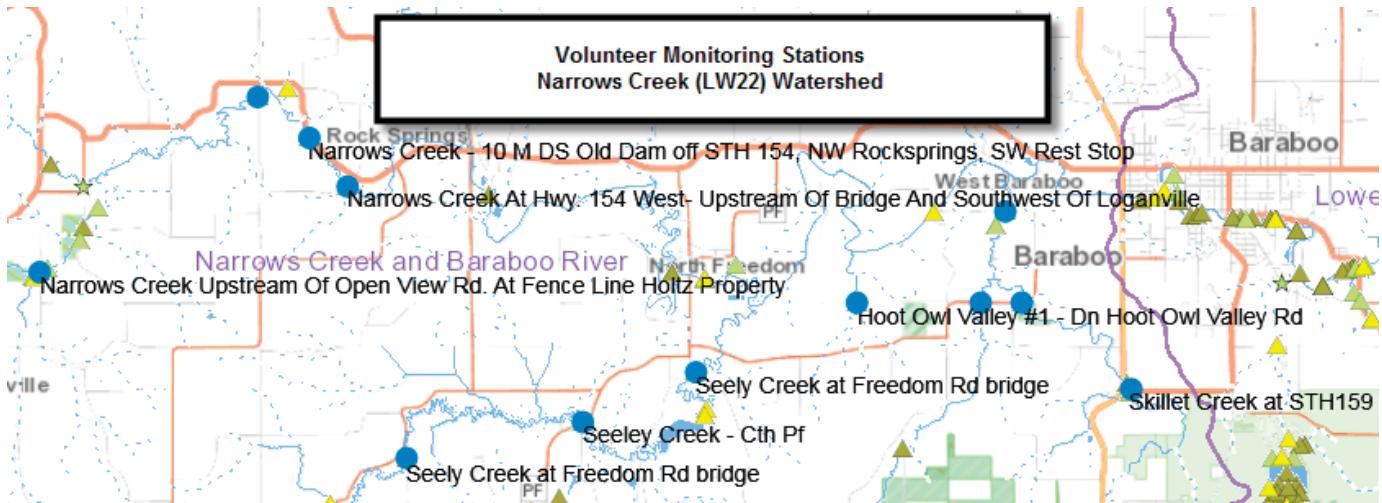
## **Citizen Stream Monitoring (Water Action Volunteers)**

There have been ten stations monitored by one independent volunteer stream monitor and the Baraboo Middle School in the LW22-Narrows Creek Watershed from 2002 through 2007. All ten stations were monitored for dissolved oxygen, pH, instantaneous temperature and transparency, using Level 1 procedures and entered in the WAV database (<http://www.uwex.edu/erc/wavdb/>). On average, stations in the watershed were monitored monthly from May through October.

Generally, dissolved oxygen levels in the watershed were sufficient to sustain aquatic life. Levels ranged from 6.3-10mg/l. Only one field event at Pine Creek at County Highway W, CBSM-10008346 dipped below ideal levels with a measurement of 4.2mg/l on 10/19/2004. Throughout the monitoring seasons, volunteers collected pH measurements within state standards (which range from 6 to 9) ranging from 7.69 to 8.25.

Temperature measurements, used to classify streams as cold, cool or warm water habitats, and which are indicative of the ability of a habitat to sustain aquatic species were recorded at all stations each season. Maximum instantaneous temperatures were less than 25°C for most streams; suggesting they may be cold water streams. Narrows Creek at Valley Bridge Road, CBSM-10032020 was measured at 26.7°C during the only field event at this station on 06/13/2007; classifying it as a cool water stream.

Stream transparency measurements indicated good water quality with over 72% of the fourteen field events measured less than 10 NTU. None of the remaining 28% measured greater than 240 NTU.



