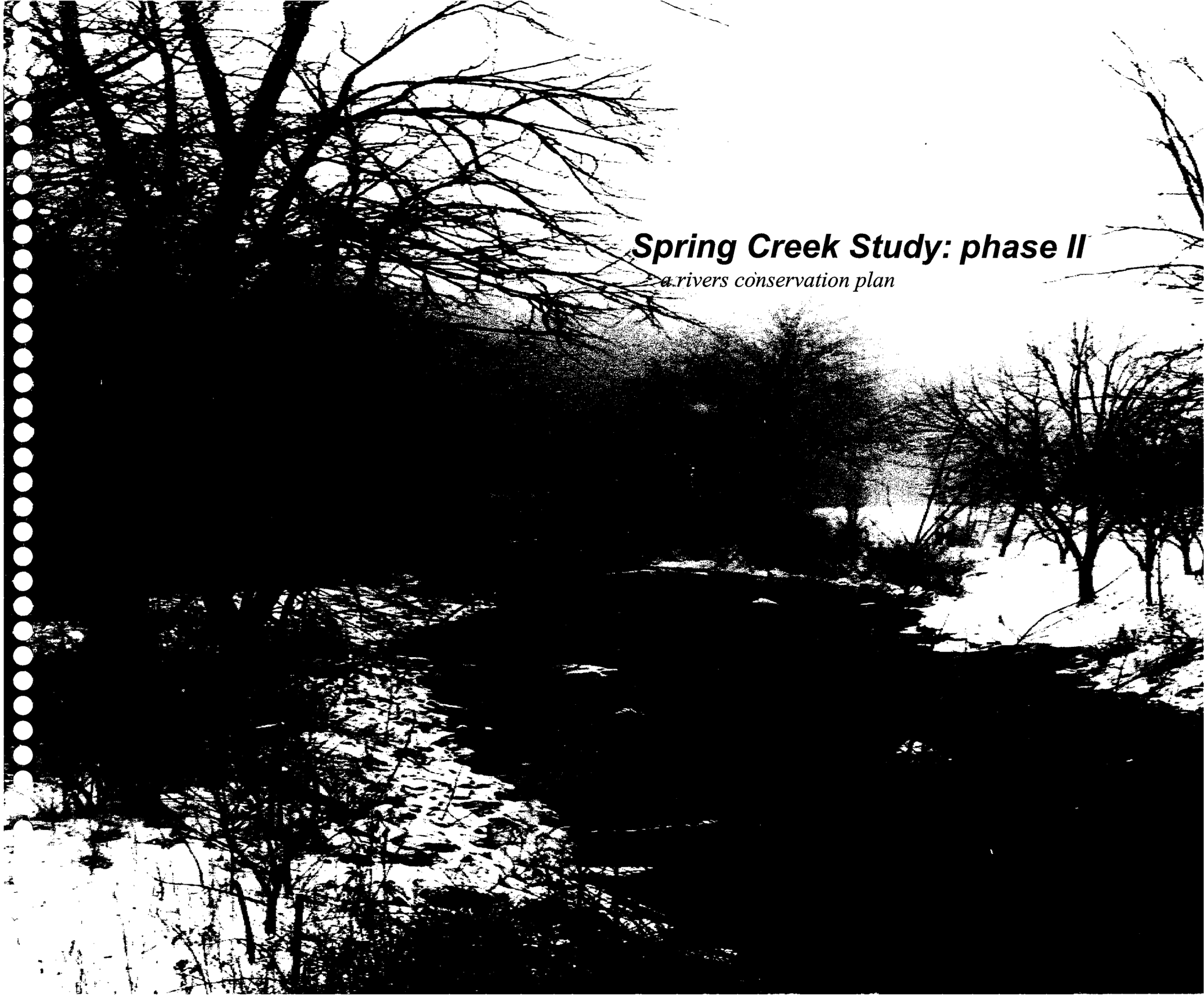


Spring Creek Study: phase II

a rivers conservation plan

Spring Creek Study: phase II

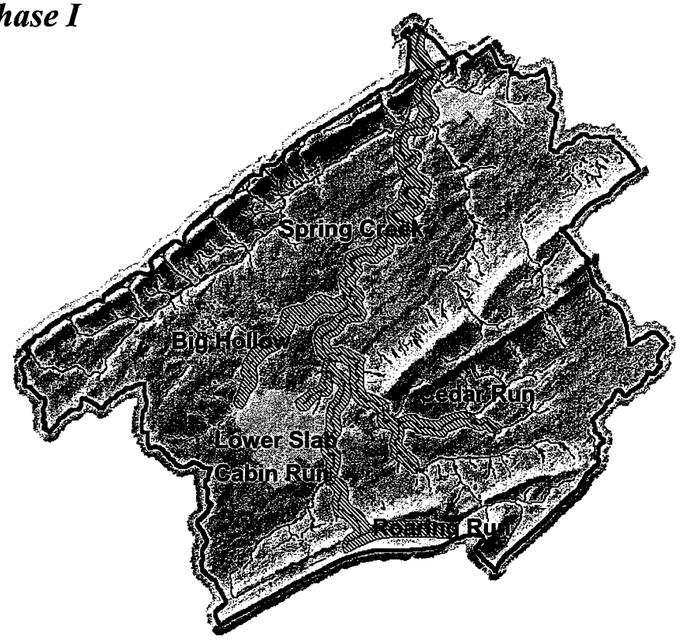
a rivers conservation plan

contents

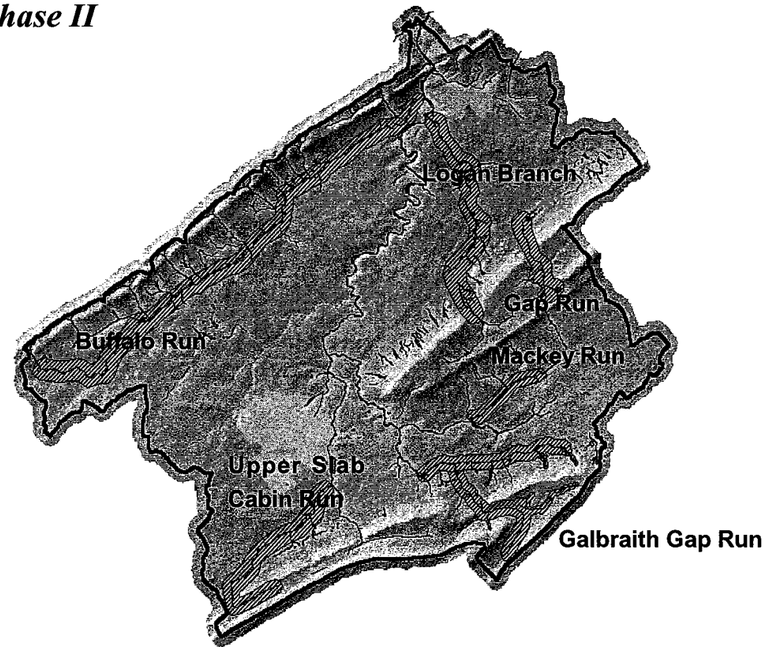
Pennsylvania Department of Conservation and Natural Resources. The intent of the study was to assess the physical resources of the stream corridor and to recommend conservation strategies for their protection. The process involved public meetings and presentations to solicit community input and participation. The product reveals the potential for these resources to enhance the well-being of the community and distinguish its identity.

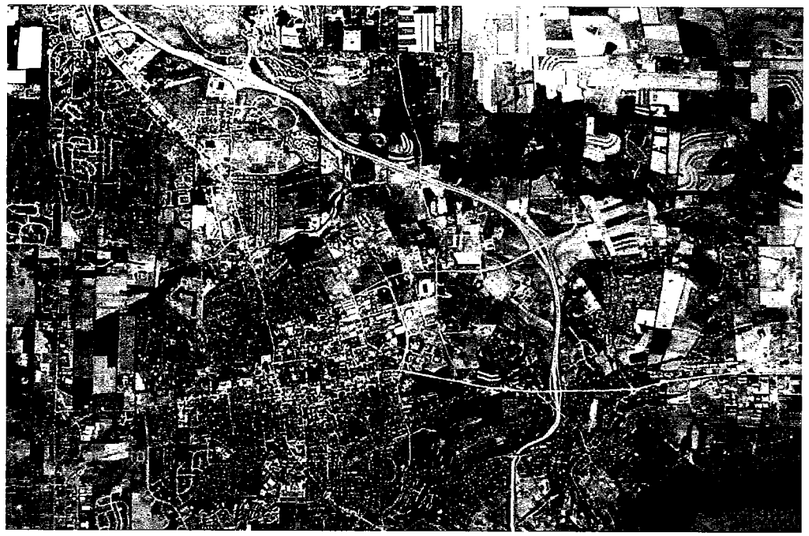
The Spring Creek Study was completed in two phases. Phase I was completed in 1995 and included the main stem of Spring Creek and its Big Hollow, Cedar Run, Lower Slab Cabin Run, and Roaring Run tributaries. Phase II, the focus of this report, was completed in December 2000 and studied the remaining tributaries, namely Buffalo Run, Galbraith Gap Run, Mackey Run, Gap Run, Logan Branch, and Upper Slab Cabin Run. Phase II also compiled G.I.S. (geographic information system) data for the entire Spring Creek watershed.

Phase I



Phase II





the changing landscape

As we live, work, and play in the Spring Creek watershed, we enjoy the quality of life that this environment provides. Abundant, pure water is available for both people and wildlife, including one of the densest populations of wild trout in Eastern North America. The forested mountain ridges scenically embrace the rolling, rural, valley landscapes and frame the views of our growing metropolis. Outdoor recreational opportunities abound and the experience of nature beckons at every turn. The fertile valley soils continue to support an agricultural economy, which has been part of our region's heritage for over two centuries. Our historic towns and villages, rooted in the mines, mills, factories, forests, and waters of Spring Creek, shape our region's identity. This is the landscape of our home today, but it is ever changing under pressures of development and economy. The quality of life we find today is a result of past actions, both deliberate and unintentional. If we are to preserve or conserve this quality, we cannot take our actions lightly.

As this community continues to change and grow, its landscape is continually transformed. Particularly here in the Spring Creek watershed, urban development is rapidly altering the landscape fabric, replacing the patterns of field and forest, town and country, with that of highways, subdivisions, and shopping malls. Comparison of aerial photographs of our region from 1958 and 1995 (see above) shows the exceptional change that has occurred in the past thirty-seven years. Predictions of future growth speculate that current trends will only intensify.

As this community thrives as a center of the information age economy, there is concern that the outstanding qualities of its environment–those that make the Spring Creek watershed an attractive place to live, work, and recreate–will be threatened by that very growth. Today there is an opportunity to shape the region's growth into a sustainable vision for the future. This Rivers Conservation Plan is one of the most important efforts in articulating a vision for the Spring Creek watershed.

The landscape can be seen as an intricate fabric of delicate threads. Spring Creek's landscape is woven of 350 million year old sandstone, limestone, and shale; cold streams and green forests; rolling fields and steep mountains slopes; roads, trails, and railroads; and compact towns and rural villages. These threads of nature and human activity compose our landscape and the basis of our future.

