
Preservation of Critical Areas in the Spruce Run Reservoir Watersheds

A Report of the Spruce Run Initiative



**New Jersey
Water Supply Authority**

Original signed pursuant to NJSA
45:14A-1 et seq., by
Daniel J. Van Abs, PhD, PP/AICP
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- **New Jersey Water Supply Authority**
 - Thomas G. Baxter, PE, Executive Director
 - Daniel J. Van Abs, PhD, PP/AICP, Manager, Watershed Protection Programs
- **Township of Bethlehem**
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- **Township of Union**
 - Robert Nargi, Chair, Environmental Commission

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Critical Areas Preservation Plan

A Report of the Spruce Run Initiative

Executive Summary

The New Jersey Water Supply Authority prepared this report in close consultation with the Spruce Run Initiative members – Bethlehem Township, Glen Gardner Borough, High Bridge Borough, Lebanon Township and Union Township – with the assistance of the Morris Land Conservancy working under contract to the Authority. The U.S. Forest Service, as part of its Highlands Regional Study, and the Authority shared the costs of the project. Spruce Run Initiative members seek to preserve critical areas within the watersheds that drain to the Spruce Run Reservoir, New Jersey's third-largest water supply reservoir. Over 60 percent of the watershed area is neither developed nor dedicated open space, and the region is subject to considerable development pressure due to the presence of Interstate Route 78 and State Route 31. Spruce Run Initiative members are concerned about the loss of natural resources, including critical water resources for local and regional use, if critical areas are not preserved through a combination of open space preservation, farmlands preservation and development layout. This report recommends critical areas for all three approaches. However, it does not address questions of appropriate zoning density or development management practices, nor remedial projects to address damages from existing or historic land uses. These issues are being addressed through municipal action and other projects of the Spruce Run Initiative.

Initiative members selected critical areas using existing local priorities and new concepts, supported by GIS information available from Hunterdon County, the Raritan Basin Watershed Management Project and the Authority. They placed the highest priority on criteria to preserve water quality and quantity, followed by avoiding fragmentation of open space and protection of critical habitat for Federal and State threatened and endangered species and prime farmland areas. Superimposed on these criteria were parcel size thresholds. Parcels of 30 acres or more were targeted, where such parcels aggregated to 100 acres or more. These criteria and size thresholds resulted in six "project areas" totaling nearly 13,400 acres, both within and outside the Spruce Run Reservoir watersheds, including over 5300 acres of preserved land within the watersheds. In a few instances, smaller parcels were included in the project areas to create important links, if those parcels had similar critical area attributes. Not all parcels are of equal environmental value, and the plan provides a method to determine which parcels provide the highest value for preservation.

Over 6700 acres are targeted for acquisition, in 240 parcels that include 6335 acres within the watersheds. If all parcels were preserved, total preserved lands would be nearly 11,700 acres, or 43 percent of the total watershed area. An additional 19 percent of the land area is already developed, leaving nearly 40 percent of the watershed area outside of existing development and targeted open space. However, Initiative members recognize that a preservation program will not be completely successful for several reasons, including time constraints and funding. Therefore, the plan recommends that existing municipal ordinances be used to affect design future subdivisions in a manner that maximizes the preservation of critical areas. Where parcels are dominated by critical areas (many are more than 90 percent critical area), this plan recommends

policies to protect the most critical attributes. Finally, the plan recommends improvements to municipal land use ordinances that will help planning boards make better decisions that protect the critical areas. No changes in zoning are recommended regarding allowable uses or densities, as these provisions are beyond the scope of the project. The emphasis is on provisions for the configuration of subdivision lots and the use of critical area information in site design.

The Spruce Run Initiative members will work with Hunterdon County, the Green Acres Program, the Farmland Preservation Program, land trusts and others to implement the recommendations of this report, and will refine the information, methods and findings over time. This project is only one part of a broader initiative to protect and enhance the Reservoir and its tributary streams.