## **Basin/Watershed Partners**

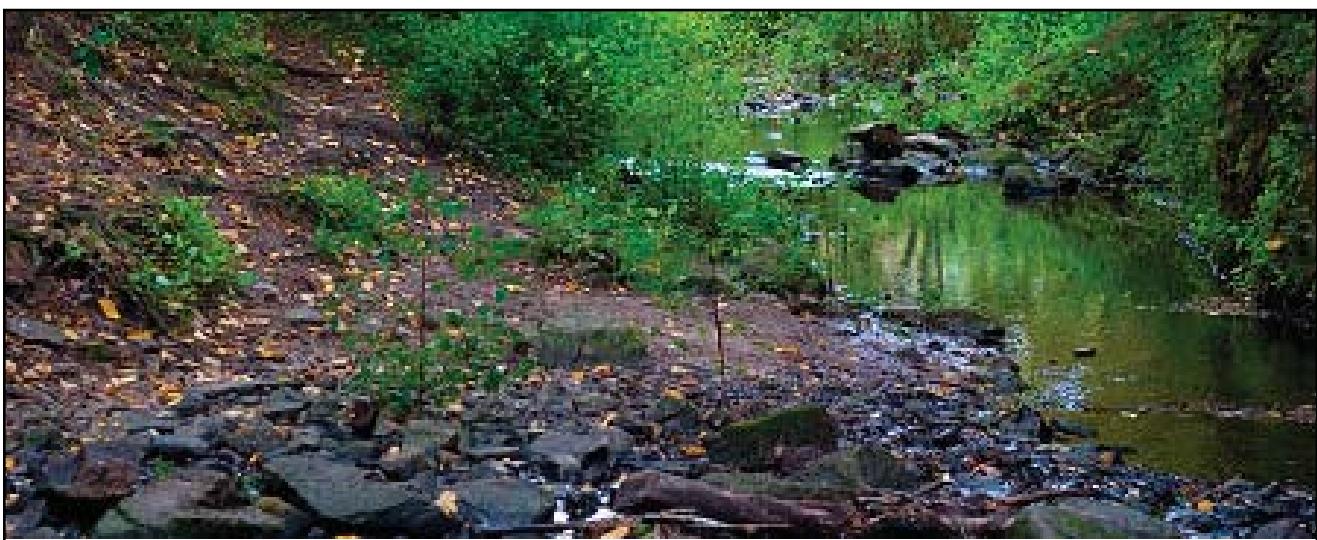
The Nature Conservancy first came to the Baraboo Bluffs in the early 1960's at the request of local residents and university professors who knew how ecologically unique this area was and who wanted the Conservancy's help in protecting the area. Today the Conservancy has 900 members in the Baraboo Hills area.

The Nature Conservancy is a private, non-profit conservation organization, whose mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

The Conservancy owns 8,585 acres at 11 preserves in the Hills, including Baxter's Hollow (5,483 acres) and Pine Hollow (337 acres), which lie within the Narrows Creek and Baraboo River Watershed.

## Recommendations

- More habitat work should be conducted on Narrows Creek.
- The two-mile stretch of the Baraboo River designated as "impaired" should be removed from the 303(d) list.
- Condition monitoring should be conducted on Seeley Lake to determine the health of the sport fishery.
- Three miles of the Class II portion of trout stream on Seeley Creek should be upgraded to a Class I trout stream and added to the list of Exceptional Resource Waters (ERW).
- The Baraboo River and Narrows Creek should be surveyed to determine if rare aquatic elements previously found in the streams are still present.
- Baseline monitoring should be conducted on streams in the Narrows Creek watershed; specifically Hillpoint Creek, Narrows Creek, Seeley Creek, and Skillet Creek.
- The small waterfall on Skillet Creek should be examined for restoration and/or tourism potential.
- Upland best management practices should continue to be installed throughout the watershed to decrease the volume of nonpoint source pollution that reaches the surface waters.



Deward's Glen, Photo by derrickM, blog on the Skillet Creek Media Website

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Wisconsin DNR's mission involves preserving, protecting, and restoring natural resources. Watershed Planning provides a strategic review of water condition to enhance awareness, partnership outreach, and the quality of natural resource management.

# Narrows Creek and Baraboo River Watershed