As values and resources change over time, new threads replace the old. They express new values or enhance existing ones, strengthening our sense of community and our connection with the landscape. Under pressures of growth and modernization, the fabric of our community has begun to change – for better and for worse.

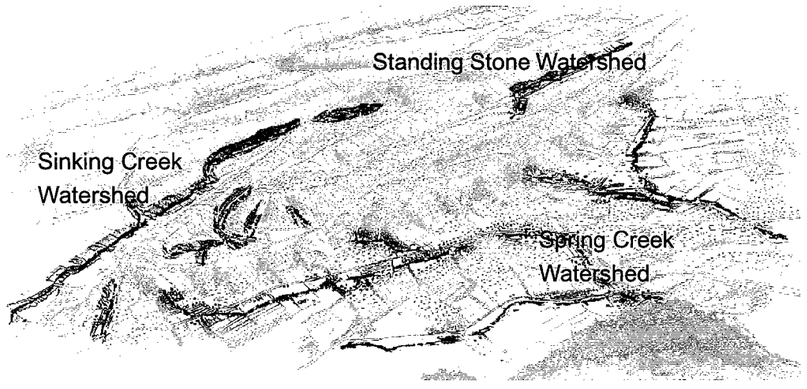
As we weave new threads into our community, we should examine the landscape for patterns and qualities we desire, in order to retain and enhance them over time. Threads of streams and forests, entwined as a stream conservation corridor, can protect our sensitive waters from harmful pollutants, promote wildlife habitat, and provide an accessible experience of nature for all. Threads of local history, preserved as structures, landforms, roads, and waterways, can maintain the notable character that distinguishes our region. The scenic threads of forested mountains, cultural resource corridors, and vibrant streams can hold intact the beauty of our watershed. And finally, the thread of an outdoor recreational network can connect our towns, villages, and neighborhoods and enhance our community life. These threads will continue to strengthen the fabric of the Spring Creek watershed if we choose to conserve and protect them as we grow.

through our parks and wild places where we hike, fish, and canoe. Designated as a Special Protection Water (a High Quality Cold Water Fishery) by Pennsylvania's Department of Environmental Protection in accordance with the U.S. Clean Waters Act, our expectations for Spring Creek are acknowledged and protected by law. Our quality of life depends upon these waters and the quality of the waters shows our value for life.

Protect headwaters subwatersheds

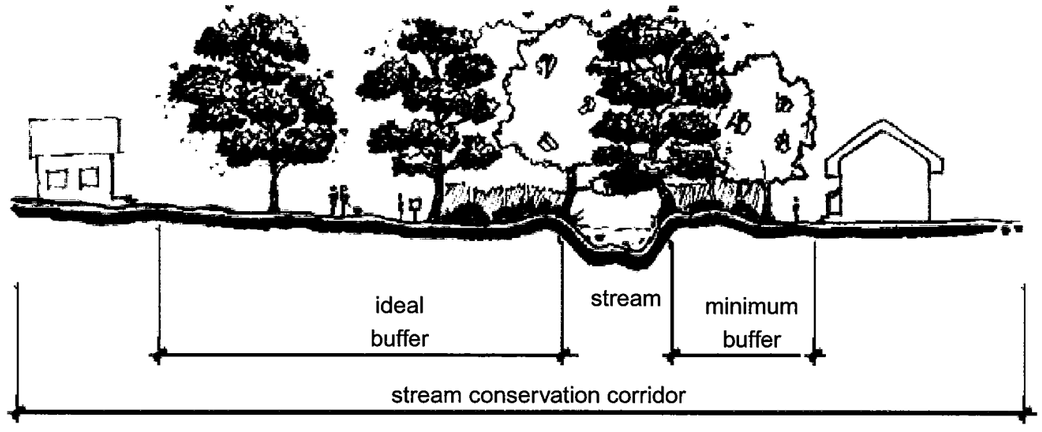
As the initial source of the groundwater we drink, headwaters subwatersheds are critical to groundwater protection. The porous sandstone bedrock of the mountain landscapes allows rainfall to soak into the surface, yielding source water, or mountain recharge, for the headwaters tributary streams. These waters, filtered through the soils and bedrock, are purified and free of dissolved solids. They emerge where impervious bedrock layers force them to the surface. As the streams flow from the mountain gaps and hillsides, they permeate the soluble strata and plunge through sinkholes deep into the valley aquifer.

Because the headwaters watersheds are predominately forested, these streams are generally free of contaminants. Water quality is protected by the buffering effects of vegetation that direct rainfall into the soil, rather than across its surface. Removal of the forest cover inevitably results in reduced water quality as bare soil surfaces erode into streams and in reduced infiltration as soils are compacted by equipment or covered with impervious surfaces. Development causes similar effects that are compounded by the addition of nutrient and chemical pollutants accumulated in runoff waters. Such changes to existing land use threaten water quality across the watershed.



Left*: The headwaters tributaries of three watersheds originate in the Seven Mountains region.*

Right*: Headwaters begin as small streams in the mountain forests. As they reach the valley floor, they disappear into sinkholes in the limestone bedrock. Streams reemerge as valley springs and meander through fields and young woodlands on their way to Spring Creek's main stem.*



Stream Conservation Corridor and Riparian Buffer

The stream conservation corridor uses a setback to protect both ecological and cultural resources that can be found or developed along the stream.

Establish a stream conservation corridor

A stream conservation corridor would protect in-stream and streamside resources, both cultural and ecological. This recommendation is broader than the previously proposed Riparian Conservation Zone. It has been recognized that the stream corridor includes more than just the ecological resources that "riparian conservation" might imply. In light of the cultural values the stream may possess–its historic, recreational, and scenic resources–the more general phrase, "stream conservation corridor," was chosen.

Historically, development was sited near the stream–even on the stream–where water was accessible for drinking, transportation, and industrial uses. Today, as a result of technological advances, such as mechanical wells and water and sewer infrastructure, our development patterns are no longer tied to these streamside or riparian areas. Though agriculture still relies on surface waters for pasturing, we have the ability and responsibility to build residences, commerical complexes, roadways, and other structures away from sensitive natural areas.

These types of development have a number of significant negative impacts on the water quality of our streams. The most important to note is the discharge of increased runoff and non-point source pollution directly to the stream. Even though development outside the stream conservation corridor will also increase runoff and non-point source pollution, setting new construction away from the stream would allow for natural absorption and filtration of stormwater. Consequently, streams would receive cleaner discharge, protecting water quality and aquatic habitats.

Create "a ribbon of green" – riparian forest buffers

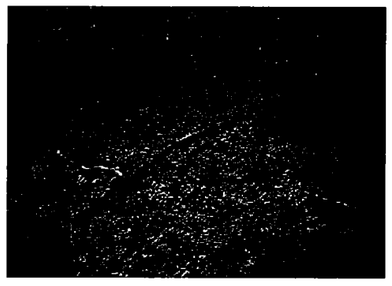
The first European settlers to the Spring Creek watershed encountered a landscape clothed in a thick green forest. The forest absorbed, filtered, and infiltrated rainwater, enhancing the quality of the water entering surface waters and subsurface aquifers. Leafy branches shielded the stream from the sun, maintaining the cool temperatures necessary for indigenous species. Woody roots held streambanks in place. The leaves and branches that fell into the stream created a food chain and diverse aquatic habitats. But as early settlers removed the natural streamside forests, these functions were impaired or eliminated.

For their role in water quality, riparian forest buffers should be protected and restored to create a continuous "ribbon of green" along Spring Creek and its tributaries. The "ribbon of green" would protect our waters for drinking, recreation, and wildlife by increasing stormwater infiltration, removing nutrients and other contaminants, retaining sediments, enhancing natural habitats, and moderating stream temperatures. A continuous buffer would connect existing streamside parks, including the Milesburg Community Park (Milesburg), Talleyrand Park (Bellefonte), Spring Creek Park (College Township) and Millbrook Marsh (College Township) into a riparian recreational network throughout the watershed.

Riparian forest buffers would also contribute to our community identity and the beauty of the stream in all seasons. They might be compared to the cherished American elm allées on the Penn State University Park campus. These allées were planted many years ago and are still valued and cared for today. Spring Creek's riparian forest, "a ribbon of green," would become

the community's grand allée. It would be a symbol of the community's affection for its environment and a functioning resource for nature and people alike. Though it may take a hundred years to realize this vision of majestic trees lining our streams, that future begins with the decision to protect and promote riparian forests today.

More detailed information and bibliographic citations regarding riparian buffers can be found in appendix a.



The elements of our industrial heritage–iron ore pits, millpower dams, and charcoal hearths–are scattered throughout the mountains, valleys, and stream corridors of Spring Creek.

Acknowledge and inventory evidence of our past

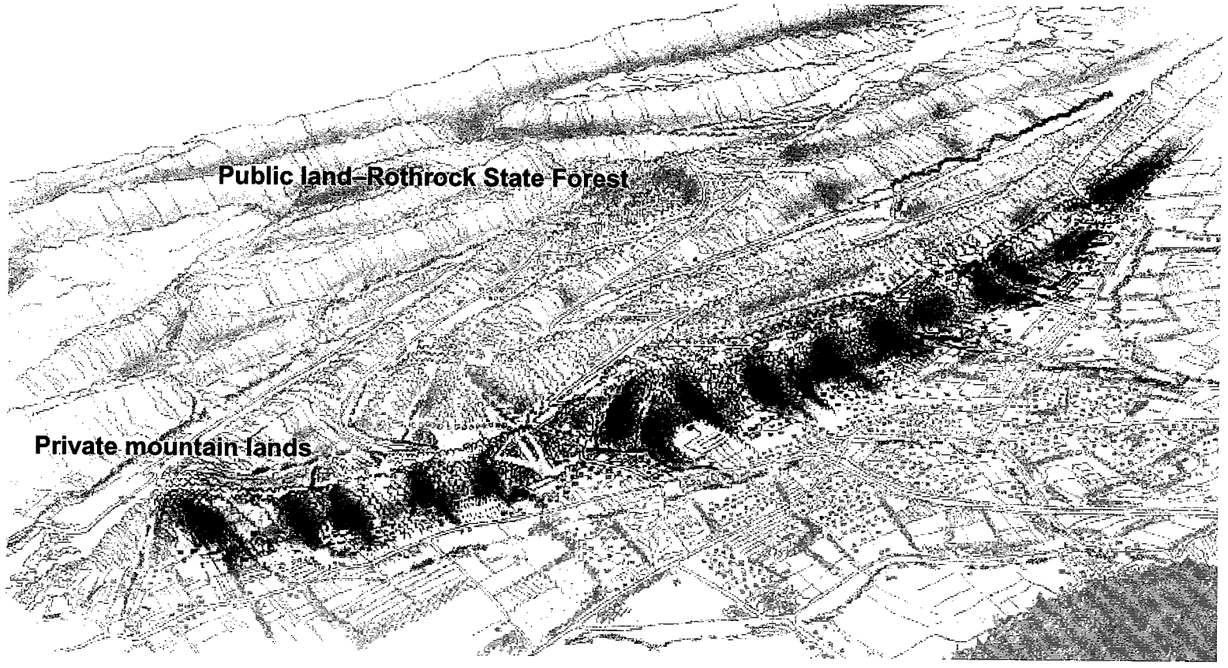
The first step toward conserving artifacts of our local heritage is to acknowledge their presence in our landscape and to develop a thorough inventory of their location, characteristics, and cultural value so that they may remain a living part of the community.