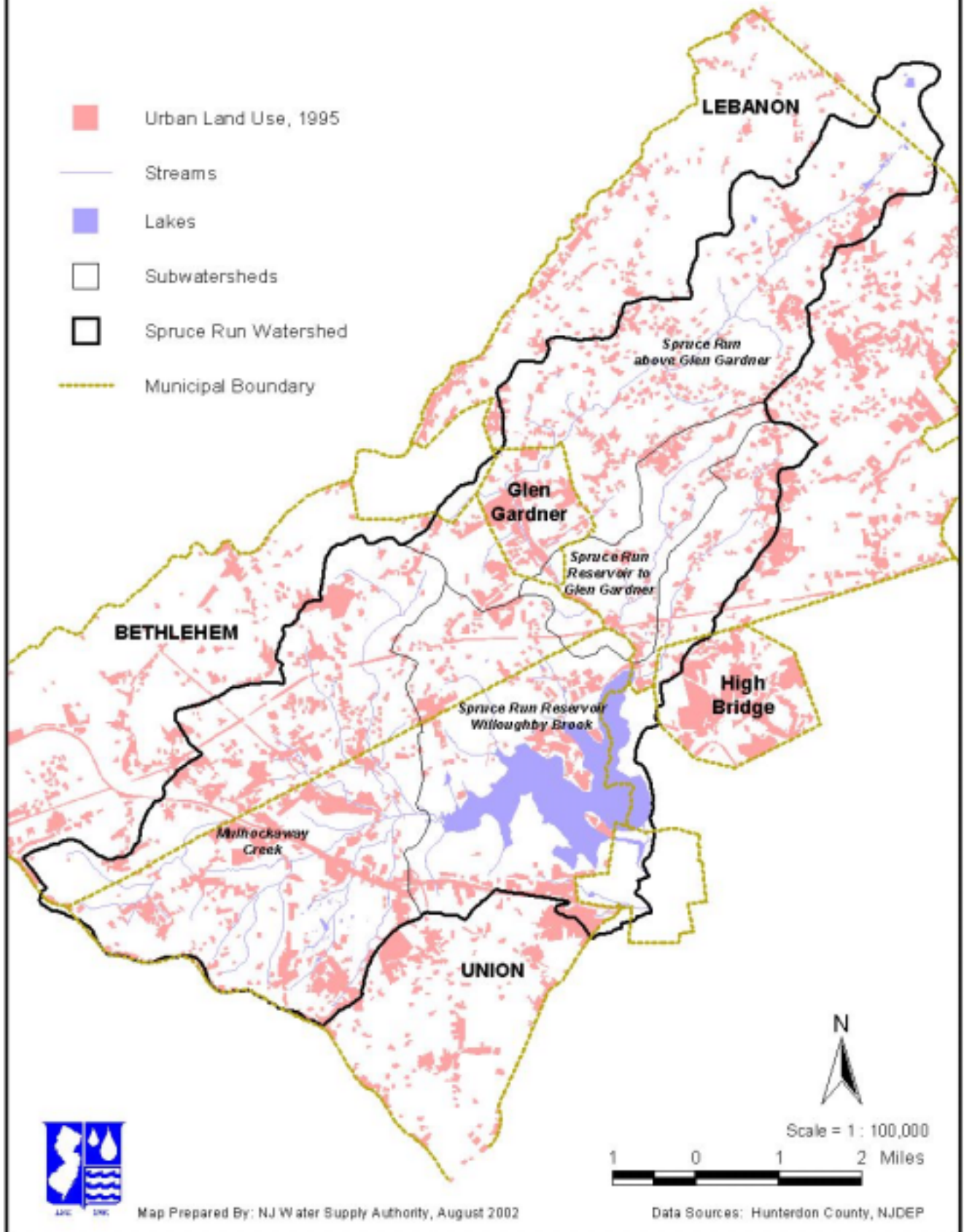
The Spruce Run Initiative

Water supply is one of New Jersey's most critical resources for future prosperity and environmental quality. The 1998-2002 drought period emphasizes this point. Protecting both the quality and quantity of water supplies is a fundamental purpose of watershed management. Protection of supplies is far preferable to treatment of polluted supplies. The watersheds feeding the Spruce Run Reservoir in Central New Jersey are currently among the best in the Raritan River Basin, but are at risk from changing land uses and already are showing signs of stress. Soils in the area often have high infiltration rates, but the underlying rock units are frequently poor aquifers. Without additional protection of its watersheds, reservoir degradation will occur, from both a water yield and water quality perspective. The stream systems themselves will also suffer, losing flow during dry periods and experiencing increased contamination and stormwater runoff. These watersheds (see **Figure 1**) include approximately 40 square miles of land, approximately 19 percent of which was classified as "urban" or developed by the NJ Department of Environmental Protection using 1995/97 data.

The goal of the Spruce Run Reservoir Initiative is to prevent future water quality degradation and the loss of water supply safe yields – in essence, a policy of no degradation to the water resources of the area. The Townships of Bethlehem, Lebanon and Union, and the Boroughs of Glen Gardner and High Bridge have each signed a Memorandum of Understanding with the New Jersey Water Supply Authority (NJWSA) to cooperate in meeting that goal in ways that benefit all partners and result in no loss of home rule. The Initiative members are cooperating in grant applications to achieve some of these purposes, and the NJWSA has also committed annual funding to protect the reservoir. The Spruce Run Initiative received a 2001 award from the Hunterdon Economic Partnership for its work. The members of the Initiative focus on the following activities:

1. Preservation of critical lands in the watersheds that feed the reservoir, wherever possible. Acquisition efforts are underway with the cooperation of the Initiative members, the County of Hunterdon, and the NJDEP Green Acres Program. This report is a key component of the Initiative's open space preservation process.
2. Watershed management activities to control the impacts of new and existing land uses in the area, to preserve and restore water resources:
 - a. Improved local land use ordinances and cooperative development controls with county and State government to minimize the impacts of new development. NJWSA works closely with watershed municipalities to develop master plan updates, draft ordinances and review development proposals. Information from NJWSA's Raritan Basin Watershed Management Project is being used to identify additional needs. NJWSA also has received a NJDEP grant to develop a sophisticated stormwater management model and plan for the Mulhockaway Creek watershed.

Figure 1
Spruce Run Reservoir Watersheds



- b. Implementation of best management practices to reduce the impacts of existing land uses, both suburban and rural. Some stream channels are already damaged due to alteration of riparian areas and excessive stormwater, and both nutrient and bacterial contamination exist in the watershed area. NJWSA is paying for a water quality model covering all streams flowing into the reservoir as a way of identifying key areas for remedial work.

Purpose of the Initiative's Critical Areas Preservation Plan

The New Jersey Water Supply Authority is a State agency, established by law in 1981 to operate the Spruce Run Reservoir, Round Valley Reservoir and Delaware & Raritan Canal as a coordinated water supply resource for Central New Jersey. The Spruce Run Reservoir is a critical part of the Raritan Basin water supply system, which has approximately 225 million gallons per day of safe yield. It is the only reservoir in the Raritan River Basin fed directly and solely by natural stream flow, and therefore is sensitive to changes to the quantity and quality of influent streams of its watershed. This 11 billion gallon reservoir also is unusual in New Jersey, in that the vast majority of its watersheds are neither publicly owned (such as for the Pequannock watershed of Newark) nor developed (such as the watershed of Swimming River Reservoir in Monmouth County). Spruce Run Reservoir is located within the most heavily forested watershed in the Basin. Development is increasing in the area, as suburban development extends along the Interstate 78, Route 31 and Route 22 highway corridors. The municipalities of the area are generally small in population and low in tax rates, and therefore have a limited ability to address the implications of oncoming development. Most of them have taken actions such as zoning based on wastewater and water supply carrying capacity, but they acknowledge there is more to be done.

Nutrient levels in the Spruce Run Reservoir have already reached a level to support eutrophic conditions; additional lawns, septic systems and other nutrient sources can exacerbate this problem. The streams flowing into Spruce Run Reservoir are prototypical Highlands streams, and are all designated FW2-Trout Production (Category 1) by the NJ Department of Environmental Protection. The U.S. Geological Survey, in a study prepared for the Raritan Basin Watershed Management Project, identified the existence of forested lands as the most consistent indicator of high water quality in the Raritan River Basin (Reiser, 2001).

The Spruce Run Initiative members identified an opportunity to work cooperatively on a project that will provide major benefits in public understanding and support, land acquisition targeting, and the coordination of land development activities in ways that increase the ecological value of dedicated open space from clustered development. Local municipalities have been creating zoning based on carrying capacity for septic systems and domestic wells. Several ordinances allow for clustering to preserve natural resources of the development sites such as farmland and forested areas. Union Township, for instance, encourages clustering in some zones, as does Lebanon Township. Bethlehem Township essentially requires clustering in some zones. However, the municipalities lacked the resources to develop more detailed plans for linking dedicated open space to protect contiguous forests, riparian corridors and critical habitats that cross property boundaries. If subdivision layout is left to developers, there is a great potential for creating isolated open space that does not maximize environmental benefits. In addition, municipalities benefit from planning to link public open space with the dedicated open space of cluster developments. Finally, there was almost no planning of this kind across municipal boundaries; most of the streams do cross boundaries.

This project has several critical outcomes aimed at **Protection of Natural Resources** – improved protection of the Spruce Run Reservoir, one of the State’s largest reservoirs, and the many Trout Production streams of the reservoir watersheds:

1. **Preservation Targets** – Identification of the most critical land preservation targets based on the best available scientific information.
2. **Coordinating Development with Preservation** – Identification of methods to coordinate cluster developments in municipalities that allow the technique, to ensure that the resulting dedicated open spaces protect contiguous forests, stream corridors and critical habitats to the greatest extent possible. In addition, identification of critical lands that should be acquired to provide linkages between the dedicated open space of cluster developments.
3. **Improved Ordinances** – Identification of appropriate changes to municipal zoning and development ordinances that will better protect the Highlands natural resources, including forests and wetlands, within the Spruce Run Reservoir watersheds.
4. **Educational Efforts** – Education of the general public and municipal and county planning boards and governing bodies about the process, rationale and results of this planning effort and the Spruce Run Initiative.

Applicable Laws

There are a number of laws that are useful for preservation of critical natural resources through municipal government, as discussed in “Laws and Regulations for Watershed Management,” a report of the Raritan Basin Watershed Management Project. The Municipal Land Use Law provides the basis for municipal regulation of new and changing land uses. There are some additional laws that affect municipal land use regulation in the process of establishing State regulatory programs (e.g., Freshwater Wetlands Protection Act, Flood Hazard Area Control Act). The acts establishing the Green Acres Program, the Farmland Preservation Program, and the Garden State Preservation Trust that oversees them all have applicability to this project. Finally, legislation signed by Governor McGreevey on 29 August 2002 (PL 2002, Chapter 76) mandates that NJDEP develop an open space plan that includes preservation of water resources, and also that the Green Acres Program emphasize protection of open spaces that protect water supplies.

The **Municipal Land Use Law** (NJSA 40:55D-1 et seq.) authorizes planning boards to adopt municipal master plans, which must include a land use element and may include a conservation plan element and a farmland preservation element, among others.

- A land use plan element is a document “(a) taking into account and stating its relationship to [the purpose statement of the master plan], and other master plan elements... and natural conditions, including, but not necessarily limited to, topography, soil conditions, water supply, drainage, flood plain areas, marshes, and woodlands; (b) showing the existing and proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial, industrial, agricultural, recreational, educational and other public and private purposes or combination of purposes; and stating the relationship thereof to the existing and any proposed zone plan and zoning ordinance...”
- Conservation Plan Elements provide for “the preservation, conservation, and utilization of natural resources, including, to the extent appropriate, energy, open space, water supply, forests, soil, marshes, wetlands, harbors, rivers and other waters, fisheries, endangered or threatened species wildlife and other resources, and which systemically analyzes the impact of each other component and element of the master plan on the present and future preservation,

conservation and utilization of those resources.” Open Space plans are often adopted as part of Conservation Elements, and serve as a valuable foundation for Green Acres funding.

- A farmland preservation plan element, if adopted, “shall include: an inventory of farm properties and a map illustrating significant areas of agricultural land; a statement showing that municipal ordinances support and promote agriculture as a business; and a plan for preserving as much farmland as possible in the short term by leveraging monies made available by P.L.1999, c.152 (C.13:8C-1 et al.) through a variety of mechanisms including, but not limited to, utilizing option agreements, installment purchases, and encouraging donations of permanent development easements.” (NJSA 40:55D-28)

The Municipal Land Use Law also authorizes municipal governing bodies to adopt zoning and subdivision/site plan ordinances. Zoning ordinances relate “to the nature and extent of the uses of land and of buildings and structures thereon. Such ordinance shall be adopted after the planning board has adopted the land use plan element and the housing plan element of a master plan, and all of the provisions of such zoning ordinance or any amendment or revision thereto shall either be substantially consistent with the land use plan element and the housing plan element of the master plan...” with certain exceptions (NJSA 40:55D-62). Under a zoning ordinance, municipalities “Regulate the bulk, height, number of stories, orientation, and size of buildings and the other structures; the percentage of lot or development area that may be occupied by structures; lot sizes and dimensions; and for these purposes may specify floor area ratios and other ratios and regulatory techniques governing the intensity of land use...” (NJSA 40:55D-65)

Subdivision/site plan ordinances must address “Suitable size, shape and location for any area reserved for public use...Reservation ... of any open space to be set aside for use and benefit of the residents of planned development, resulting from the application of standards of density or intensity of land use, contained in the zoning ordinance... Regulation of land designated as subject to flooding...Protection of potable water supply reservoirs from pollution or other degradation of water quality resulting from the development or other uses of surrounding land areas, which provisions shall be in accordance with any siting, performance, or other standards or guidelines adopted therefor by the Department of Environmental Protection.”¹ Further, subdivision/site plan ordinances may address “Provisions for standards encouraging and promoting flexibility, and economy in layout and design through the use of planned unit development, planned unit residential development and residential cluster; provided that such standards shall be appropriate to the type of development permitted... Provisions for planned development setting forth how the amount and location of any common open space shall be determined.” (NJSA 40:55D-38 through 40)

PL2002, c.76, as signed by Governor McGreevey, provides “that of the open space preserved, as much of those lands as possible shall protect water resources and preserve adequate habitat and other environmentally sensitive areas; the department shall accord three times the weight to acquisitions of lands that would protect water resources, and two times the weight to acquisitions of lands that would protect flood-prone areas, as those criteria are compared to the other criteria in the priority ranking process.... The Department of Environmental Protection, in consultation with the Office of State Planning in the Department of Community Affairs and the Pinelands Commission, shall prepare and submit to the Governor and the Legislature an Open Space Master Plan, which shall indicate those areas of the State where the acquisition and development of lands by the State for recreation and conservation purposes is planned or is most likely to occur, and those areas of the State where there is a need to protect water resources, including the identification of lands where protection is needed to assure adequate quality and quantity of drinking water supplies in times of drought, and which shall provide a proposed schedule and expenditure plan for those acquisitions and developments for the next reporting period, which shall

¹ No standards or guidelines have been developed by NJDEP for this purpose.

include an explanation of how those acquisitions and developments will be distributed throughout all geographic regions of the State to the maximum extent practicable and feasible.” (Emphasis added.)

The provisions of the Municipal Land Use Law, the Garden State Preservation Trust, the Farmland Preservation Program, the Green Acres Program and the recent PL2002, c.76, when viewed as a whole, provide a solid and compelling justification for a watershed-based preservation plan for this area. This plan can meet both MLUL and PL2002, c.76 provisions as applied to the Spruce Run Reservoir watersheds.

Planning Process

The municipal Initiative members discussed and decided each element of this plan. The Authority and Morris Land Conservancy (working under contract to the Authority) served as staff, planning and technical assistants and facilitators, and conferred between meetings to develop information requested by the Initiative members. Meetings were also held with professional planners for Bethlehem, Lebanon and Union Townships (which contain most of the undeveloped land in the area) to update them on the work and solicit input.

The following tasks were performed for this project. The results will be used in the coming years through the overall Spruce Run Initiative.