Remnants of our industrial heritage are usually subtle and often overlooked–easily erased from the landscape or allowed to fade away in neglect. While the Centre Furnace stack and iron master's mansion are well preserved and interpreted, much of what remains of the charcoal iron industry is virtually hidden from view. Benner's Forge on Spring Creek, the iron ore pits scattered throughout the valley, and the charcoal hearths in Shingletown Gap all offer opportunities for revealing that era of the community's history, but they require interpretation or enhancement to be meaningful. In addition, evidence of lumbering, railroads, quarries, mills, and dams is sprinkled in fading, but still discernable, patterns across the watershed.

Over two hundred years of intensive agriculture have also shaped the character of our landscape. Hedgerows, stonewalls, farmhouses, and bank barns mark the location of past and present agricultural activities. Although its presence is still strong, the agricultural landscape is under tremendous pressure to modernize or urbanize. Farming practices are changing, and agricultural land is rapidly becoming residential and commercial suburbia. Agricultural fields are now bisected by highways and sprouted with housing subdivisions. Commercial zones spill out along roadways, blurring the distinction between town and country. These changes are dramatically transforming the character of the landscape and threaten to obliterate this important part of the region's history.

Our towns and villages are unique and contribute to the particular character of the watershed. While several have been designated and protected as part of our state or national heritage, many more are telling of our local history. Our historic

Historic farmhouses, hand-built stonewalls, and majestic silos are functional and aesthetic components of Pennsylvania's farmstead architecture.



Private ownership and management of forested, valley-facing slopes impacts our entire community's identity. Partnerships with private landowners would protect our scenic landscape.

Conserve scenic value

The headwaters landscapes constitute some of the most important scenic views from within our community. These forested, valley-facing slopes frame our community with wild, verdant mountains. We must recognize that 95% of these valley-facing mountain slopes are in private ownership. Current regulations in many locales would permit logging and some level of residential development on these highly visible slopes. It is important for the community to work in partnership with private landowners to protect both the private and public values of these sensitive landscapes.

Develop partnerships for conservation

The task of headwaters protection is great and the responsibility is communal. Only through cooperation between the community, private landowners, and the State Forest administration can we adequately protect our resources in the Spring Creek headwaters through conservation easements and other means. User groups, such as bicyclists, hikers, snowmobilers, and horseback riders, should work together with the State Forest administration toward the planning, design, construction, and maintenance of trails, signs, and improvements. By partnering with other state and federal agencies, such as the PA Game Commission and the PA Fish and Boat Commission, such groups can participate in establishing and maintaining larger and better recreational networks. Other interest groups, such as the Centre County Historical Society, could partner with the State Forest administration to preserve and interpret historical resources. The landscape of the Spring Creek headwaters has much to offer if we engage, rather than disregard, its numerous resources.

A riparian park at Waddle Marsh could inform local residents of the many ecological functions that wetlands perform.

Waddle Marsh Riparian Park

Some of the most extensive wetlands in the Spring Creek watershed can be found along Buffalo Run near the historic settlement of Waddle. These wetlands, noted for their ecological value in the Centre County Natural Heritage Inventory, could become the core of a new riparian park that preserves wetland functions and meets the outdoor recreational needs of a nearby growing residential population.

Historically, wetlands have been overlooked by both land and water resource managers, but recently they have been recognized as vital components of both systems and have been incorporated into water quality and water quantity management. By slowing the flow of surface waters, they allow sediments to settle out of suspension, vegetation to absorb nutrients, and soils to absorb and infiltrate floodwaters. In addition to their role in the hydrologic cycle, wetlands support both aquatic and terrestrial wildlife communities.

Whether Waddle Marsh is a result of natural geologic and hydrologic patterns or of historic railroad development (or perhaps a combination of both), plant and animal communities have come to inhabit this local ecosystem, and their contribution to our local ecology should be preserved.

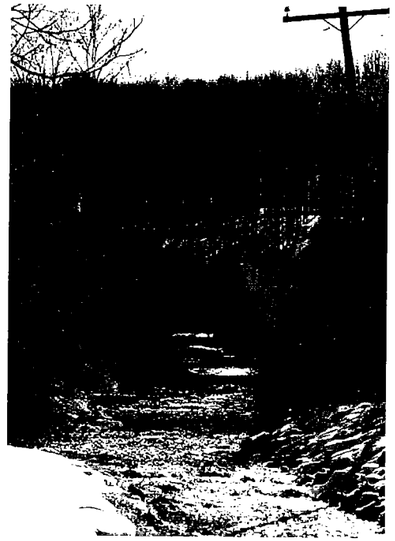
A park at Waddle would offer opportunities for environmental education specific to wetland communities and the riparian corridor. It would also provide open space for hiking, bird watching, and fishing. By providing trail links to existing parks, such as the Benner Township Park, a local valley network for outdoor recreation would be created. A broader connection to the watershed-wide recreational network centered at Spring Creek Canyon could be made via trails through State Game Lands 176 and properties owned by the Pennsylvania State University. By this same network, residents from across the watershed could access, appreciate, and enjoy the wetlands at Waddle Marsh.

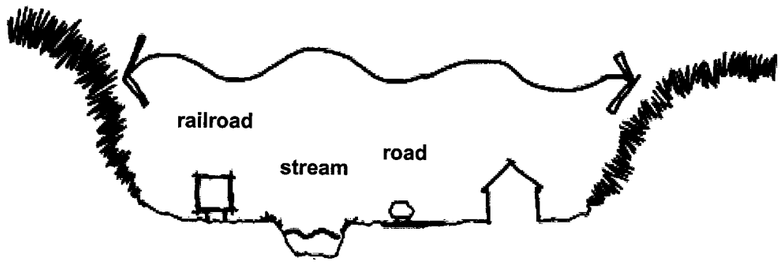
Upper*: The proposed site for the Pleasant Gap Riparian Park is located on Robinson Lane, adjacent to the Pennsylvania Fish and Boat Commission hatchery.*

Lower*: With anticipated growth resulting in new residential communities, this park would provide recreation and open space as well as ecological mitigation of development.*

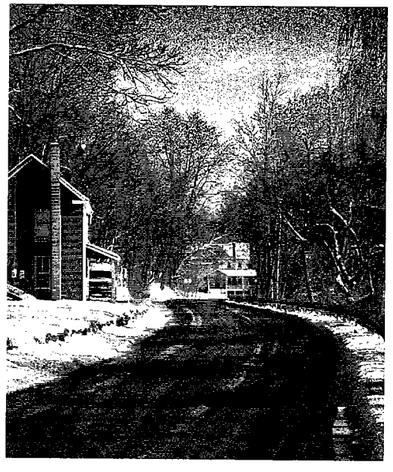
Pleasant Gap Riparian Park

At the upper reaches of Logan Branch, adjacent to the Pennsylvania Fish and Boat Commission's Pleasant Gap site, another streamside public park could be established. Like Pine Grove Mills, this region has also seen rapid residential growth–a trend that will likely continue as a result of the new Interstate 99. A new riparian park in this part of the watershed would provide public open space and needed outdoor recreational opportunities for current and future populations of Pleasant Gap. It would also help to mitigate the impact of residential development upon the stream by restoring natural riparian vegetation that absorbs, filters, and infiltrates stormwater. Recreational paths could link the new riparian park to the existing Gettig Park and to Fish and Boat Commission lands to create a local network of connected open spaces. The Bellefonte Historic Railroad could also serve the new park, reinforcing the historic connection of Pleasant Gap with Bellefonte and Lemont. The Pleasant Gap Riparian Park could weave water, forest, history, and recreation into one public open space.





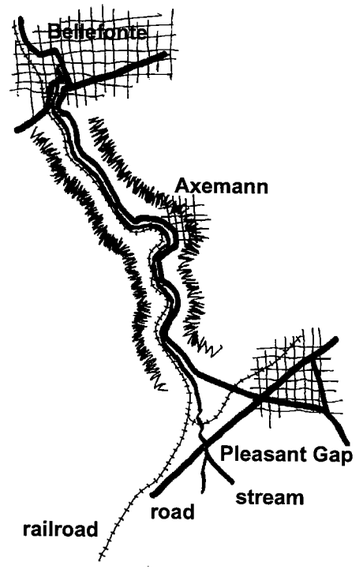
The Logan Branch corridor focuses our attention on the historic village of Axemann, the architecture of buildings, and the spatial pattern of the landscape as we travel between Bellefonte and Pleasant Gap.



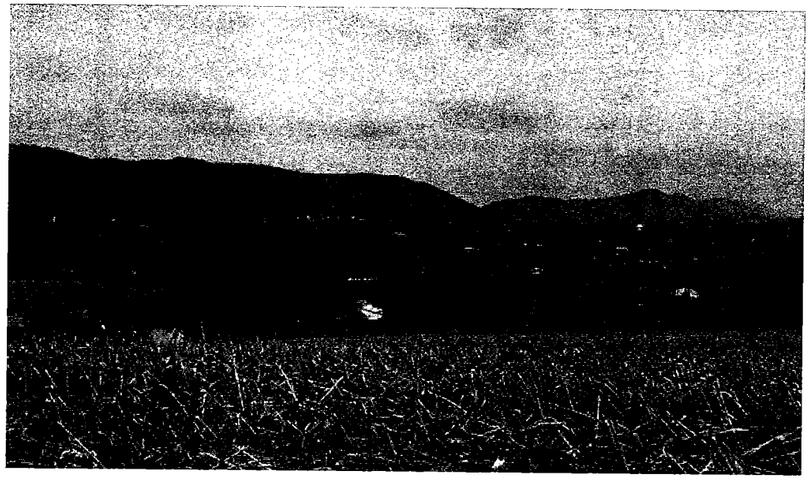
Logan Branch Scenic Corridor

Logan Branch has deeply eroded the limestone terrain between Pleasant Gap and Bellefonte, providing a spatial corridor for travelers along historic Route 144. A journey down this winding road is history living in the present– limestone farmhouses and bank barns, the manufacturing village of Axemann, an elegant, early nineteenth century iron master's home, the historic and still active railroad, and the gurgling sounds of a high-gradient, trout-filled stream, all within forested hillsides. The slow and sinuous Route 144 reveals the history, ecology, and beauty of our watershed community in a linear progression through the landscape. These resources define our community and would easily be lost if the road were "modernized" to contemporary standards.