- 1) **Partnership Development** – The Authority signed Memoranda of Understanding with the municipalities of Bethlehem, Lebanon and Union Townships and with Glen Gardner and High Bridge Boroughs. This partnership will continue well beyond this grant project.
- 2) **Coordination Process** – The Authority convened regular meetings of the Initiative partners to discuss tasks, review draft work products, assess progress and decide next steps, through the project life and beyond.
- 3) **Assess Available GIS Information** –The Authority compiled a great deal of GIS information for review and assessment. Of special note are products of the Raritan Basin Watershed Management Project (e.g., ground water recharge estimates, riparian area delineations) and the Hunterdon County coverage of all lots and blocks. The partners identified major undeveloped tracts not in public or land trust ownership; significant stream-side tracts or “back yard” areas that would be valuable to protect the streams; and lands with major natural resources such as forests and wetlands that are at risk.
- 4) **Identify Preservation Priorities** – Using the information from the prior task, the partners identified preservation priorities, with full justification for the priorities. Funding for land acquisition can come from many sources, each with its own priorities. With a detailed justification for preservation priorities, it will be possible to better match funding with acquisition targets. In addition, there are many regulatory mechanisms for land preservation, each with its own priorities, legislative mandates and limitations. Matching these legal needs and limits to the justification for preservation priorities will limit the exposure of any municipality to legal challenges. Morris Land Conservancy facilitated these discussions and worked with the Authority to identify useful GIS information. NJWSA developed all GIS analyses.
- 5) **Review Existing Master Plans and Ordinances** – The Initiative members reviewed existing land use control ordinances in detail to determine the extent to which they currently do or do not protect natural resources that typify the Highlands Province and are important to reservoir protection. Morris Land Conservancy conducted this review. This assessment provided a foundation for recommendations regarding desirable improvements to the master plans and ordinances.

- 6) **Identify Challenges and Opportunities** – The partners have identified the key challenges and opportunities needed to implement the preservation priorities. Major **challenges** are: financial constraints; the difficulty of master plan and ordinance changes; landowner disinterest; State requirements for “willing seller” transactions; limited local staff; and the complexity of coordinating regulatory and non-regulatory mechanisms to achieve a “seamless” protection of the watersheds, the reservoir and Highlands resources. **Opportunities** include: ongoing preservation work by municipalities, Hunterdon County, land trusts, the Authority, and others; available municipal powers; Green Acres and farmland preservation funding; municipal and county land acquisition funds; Authority funding for planning and acquisition costs (other than the land purchase itself); and strong public interest in the area.
- 7) **Develop Action Plan** – Tasks 5 and 6 provided the basis for an action plan (this document); a set of strategies to achieve preservation of the priority areas, overcoming the challenges and making best use of the opportunities.
- 8) **Develop Public Education Program** – As part of the action plan, public education efforts will be implemented to assist with: building support for the action plan; encouraging landowners to become involved in the voluntary protection agreements or the donation or sale of land rights; and improving public understanding of the area’s natural resources and the benefits of land conservation in this portion of the Highlands.
- 9) **Plan Adoption** – This report is offered to the municipalities for use as a component of the Conservation Element of their Municipal Master Plans, as authorized by the Municipal Land Use Law. Upon adoption, the report can be used as part of the basis for changing subdivision ordinances, for review of subdivisions and for targeting land preservation efforts. The Authority will also use this report for its land preservation activities, and will encourage Hunterdon County and the NJDEP Green Acres Program to do likewise.

Selection of Criteria for Critical Areas

Initiative members reviewed a wide array of information available on GIS. The planning process revolved around GIS analysis as the best method to understand an area of 40 square miles. As an innovative approach, interactive GIS analysis occurred during each meeting so that the participants could actually see the results of their discussions as the meeting progressed. The Authority used ArcView 3.2 on a laptop computer with a digital projector to perform these analyses. More sophisticated GIS work occurred between meetings. Table 1 describes the GIS information available to the Initiative members.

Table 1 – GIS Information Used at the Spruce Run Initiative Meeting 8 May 2002

• Base Files	• 100 foot Stream Buffer
○ Spruce Run Watershed Boundary	• Land Use/Land Cover
○ Roads	○ 1986 and 1995/97
○ Streams and Lakes	○ Change to Urban, 1986 to 1995/97
○ Municipalities	○ 1995/97 Forests
○ Subwatersheds	○ Forests inside 400 foot Buffer
○ 1995/97 Aerial Photos and Grid	○ 1995/97 Agriculture
• NJDEP “Landscape Project”	○ 1995/97 Urban
○ Forested Wetlands	• Parcels
○ Forests	○ Developed between 1995/97 and 2000
○ Grasslands	○ Land Use/Land Cover by Percent
○ Emergent Wetlands	• Future Sewer Service Areas
• Ground Water Recharge	• State Development & Redevelopment Plan
○ By Recharge (inches)	• Hunterdon County Dedicated Open Space (by type)

○ By Priority	• Agricultural Development Areas
• Steep Slopes	• Zoning
• 100-year Floodplain (FEMA)	○ By Type
• 100 foot Floodplain Buffer	○ Residential by Name
• 1995 Wetlands	• Riparian Areas
• NJDEP Floodprone areas	○ By 1995 Land Use/Land Cover

Based on this information, the participants identified a number of key criteria for preservation of land within the Spruce Run Reservoir watersheds, as listed in Table 2.

Table 2 – Spruce Run Reservoir Watersheds Open Space Preservation Criteria

Water Quality and Quantity – Highest Priority for this project
Streams and lakes
Best ground water recharge areas (greatest recharge efficiency, approximately top 5%)
100 year flood plain plus 100 foot buffer
Riparian areas as defined by the Raritan Basin Watershed Management Project
Forested lands (larger concentrations and those within riparian areas)
Preservation of Wildlife Habitat and Diversity
Critical habitats identified by the NJDEP-Nongame and Endangered Species Program, “Landscape Project” using the habitats for Federal and State endangered and threatened species
Large parcels and clusters of parcels of 30 acres or more that total more than 100 acres
Streams
Dense forests (those with significant core areas, defined as forest cover more than 400 feet in from the outside forest boundary)
Agricultural Preservation
Agricultural Development Areas (generally locations with the best soils and current farming)
Agricultural lands on other prime soils
Preservation of Large Open Spaces and Avoiding Land Cover Fragmentation
Large parcels and clusters of parcels (30 acres or more) that aggregate to more than 100 acres
Proximity to preserved open spaces
Considerations: Zoning; location relative to development; possible greenways and other linkages
Additional Criteria for Consideration (not used in this project)
Scenic and historical resources (would need Hunterdon County data)
Points where roads cross streams, as a local scenic resource
Steep slopes
Opportunities for passive recreation (both trails and larger parks)

The Initiative members reached consensus on all criteria in the first four categories, including an emphasis on protection of water resources above all other criteria. However, they also recognized that other priorities would be useful depending on the funding source and organizational entity involved. For instance, some organizations would focus on protection of threatened and endangered species. The agricultural development boards (County and State) would focus on farmland preservation within Agricultural Development Areas. Recreation departments would focus on lands for playing fields, which would not achieve Initiative purposes. Therefore, these criteria are focused on protection of water resources, with the expectation that other entities, with other priorities, might use these criteria to choose among prospective acquisition targets (i.e., looking for properties that protect endangered species and water resources over properties that just protect endangered species).

The Water Quality and Quantity criteria are for the most part self-explanatory. One exception might be “best ground water recharge areas.” These areas allow the greatest flow of precipitation into the soils, from which it moves either to streams (becoming “base flow”) or to aquifers. Ground water recharge is the foundation for both ecosystem health and development in this area, as all homes rely on ground water. This criterion relates to the lands that have the greatest ground water recharge per year in inches. The threshold was chosen in large part because a natural breaking point in the estimates occurred at approximately 5 percent, and the next breaking point was a much higher percentage. These areas, comprising 5 percent of the total area but with the highest recharge levels, actually recharge much more than 5 percent of the total recharge within the project area. It also should be noted that the method for analysis was the NJ Geological Survey’s GSR-32 method, a statewide method that is considered controversial in this region. Because this project was focused on relative ranking of recharge, rather than the specific rate of recharge, GSR-32 is sufficiently useful for this purpose regardless of its accuracy for each parcel. One modification was in the use of a single climate factor for the full area. The original method used two factors, which resulted in significantly different recharge rates for the same soils in adjoining municipalities. By using a single factor, the results were comparable across the area.

The riparian area criterion is based on work from the Raritan Basin Watershed Management Project. Riparian areas include surface water bodies, and the floodplains, hydric soils and wetlands associated with them. Isolated hydric soils and wetlands are not included. Finally, a wildlife corridor is included on both sides of streams, at 150 feet for first and second order streams and 300 feet for third and higher order streams.

The Preservation of Wildlife Habitat and Diversity criteria focus on several aspects of Highlands ecosystems that have long been a focus of preservation efforts. The critical habitats for threatened and endangered species were taken from a “Landscape Project” report by NJDEP’s Nongame and Endangered Species program, which focuses on vertebrate species and the habitats that support them. The Initiative participants decided to focus on the top three habitat priorities (Federal threatened and endangered species, State endangered species, State threatened species) and not the final two categories where suitable habitat exists but the species have not been sighted. The criterion for dense forests focuses on the special ecological role that such forest areas serve for bird and other species that cannot tolerate invasive species. Included are forest polygons with areas more than 400 feet from the forest edge.

The criteria for Preservation of Large Open Spaces and Avoiding Land Cover Fragmentation included one criterion that also was included under wildlife habitat and diversity – parcels of 100 acres or more, parcels of 30 acres or more that are contiguous to 100+ acre parcels, and contiguous parcels of 30+ acres that in aggregate are more than 100 acres. The major purpose here was to recognize that these parcels and aggregates provide the greatest opportunity for cost-effective preservation, contiguous habitats, greenways, wildlife corridors, etc. As it turns out, they are also closely identified with the water resources, wildlife and agricultural criteria. Proximity to existing preserved open space was also included as a factor, to create large aggregate areas of green space and greenways.

Other criteria were considered, but not adopted due to a lack of detailed information (e.g., steep slopes, due to poor resolution in available slope data), complexity of analysis (e.g., scenic resources including both large scale vistas and small scale opportunities such as stream crossings), and lack of connection to the project purpose (e.g., historical resources and recreation). The Initiative members recognized that other efforts will likely focus on these criteria, and that some of these criteria would benefit indirectly from Spruce Run Initiative preservation efforts.

The Initiative members reviewed these criteria several times, refining them and developing rules for exceptions (e.g., parcels smaller than 30 acres that would provide a linkage between two clusters of properties). The resulting criteria were approved by consensus. **The environmental criteria**

are: Riparian areas; highest ground water recharge; dense forest; critical habitats for threatened and endangered species; prime agricultural soils; and flood plain buffer. The 30 acre parcel size and 100 acre aggregate area size are then used to refine the focus and define project areas.

Critical Area Results

Based on the water resource, wildlife and agricultural criteria discussed above, the Authority developed GIS coverages of the resulting critical areas and presented the results in three ways. First, a composite map shows which areas are included within any of the criteria (see **Figure 2**). The true scope of these critical areas is shown in this map. A great deal of the entire watershed is included within one or more critical area, showing the importance of land preservation efforts and sound development management. The region has a threaded pattern of riparian areas throughout the area, pockets of exceptional ground water recharge areas, significant areas of dense forests (especially along the ridgelines to the north of Spruce Run Reservoir and in northern Lebanon Township) and a few areas with prime farmland soils (especially in the Mulhockaway Creek subwatershed). A comparison of existing, dedicated open space to the critical areas shows that nearly all existing parkland is covered by critical areas.

Second, a detailed map shows lands based on the collection of criteria that qualify that land for inclusion (see example in **Figure 3**). For example, one strip of land (which could be part of one or more parcels) could be included because it has both critical wildlife habitat and riparian area; the next one over could have both of those attributes plus dense forest; while a third land area could be included only due to critical habitat. Third, the individual criteria are all available as individual GIS maps (see example in **Figure 4**).

Identification of Project Areas

The next step in the planning process involved applying the parcel size and fragmentation criteria to the critical areas maps. **Figure 5** shows the results, where six “project areas” were identified using the criteria. The municipal representatives named these areas according to locally recognizable locations:

- Upper Spruce Run/Mt. Lebanon – Lebanon Twp
- Mt. Kipp/Rocky Run/Voorhees Park – Lebanon Twp
- Spruce Run Reservoir Area – Union Twp
- Musconetcong Mountain – Bethlehem Twp
- Hoffmann Farms Area – Union Twp
- Mulhockaway Headwaters – Union/Bethlehem Twp

All six areas are greater than 100 acres in size, and in fact average over 1000 acres. Three are linked to and incorporate major areas of existing preserved open space – Hoffmann Farms, Spruce Run Reservoir, and Voorhees State Park. In two areas, parcels of slightly less than 30 acres were included because they provided valuable links between other parcels in the project areas and contained similar environmental resources.