Designation of Logan Branch as a scenic byway could preserve these resources and, more importantly, the rich experience of viewing them through the corridor. With innovative design, the road could be made safely accessible to bicyclists, pedestrians, and slow-moving automobiles. Historic sites could be identified with subtle signage, encouraging observers to explore this rich, compact passageway. The relationship of the stream and its geology could be described and illustrated to explain this miniature canyon. Architectural styles, materials, and details could be interpreted to leisurely travelers. The use of this valley corridor by the Bellefonte Historic Railroad further enhances the rationale for protecting the diverse resources of Logan Branch for ourselves and for the future of our community.

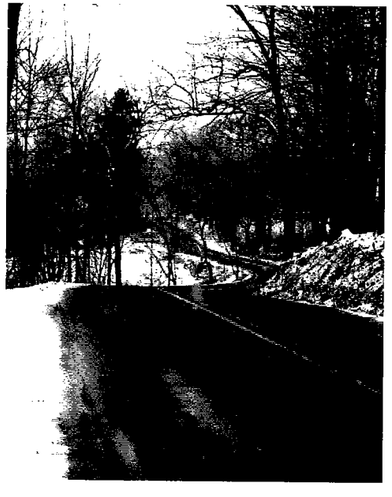


Over thousands of years, this stream has carved a narrow canyon in the valley floor. Within this canyon, previous residents developed parallel routes of transportation: waterways, railroads, and roadways.



Left: *The Buffalo Run corridor is characterized by crossroads villages and winding country roads set against the backdrop of the forested Bald Eagle Ridge.*

Right: *Residents of this long valley landscape will need to establish conservation goals to protect the resources that define its rural character.*



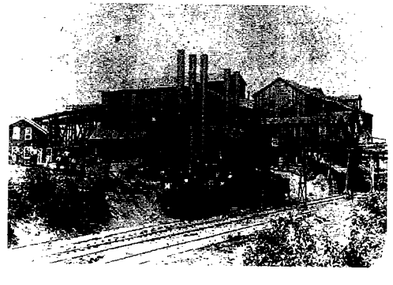
Buffalo Run Scenic Corridor

Buffalo Run, the longest major tributary of Spring Creek, offers views to natural and cultural resources throughout its corridor. The rolling limestone valley, bordered by Bald Eagle Ridge, provides numerous opportunities to revere and protect these important resources. Due to the valley's proximity to growing populations at Bellefonte and Park Forest Village and its intersection by I-99, there is added impetus for such efforts.

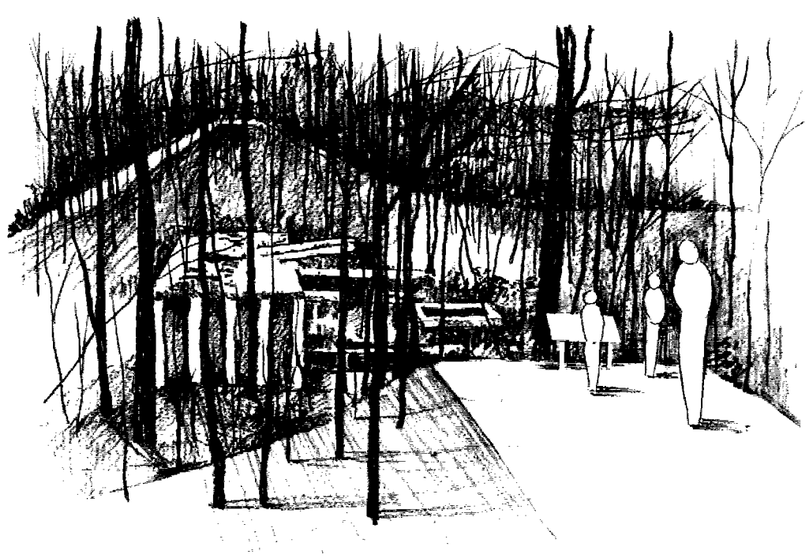
Pennsylvania Route 550, which parallels Buffalo Run through much of the valley, is another of the picturesque, historic roads that still serve our community. The village sites that resulted from iron mining and agricultural operations in the valley remain in our modern landscape as a small crossroads church, a family store, or a short row of houses placed side by side. The road itself reveals the texture of the valley floor as it rises and falls. Roadside hedgerows filter views to forest and farm. These characteristics, collectively and simultaneously, define the experience of a drive in the country.

Key to that experience is Bald Eagle Ridge, which provides a scenic backdrop of forested mountains to the Route 550 corridor and the surrounding community. Since the entire ridge is privately owned, logging and development could occur, fragmenting the forest and drastically changing the already rare, rural character of the valley. Conservation of this contiguous background and habitat presents a special challenge for the community to work with landowners to protect public and private values.

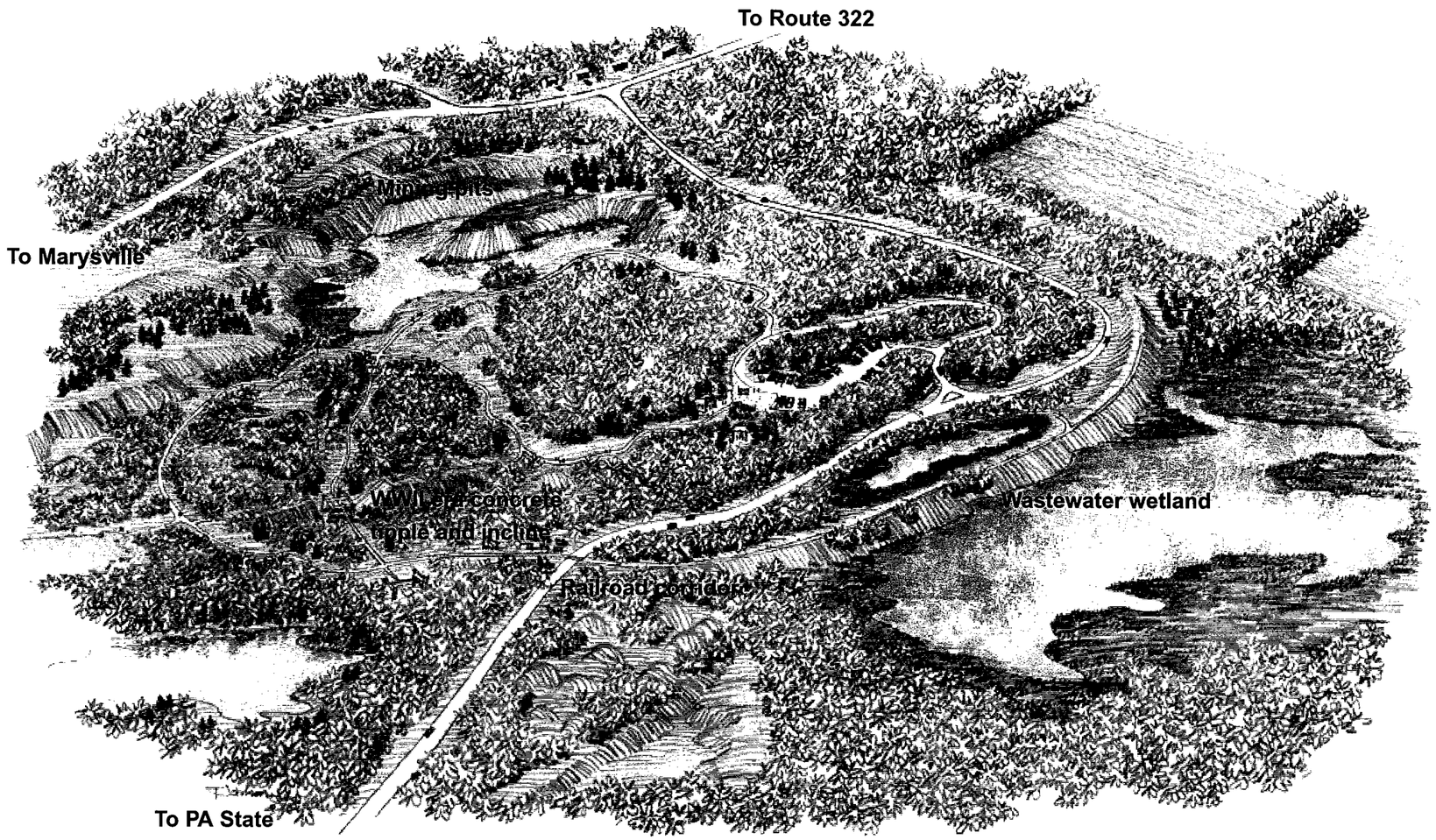
This site expresses multiple eras of iron ore mining history. Due to its primarily timber construction, structural elements of the original village have been lost to decay and subsequent mining activities. What remains of this era are mostly landforms and archeological sites. The latter era is more evident in the concrete frame of the twentieth century tipple and the earthen incline that we can see today. It can also be seen more subtly in the young age of the surrounding forest, dating the last significant surface disturbance. Taken together, all of these remains help to reveal the great shifts that have occurred in the story of iron ore mining in Pennsylvania over the past 200 years.



While much of this history can be interpreted through close examination of the Scotia landscape, more information about historic mining processes and mining village life is needed to illustrate the complete story. Some research has already been published, for instance Harry M. Williams' *The Story of Scotia*. However, more extensive archival, archeological, and ecological work needs to be completed and made available to the public. Partnerships with the Centre County Historical Society, the Pennsylvania Historic and Museum Commission, and the Carnegie Institute could support such efforts.



While the structures we see today are remnants of mid twentieth century mining interests, they could direct our attention to the technological changes in mining processes that have occurred over time. From historic photographs of Scotia-era structures to concrete frames we see today to their connections with Centre Furnace, we can portray the iron ore mining landscape through layers of history.



While more research is needed to discover the historic and ecological details of this site, ideas and visions of what this place could become provide our motivation. Imagine walking through time: entering the park through acres of forest, perhaps along a path traveled by miners from their houses to the ore pits, descending into the now grassy pits, where water once flooded miners feet, hiking the rail lines that brought raw iron ore to the washer, ascending the now tree-covered incline where carts weighing hundreds of pounds were pulled to the top and emptied into the hopper, walking through the solid structure where soil and organics were washed from the ore chips with streams of water tapped from local wells, passing the scrubby fields where the fouled waters deposited layers of fine sediments that created present day wetlands, and finally leaving the park along the rail lines that transported the clean ore to local furnaces. With visions such as these, we can bring history and nature to life within public open space.

The landscape of the Spring Creek watershed is an intricate fabric of streams and forests, fields and mountains, roads and railroads, and modern towns and historic rural villages. The watershed, in the heart of central Pennsylvania, is part of the larger cloth of the Susquehanna River and Chesapeake Bay watersheds. Located in south central Centre County, in the Ridge and Valley physiographic region, Spring Creek drains an area of approximately 175 square miles. Within the Spring Creek watershed, fourteen municipalities are searching for new and creative ways to weave together their common interests, heritage, and resources. The watershed contains all or portions of Benner, Boggs, College, Ferguson, Halfmoon, Harris, Patton, Potter, Spring, and Walker Townships and the Boroughs of Bellefonte, Centre Hall, Milesburg, and State College.