Figure 2
Composite of Critical Areas

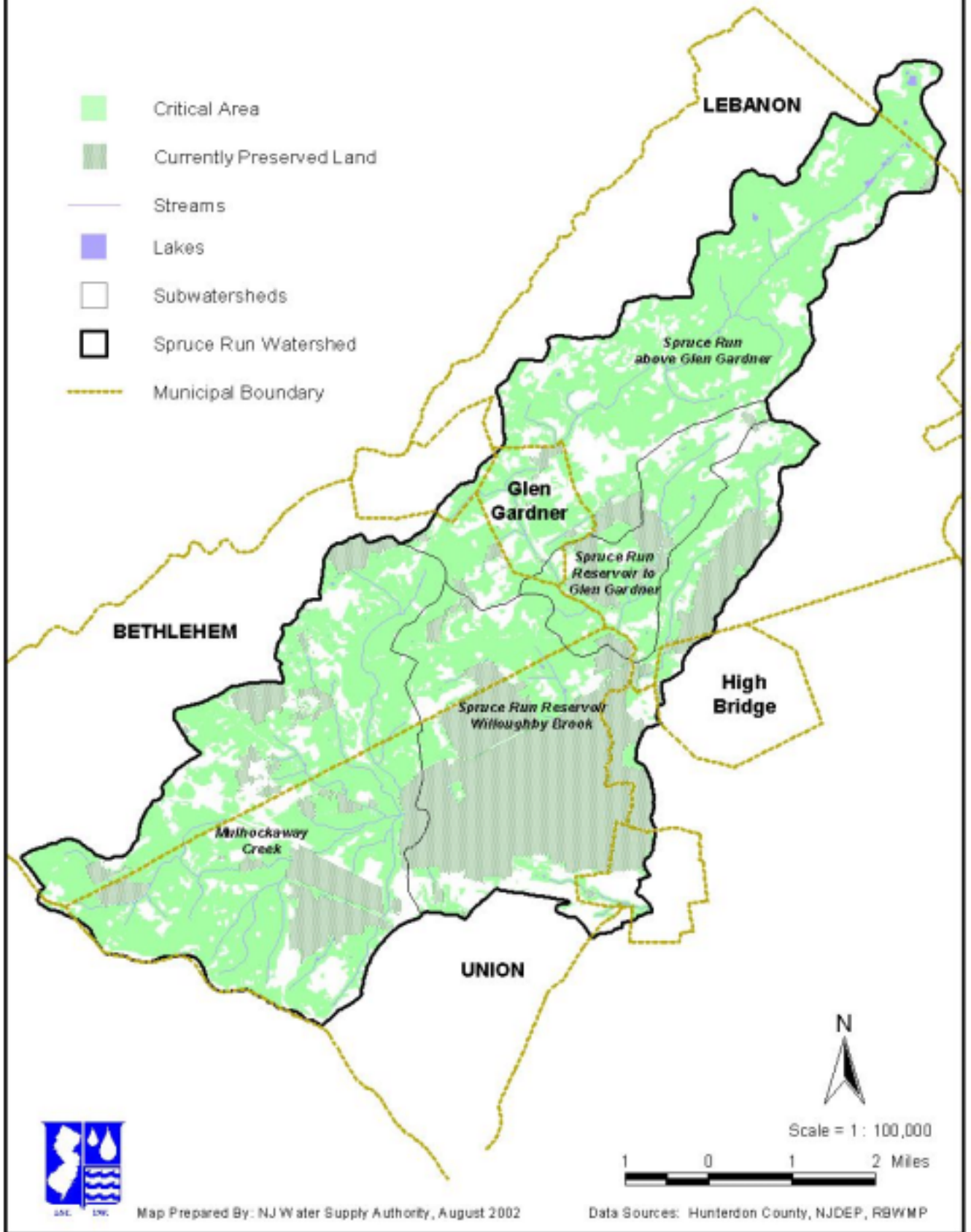


Figure 3
Example of Detailed Critical Areas

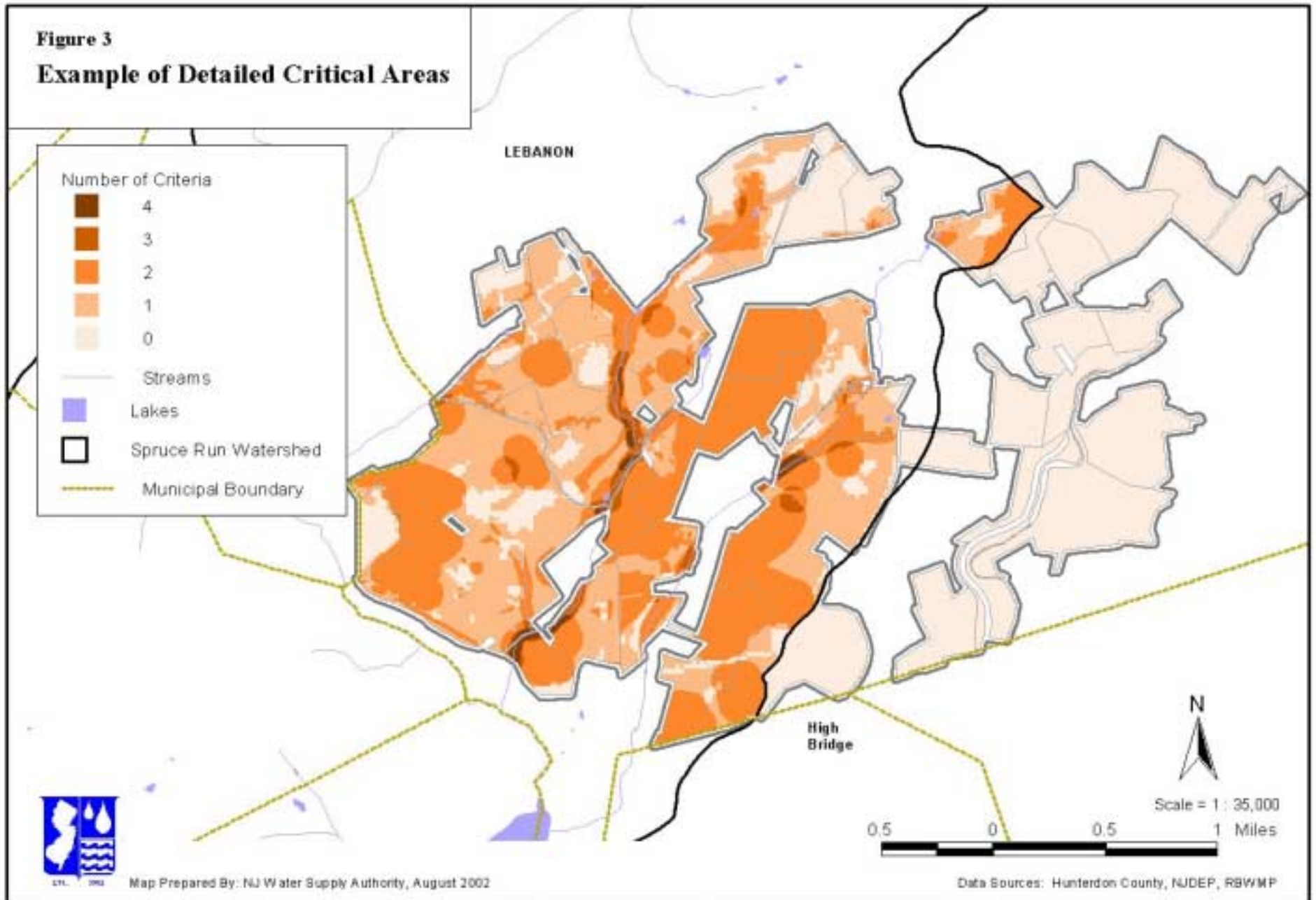


Figure 4
Riparian Area Criterion

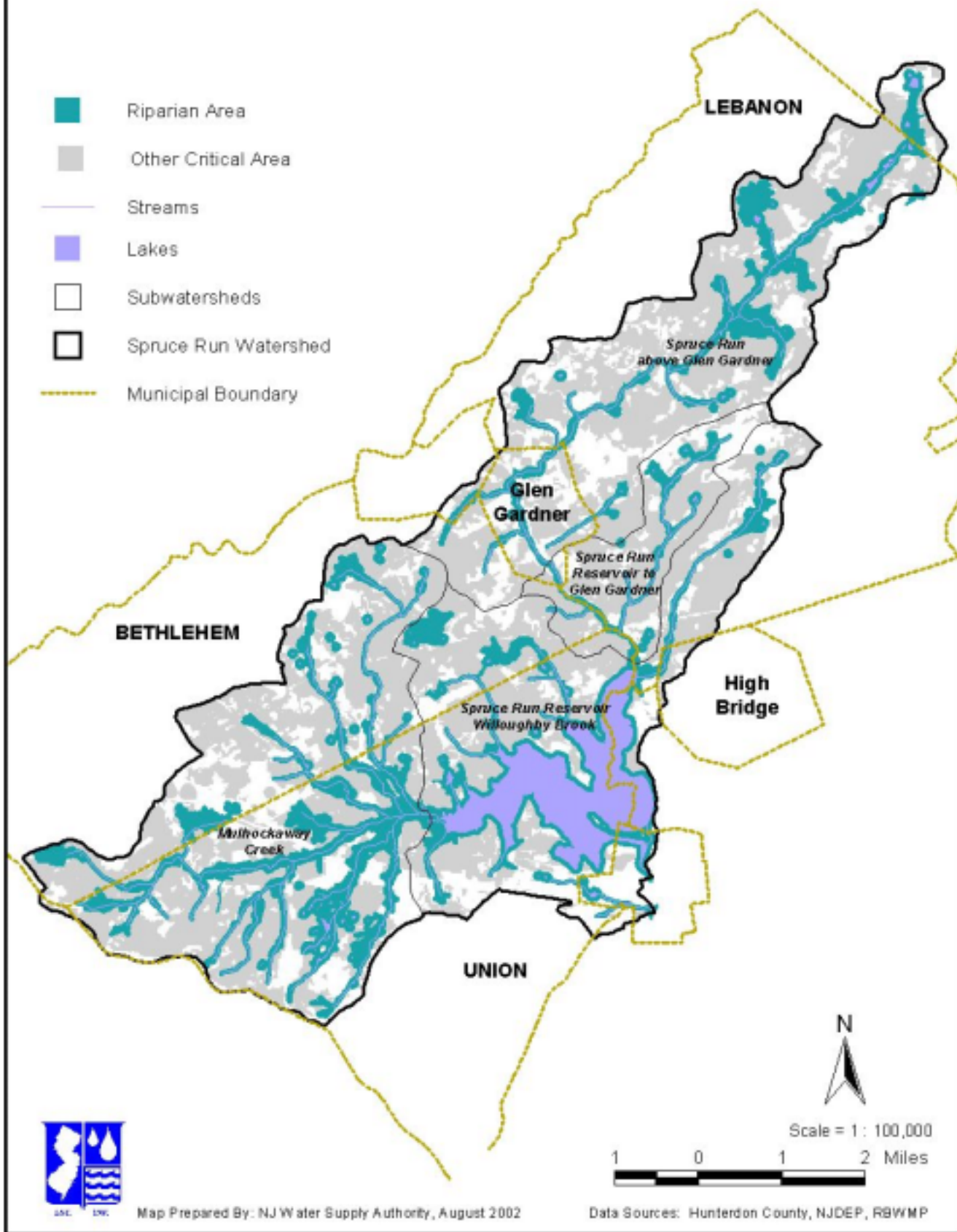
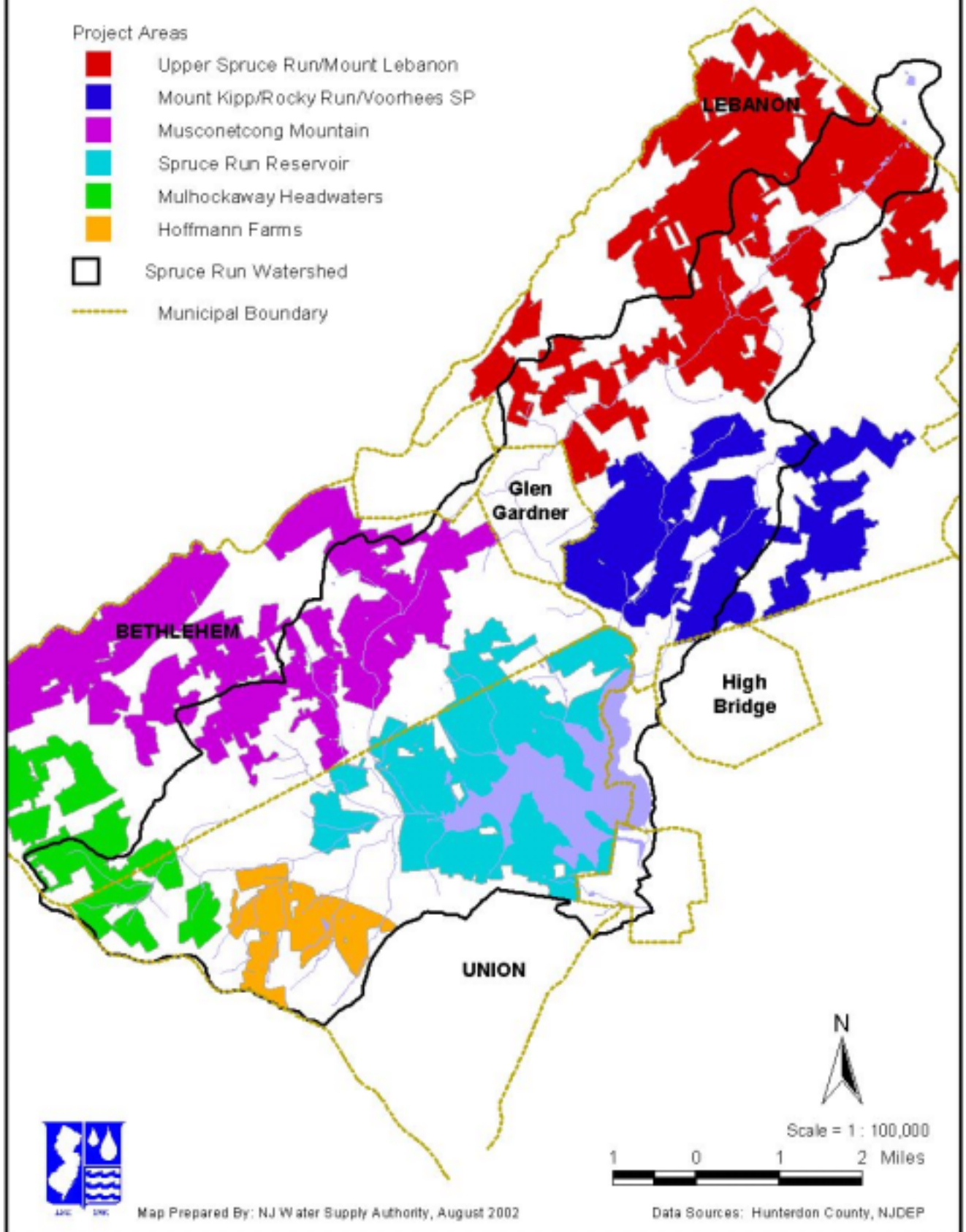


Figure 5
Spruce Run Preservation Project Areas



The project areas total approximately 13,400 acres, of which 12,415 acres are within the watersheds (46 percent of the total watershed area of 27,147 acres). Current preserved areas total 5365 acres, or 19.8 percent of the total watershed area. If every parcel targeted for preservation were in fact preserved, 43 percent of the total watershed area would be preserved. As of 1995, approximately 19 percent of the area was developed in some manner,² leaving approximately 38 percent that was not developed as of 1995 and would not be targeted for preservation by the Spruce Run Initiative. It can be anticipated that some of the currently undeveloped land would remain in some form of dedicated open space due to: acquisition of smaller properties through other efforts; creation of common open space in subdivisions; voluntary donation of easements and property in smaller parcels; farmland conservation easements in Agricultural Development Areas outside of the project areas; and acquisition for active recreational areas. However, not all of these purposes would maintain the critical areas on those properties.