In 1997, ClearWater Conservancy received a planning grant from Pennsylvania's Department of Conservation and Natural Resources Rivers Conservation Program to prepare Phase II of the Spring Creek Study and mold it into a Rivers Conservation Plan for the entire stream network. Phase I of the Spring Creek Corridor Study (Penn State Department of Landscape Architecture, 1995) had documented much of the main stem of Spring Creek and several important tributaries, including Big Hollow and the lower reaches of Cedar Run and Slab Cabin Run. Phase II extended the conservation plan to the remaining tributaries of the Spring Creek watershed, including Buffalo Run, Logan Branch, Galbraith Gap Run, and the upper reaches of Slab Cabin Run, Spring Creek, and Cedar Run. Phase II also included the conversion of earlier Phase I data to a common geographic information system (G.I.S.) format (ArcView).

Public presentations were made of preliminary study recommendations, and public comments from those events, and others, were incorporated into the final study recommendations. Final study recommendations were presented to the public through a computer-based presentation and broadcast on local C-NET on February 22, 2000. Final editing and production of the study report and display boards was completed in May 2001.

With the continued leadership of the ClearWater Conservancy, the communities of the Spring Creek watershed have begun to recognize the value of Spring Creek as an important asset for the future. Spring Creek's special regulatory status as a High Quality Cold Water Fishery is a reflection of the environmental quality of the watershed and the quality of life of the people who live, work, and play there. In order for these communities to adequately consider Spring Creek in their ongoing decisions about land use planning and community design, public awareness of the value of the creek must be enhanced. The Spring Creek Study and the Spring Creek Rivers Conservation Plan are intended to provide that foundation and give the communities specific ideas for the future of the watershed.

The conclusions of this study were grouped together as either watershed-wide recommendations (those applicable to larger areas or throughout the study area) or site recommendations, for specific locations within the watershed.

- Heritage Park at Scotia

  Protect, reveal, and interpret iron mining history

  Attend to all historic eras – Centre Furnace, Andrew Carnegie, World War II

  Protect and interpret special ecology of Scotia Barrens

  Create recreational destinations

The ClearWater Conservancy and the residents of the Spring Creek watershed are excited to move forward to implement the recommendations of the Spring Creek Study (Phases I and II) and the Spring Creek Rivers Conservation Plan. Progress is already underway on many fronts, but possibly the most exciting opportunity before the community is the creation of a comprehensive watershed plan for the fourteen municipalities of the Spring Creek watershed. The Spring Creek Watershed Commission, convened by the Centre County Commissioners and composed of an elected official from each of the municipalities in the watershed, will lead that effort in partnership with the Spring Creek watershed community, ClearWater Conservancy, and other interested state and local stakeholders.

The ClearWater Conservancy would like to thank the Pennsylvania Department of Conservation and Natural Resources for helping to make this Rivers Conservation Plan possible and for its continued support of Spring Creek watershed initiatives.

appendix a

the stream conservation corridor: promoting diversity, clean water, and healthy streams

Background

The health and diversity of the Spring Creek watershed depends upon the conservation of riparian areas. "Local land-use practices can impact not only the immediate riparian zone area, but also can influence water quality and areas located further downstream" (Barsk 1996). For example, excessive forest cutting or the mismanagement of agricultural lands can accelerate soil erosion that can in turn affect downstream aquatic habitat and species populations. Development that increases impervious surfaces, decreases infiltration capacities and increases runoff, elevating stream flow quantities and the energy that accelerates soil erosion processes. Agriculture and roads can contribute nutrient and sediment laden runoff directly into streams and aquifers, endangering both drinking water supplies and species habitat. Because all of these land uses occur in the Spring Creek watershed, stream conservation that targets land use is clearly needed.

Forested buffers offer land management options for mitigating these impacts. They have proven to effectively remove excess nutrients, particularly nitrogen and sediment-attached phosphorus, and are moderately effective at removing excess metals and other nutrients from overland and subsurface stormwater. A minimum buffer width of 30 feet on each side of the stream is generally recommended for nutrient dilution and stormwater infiltration. A minimum 50 foot buffer on each side of the stream is recommended for the removal of excess sediment. In addition, forested buffers control erosion by stabilizing stream banks and wetland edges and by promoting infiltration (Shisler et al 1987).

A stream conservation corridor can combine land use conservation and land management (buffers) for the protection of water quality and aquatic habitat. Proper planning and management of these areas will also foster diverse native plant and animal habitats, improving the overall ecological health of the Spring Creek watershed.

subwatersheds, recharge areas, and wetlands. Headwater streams provide source water for subsequent tributaries, drinking water supply for the community, and habitat for high quality coldwater fisheries. Aquifer recharge areas feed the ground water table, another source of potable water for the community. Wetlands provide refuge for countless species in addition to filtering excess nutrients and sediment. These areas are critical to maintaining high water qualities and at the same time are particularly sensitive to adjacent disturbance.

As a result of hydrologic and geologic factors, the following areas are considered sensitive in the Spring Creek watershed and should be buffered* (Lowrance et al, The Federal Interagency Stream Restoration Working Groups, 1990):

• areas adjacent to permanent or intermittent streams which occur at the lower edge of up-slope cropland;

• areas at the margins of lakes or ponds which occur at the lower edge of up-slope cropland, grassland, or pasture;

• areas at the margins of intermittent or permanent flooded, environmentally sensitive open water wetlands which occur at the lower edge of up-slope cropland, grassland, or pasture;

• areas on karst formations at the margin of sinkholes and other small ground water recharge areas occurring on cropland, grassland, or pasture;

• all areas within the 100-year floodplain;

• all undevelopable steep slopes adjacent to the water body (in excess of 25% slope); and

• any adjacent wetlands or critical habitats.

**Again, buffer widths are naturally dependent upon existing land ownership and development.*

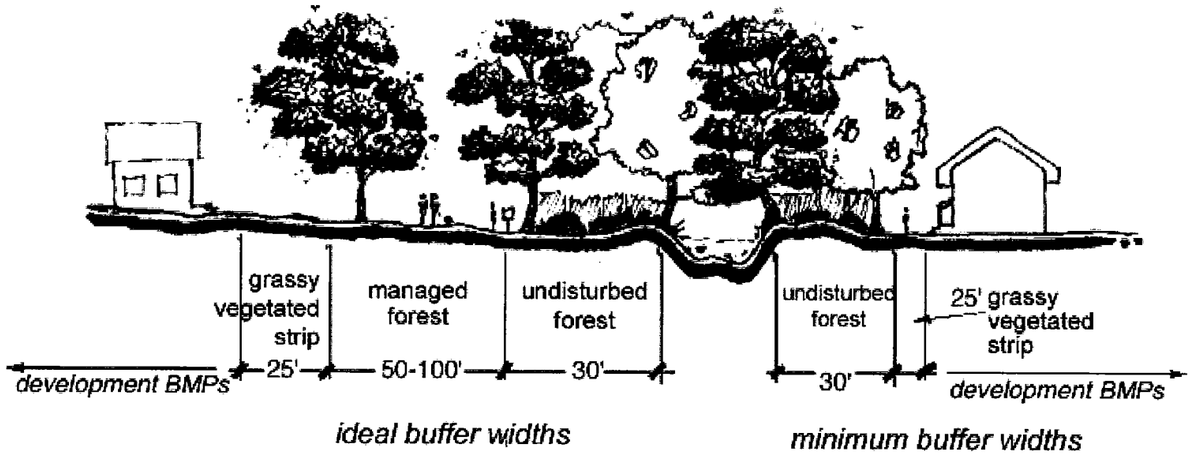
Buffer characteristics at the site and watershed scales: integrity and continuity

A buffer will be most effective if it is continuous around the entire stream system. It follows that a fragmented or noncontinuous buffer will be less effective since stormwater and its pollutants are able to bypass the forested filtration area. Buffers that discharge to the stream must direct water through the riparian soils and vegetation in order to filter and infiltrate the water. "It is only under these conditions that flow output can be treated as the output from the riparian forest system" (Lowrance et al, 1997).

The specific water quality and/or habitat functions desired

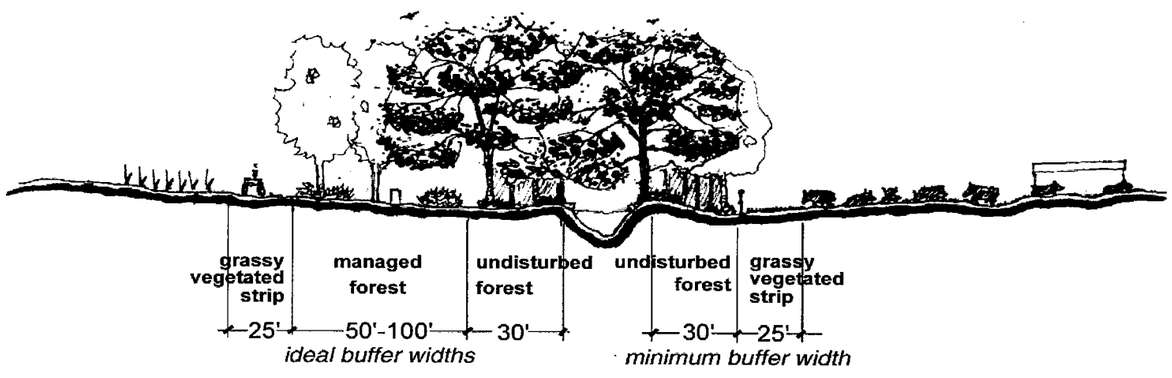
In some areas, water quality is heavily dependent upon water cycling through soils and the underlying geology (Lowrance et al). Located in the Ridge and Valley Province, Spring Creek is dominated by limestone (karst) valleys and sandstone ridges. Karst topography promotes direct aquifer recharge, and thus riparian buffers are less effective. Lowrance, et al 1990, developed the following guidelines with respect to underlying geology:

In the valleys of the Ridge and Valley Province, which are dominated by limestone (karst) topography, buffers will have the least potential for nitrate removal. Porous karst topography promotes direct infiltration of runoff into the local aquifers. This runoff often bypasses forested riparian areas, which would remove nutrients and sediment discharging directly into the bedrock through seeps, springs, and floodplains. Thus, regions characterized by limestone bedrock are critical areas to protect. Deep-rooted vegetation that reaches or approaches the water table, can play a pivotal role by promoting nutrient removal from groundwater that otherwise bypasses riparian filtration at the ground surface.



urban / developed land

figure a.i



agricultural land

figure a.ii

Silvicultural areas (see figure a.iii)
An unbuffered stream adjacent to a silvicultural (logging) area is vulnerable to elevated sediment yields and erosion in addition to nutrient loading and thermal pollution. Best Management Practices, as described below, have been shown to effectively limit stream quality degradation. These practices include (Lynch and Corbett 1990):

- A minimum of 100 feet (starting at bankfull) of undisturbed riparian forest buffer per side. Selective logging can be permitted in this zone for individual trees that threaten the stream channel.
- Harvesting divided into blocks – one block must be completed before another commences to ensure efficiency.
- Frequent site inspections by a professional forester. These inspections should be more frequent during wet periods.
- Skidding prohibited over perennial streams unless approved. If approved, skidder crossing should be designed in a manner that limits damage to the stream.
- Slash prohibited within 25 feet of all streams.
- Main skid trails and logging roads laid out by a professional forester before harvesting and allowed to settle. The loggers can lay out smaller roads if they consult with the professional forester beforehand.
- Log landing sites selected by a professional forester in cooperation with the logger. They should be no closer than 300 feet to the stream.
- All roads and trails 'properly retired.' This entails proper removal of all culverts and installation of water bars and other drainage devices. Site grading should be returned to pre-logging conditions. Gates should be used to eliminate future vehicular road access.
- Logging prohibited during excessively wet periods as deemed appropriate by the supervising forester.
- Performance bond (set at 25% of the timber's value) required prior to logging.

Sensitive areas (see figure a.iv)
Areas characterized by steep slopes, development-sensitive soils, or that are ecologically valuable (or adjacent to areas of high ecological value) are considered sensitive. Examples of these areas include large patches of undisturbed forest, areas that have a high percentage of forest cover, and areas where there are endangered or rare species. Sensitive areas should maintain a wider buffer of mature forest to promote aquatic-terrestrial connections and foster wildlife habitat. A width of at least 300-600 feet of undisturbed or carefully managed forest is recommended for these areas.

Supporting Research

The following paragraphs outline additional research that supports the development and implementation of riparian buffers for water quality protection.

Temperature Moderation:
Trees cut in areas immediately adjacent to stream channels promote the elevation of water temperatures due to an increase in direct sunlight penetrating the water. Maintaining buffers zones along the stream and utilizing BMPs with respect to cutting resulted in a reduction of stream temperature fluctuation (Lynch and Corbett 1990, Yankey et al 1991). Castelle et al (1995) found that a minimum of 15.2 m (49.9ft) is necessary for adequate shade.

Nutrient removal:
Doyle et al found a 30 foot grassy filter strip was 96-99% effective in removing nitrogen, phosphorus, and potassium; this study further suggested a 12 foot

Assistance and Incentive Programs:

Numerous government-sponsored programs exist to help landowners implement buffer zones along their property. Most work closely with landowners, providing technical assistance to develop sustainable land use practices and minimize stream degradation. Some provide financial assistance for implementation, while others offer landowners incentives to implement conservation practices.

Wetlands Reserve Program:

Designed to restore and protect wetlands on private property, the wetlands reserve program offers landowners financial incentives to retire marginal farmland. It serves to establish fish and wildlife habitat, improve water quality, protect biological diversity, and provide recreational opportunities. Riparian areas can be restored and must be maintained for at least ten years. The government will fund up to 75% (cost-share) of the restoration activity.

Wildlife Habitat Incentives Program (WHIP):

WHIP is designed for private landowners who want to develop and improve fish and wildlife habitat on their land. Plans are developed through consultation with local conservation districts who provide technical and financial assistance.

Conservation Easements:

Conservation easements are voluntary legal agreements created between private landowners (grantors) and qualified land trusts (grantees) that limit land use practices and protect land from development. Grantors can receive federal tax benefits for donating easements as well as a reduction in income, property, and estate taxes. Grantees monitor the land and enforce the easement. Easements can apply to the entire parcel or one specific portion of the property. Most are permanent and follow the land even after it is sold, however term easements, are set for a limited number of years.

Streambank Fencing Program:

The Pennsylvania Fish and Boat Commission offers assistance and cost-share incentives to producers for fencing off stream areas adjacent to agricultural lands. The program attempts to minimize the effect of cattle grazing on the stream.

Conservation Reserve Program:

This program targets the protection of wetlands and forested riparian wildlife areas through the Natural Resource Conservation Service (NRCS) and Pennsylvania's Bureau of Forestry. A 50% cost-share is provided with annual payments up to $50,000 for 10-15 years. A 20% bonus incentive is added for trees and continuous enrollment.

Forestry Incentives Program:

The Forestry Incentives Program, implemented by NRCS and the US Forest Service, is applicable on areas of 10-100 acres. Up to 65% cost-share is offered for tree planting and preparation.

AM:

AM is a US Forest Service program, applicable to private forests ranging from 1-1000 acres that will be maintained for at least ten years. As much as a 65% cost-share for SIP (Stewardship Incentive Program) practices is available, including those aimed at riparian and wetland protection and improvement.

Environmental Quality Incentives Program:

This long-term program is applicable on agricultural land, including forests. Up to 75% cost-share is available from NRCS for riparian forest buffers and related practices.

Federal: PL96-451:

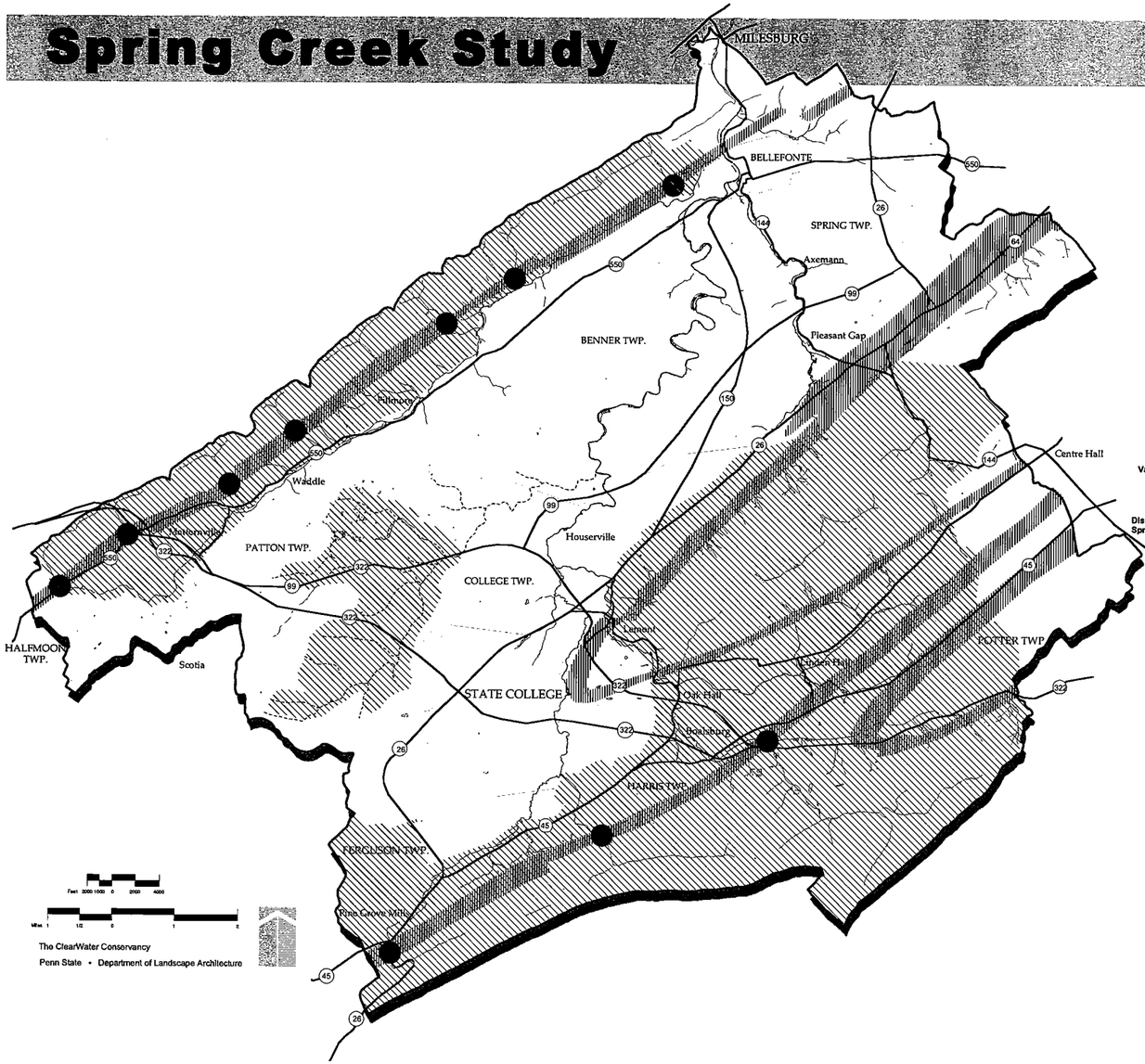
This program provides federal income tax incentives to reduce reforestation costs. The law permits up to $10,000 of capitalized reforestation costs each year to be eligible for an investment tax credit and seven-year amortization.

appendix b

resource and recommendation maps

The maps contained in this appendix are included as a reference of the watershed-wide inventory and recommendations that resulted from this study. They are available for viewing at their full size (24" x 36") at the Clearwater Conservancy office.

Spring Creek Study



Water Resources

Protect headwaters watersheds

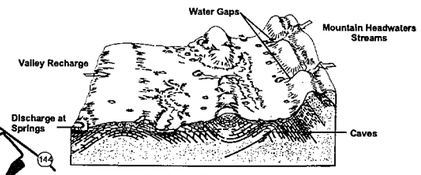
Headwaters watersheds

Protect groundwater recharge areas

Primary recharge zone

Secondary recharge zone

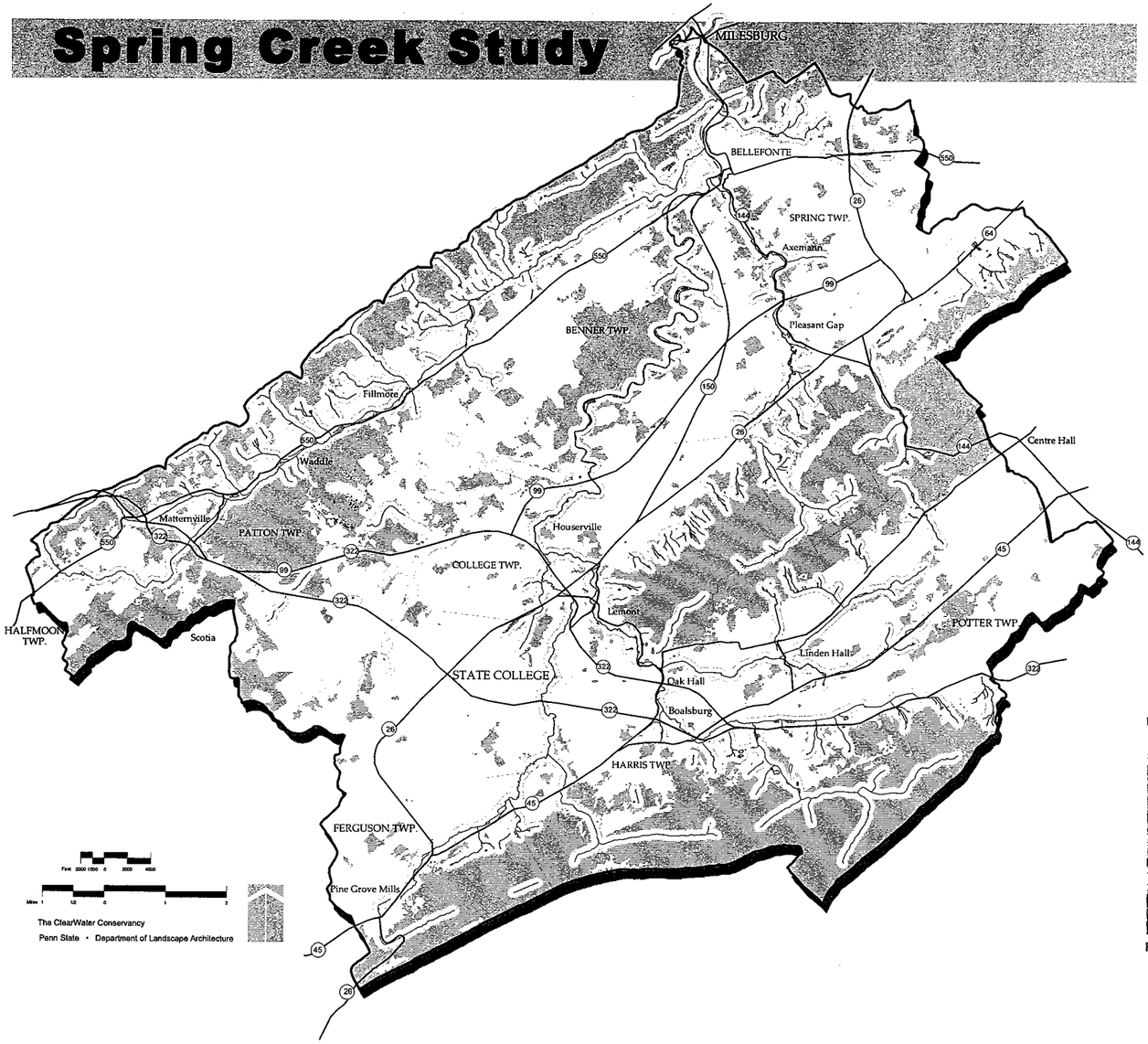
Diffuse valley recharge



Hydrogeologic block diagram

Mountain headwaters stream

Spring Creek Study

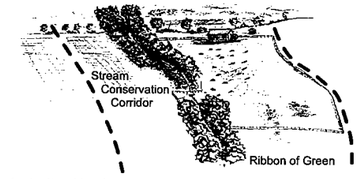


Create "Ribbon of Green"

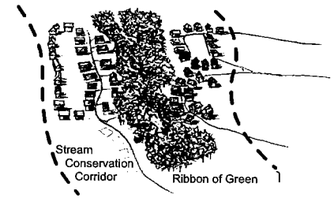
Riparian forest buffer

Establish stream conservation corridors

Stream conservation corridor



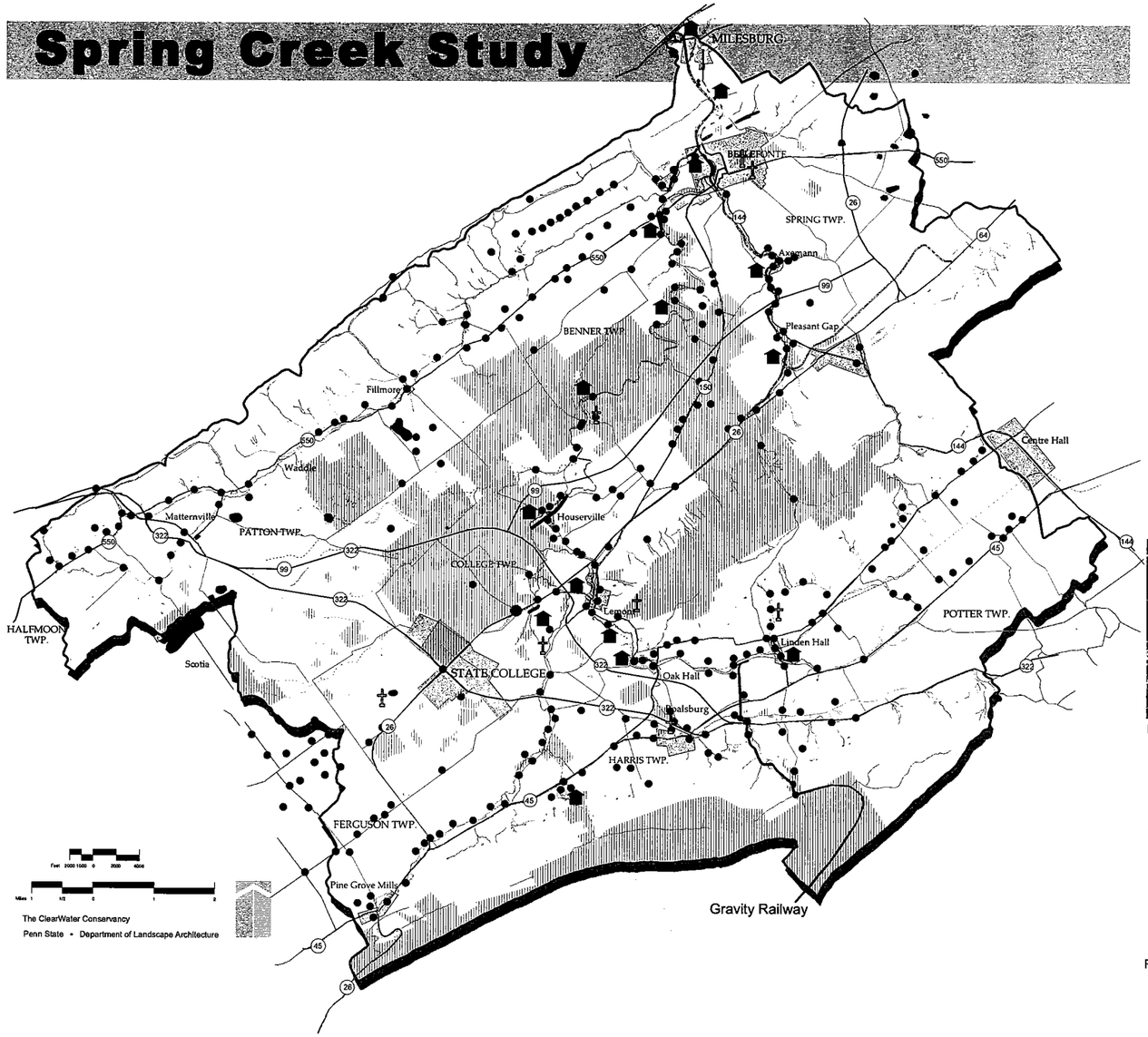
Agricultural landscape



Urban landscape

Riparian forest buffer

Spring Creek Study

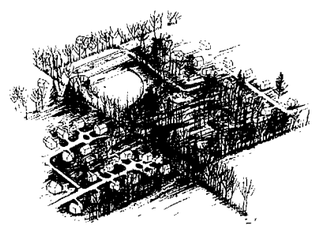


Historic and Cultural Resources

- **Acknowledge and inventory evidence of the past**
- **Develop with history**

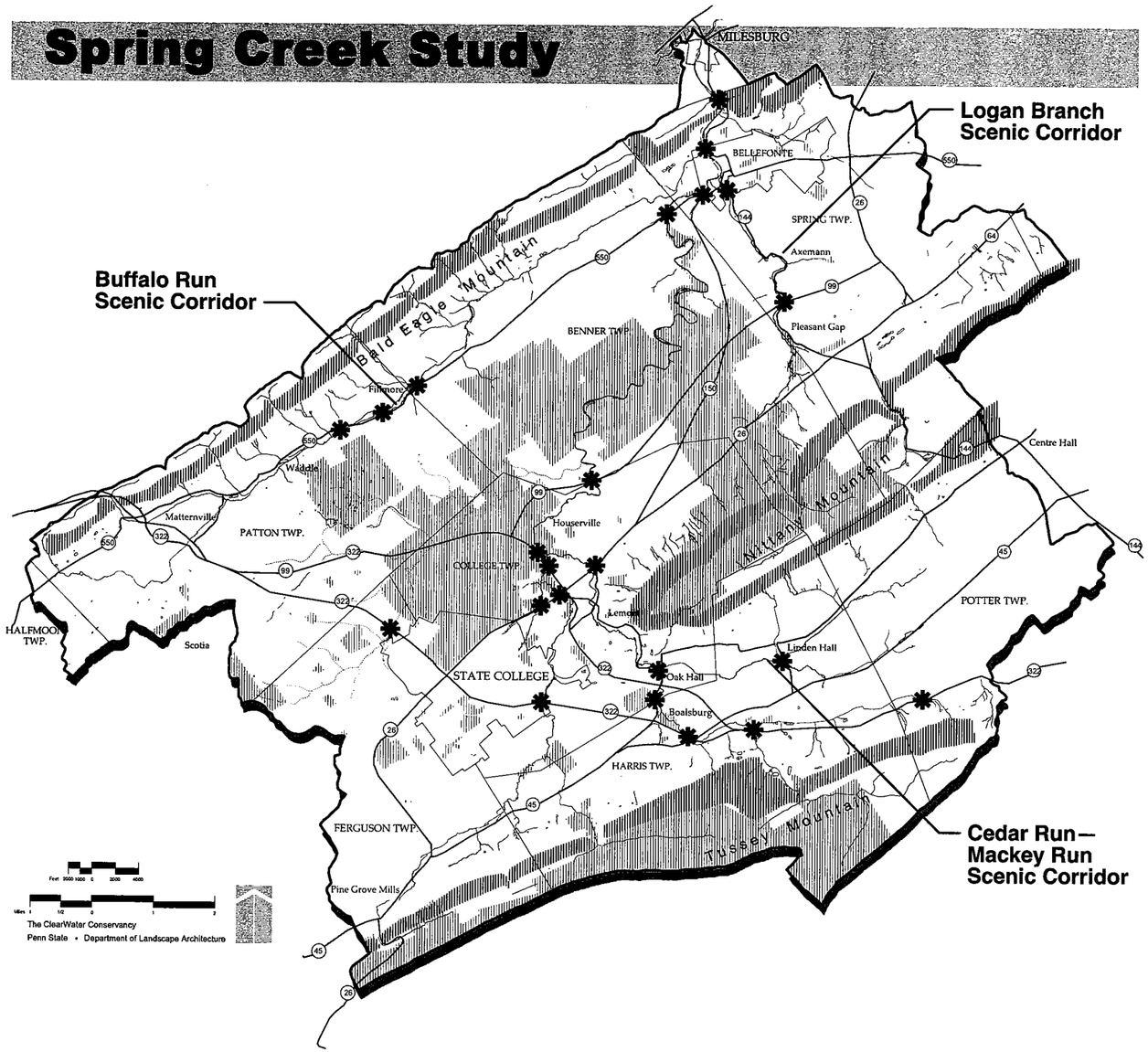
- Navigation canal
- Cemetery
- Location of iron furnace or forge
- Location of grist mill
- Inactive railroad
- Active railroad
- Iron mine
- Mill race
- Historic quarry
- Roads in 1874 Atlas of Centre County
- Structures in historic buildings survey
- Historic town or village

Logging steam locomotive circa 1900



Residential development preserving historic resources

Spring Creek Study



Scenic Resources

Conserve forested mountains

Scenic valley facing slopes

Protect scenic corridors

Scenic corridors

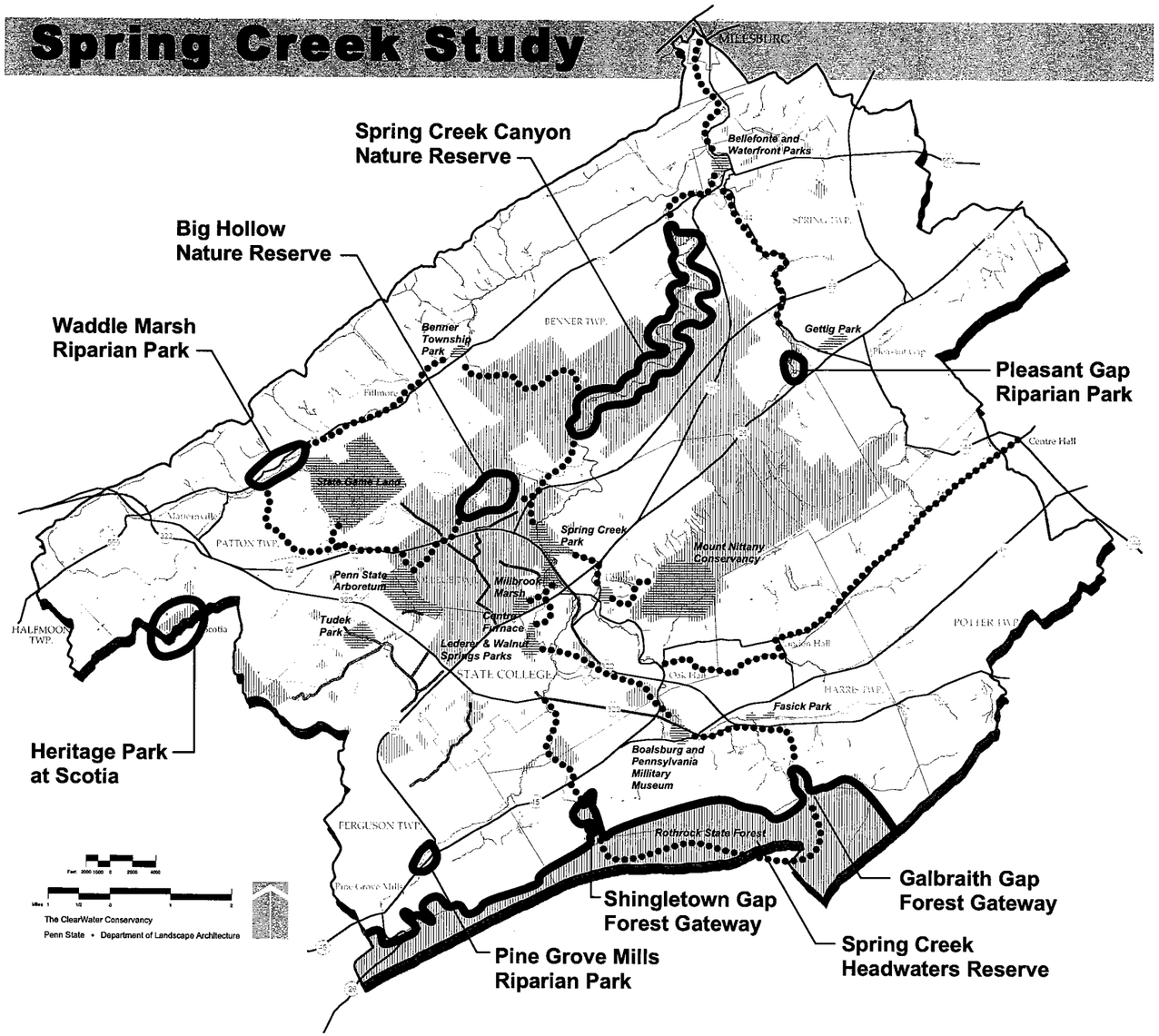
Enhance visual access to Spring Creek and tributaries

Important view to stream

The stream from the road

Scenic valley facing slopes

Spring Creek Study



Recreational Networks

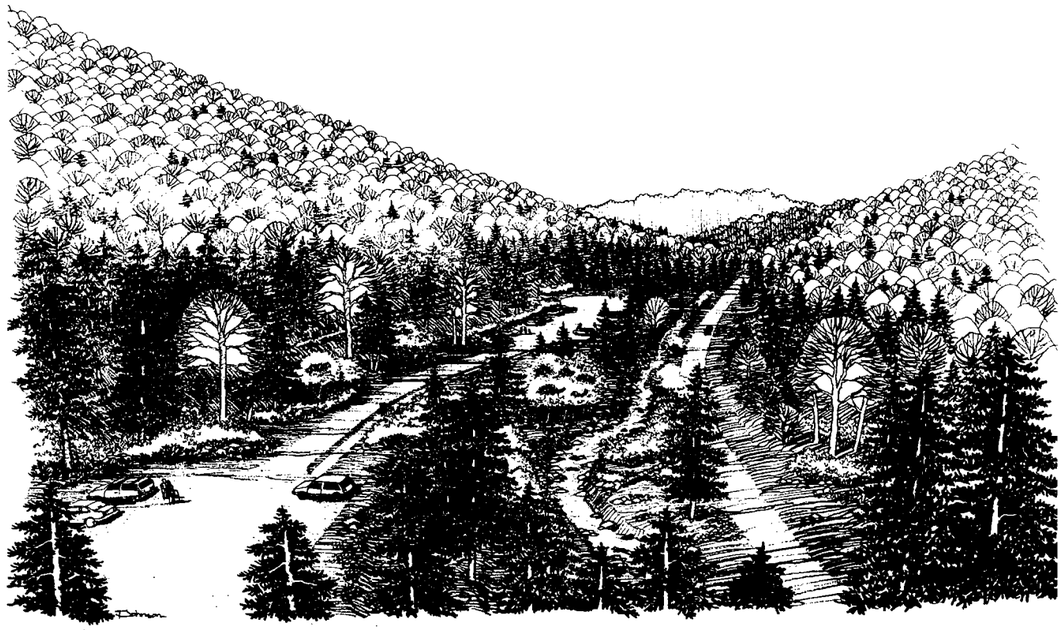
Establish new recreational destinations within and beyond the watershed

- Proposed recreational destinations
- Existing recreational destinations
- Existing public land

Enhance recreational connections

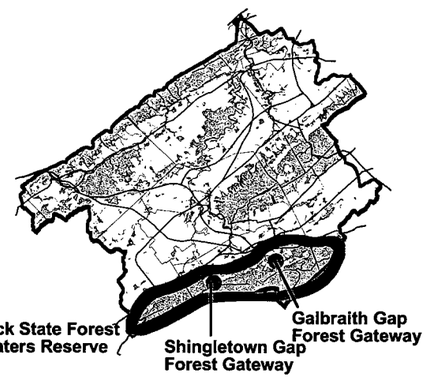
- Proposed recreational access
- Existing bikeways

Spring Creek Study

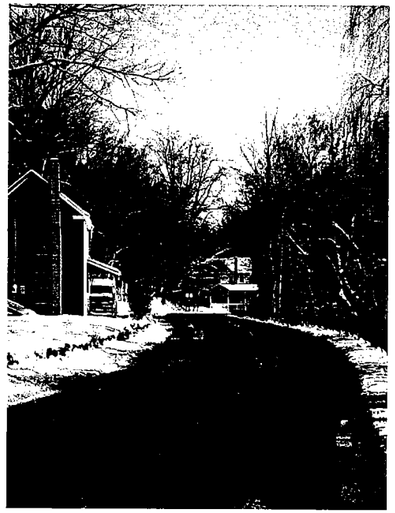


Headwaters Reserve

- Protect headwaters
- Establish forest gateway
- Reveal and interpret history
- Enhance scenic value
- Establish partnerships for conservation



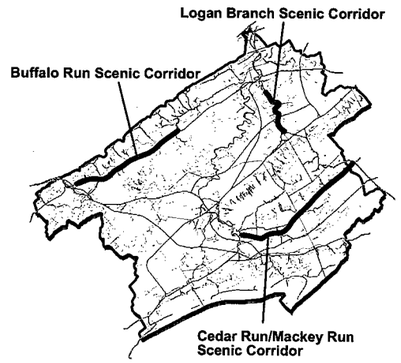
Spring Creek Study



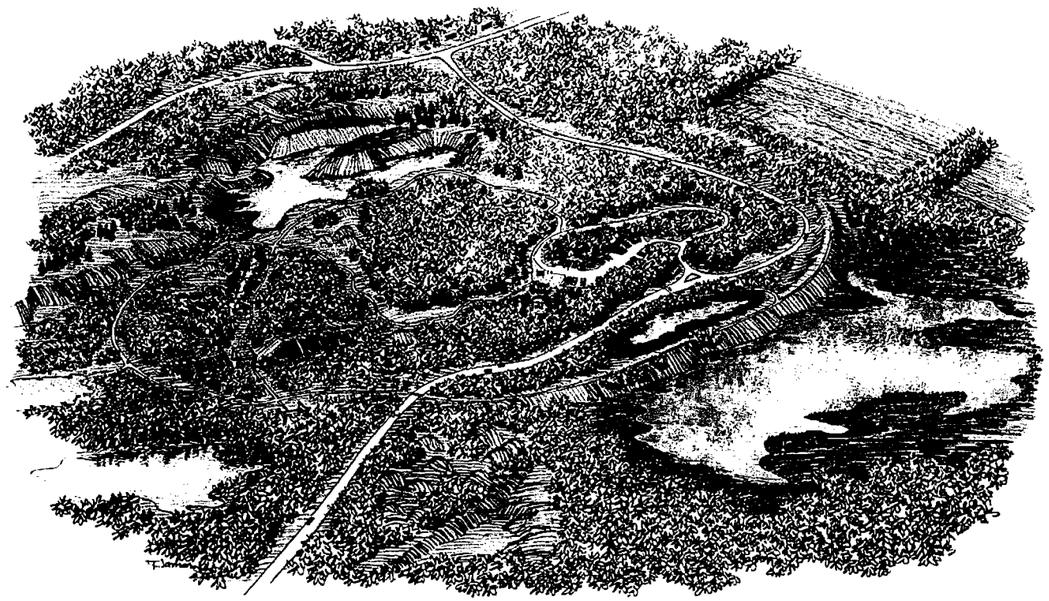
Scenic Corridors

- Value the view from the road
- Protect cultural, natural, and scenic resources
- Preserve historic road alignment
- Establish special management and design standards

Scenic Corridor



Spring Creek Study



Heritage Park at Scotia

- Protect, reveal, and interpret all eras of iron mining history: Centre Furnace era, Andrew Carnegie era and World War II era
- Protect and interpret ecology of the Barrens
- Create recreational destinations