The parcels in the project areas were then subject to two types of analysis. First, each parcel was assessed to determine the extent to which the parcel was included in critical areas, by percent. **Figure 6** shows the results of this analysis. It is important to note that some of the parcels on the watershed borders extend into the neighboring watersheds. The GIS analysis shows the percent of each total property that is within the critical area of the Spruce Run Initiative area – properties that extend across borders may show artificially low scores. For this reason and others, the detailed critical areas map was then revised to show the number of criteria in each portion of each parcel, so that it is easy to determine which parts of a parcel are included in anywhere from one to four of the six criteria.

To aid in the next step, the parcel (lot) boundaries and roads from Hunterdon County GIS were available to Initiative members, along with NJDEP's aerial photographs from 1995/97 (see example in **Figure 7**). Using the critical area analyses and these information tools, it was possible for local representatives to understand the preservation priorities, opportunities for creating large nodes and corridors of open space, opportunities for using open space zoning and other subdivision tools to protect parts of lots that were critical areas, and how these general ideas actually fit into the local landscape.

Protection Methods: Preservation versus Development Controls

There are several important methods for preserving the critical areas defined above. Each has its strengths and weaknesses, but can be combined into a broad program that tailors a method to each lot, based on the nature of the critical areas, availability of funding, and whether the property is proposed for development. This plan does not recommend “reactive acquisition” (i.e., the pursuit of property once development is proposed) for two reasons: these properties are usually owned by or under contract to the developer, making acquisition very difficult; and the costs are usually higher than proactive acquisition efforts that seek willing sellers. The most applicable methods are:

- **Green Acres Program** – The Garden State Preservation Trust and NJ Department of Environmental Protection are responsible for this program, which has three relevant components. The NJDEP directly purchases land for preservation. NJDEP also provides matching grants for counties and municipalities to purchase open space. Finally, NJDEP provides matching grants to non-profit land trusts. The Green Acres Program is actively involved in the Spruce Run Initiative area, and has also committed \$2 million in State acquisition funds to the NJ Water Supply Authority, which uses its own funds to cover the “soft costs” of acquisition (e.g., staffing, surveys, contract development, appraisals, environmental

² Development and development approvals since 1995 have changed these values slightly, comprising less than 20 sites.

Figure 6
Parcels within Project Areas by Percent Critical Area

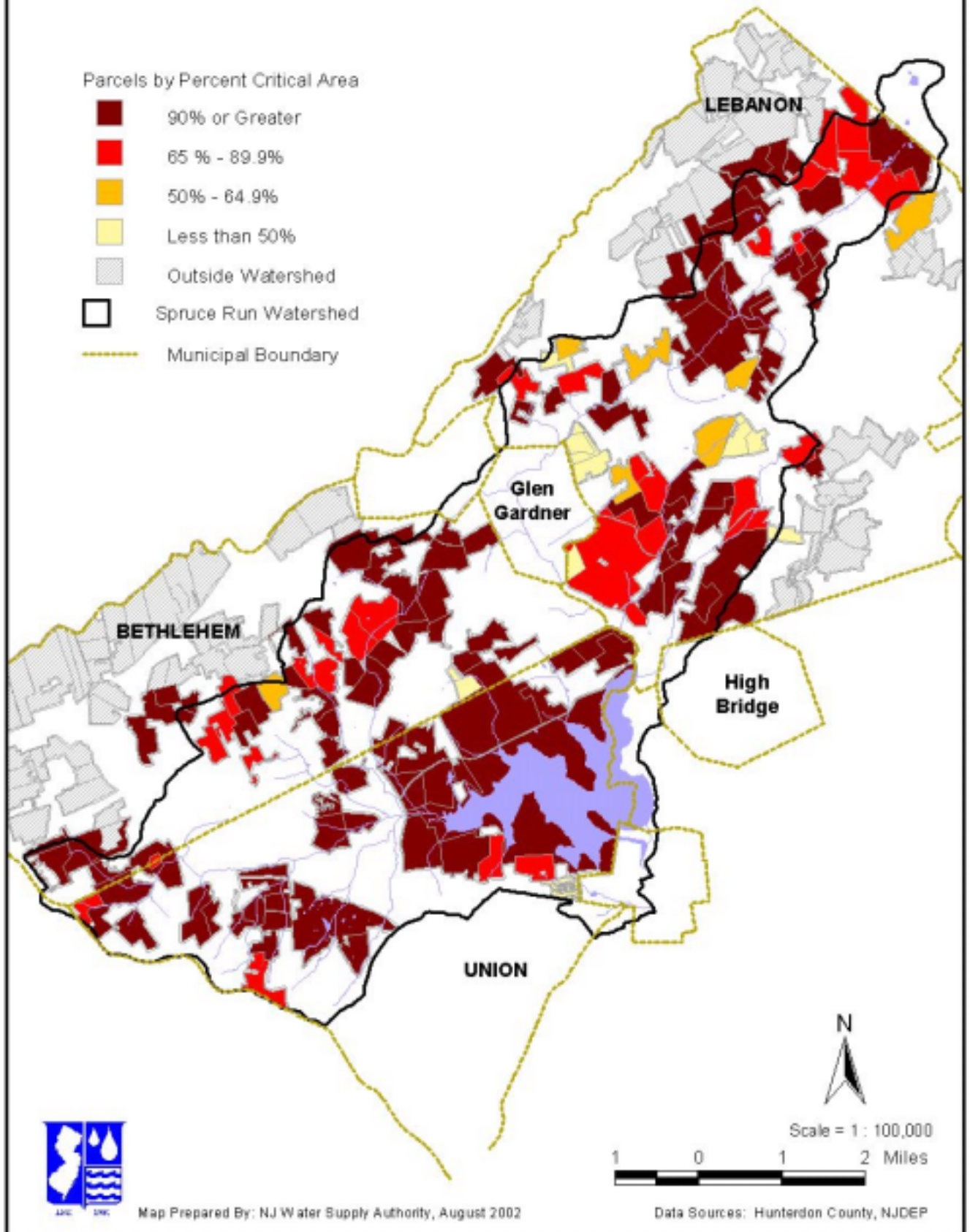
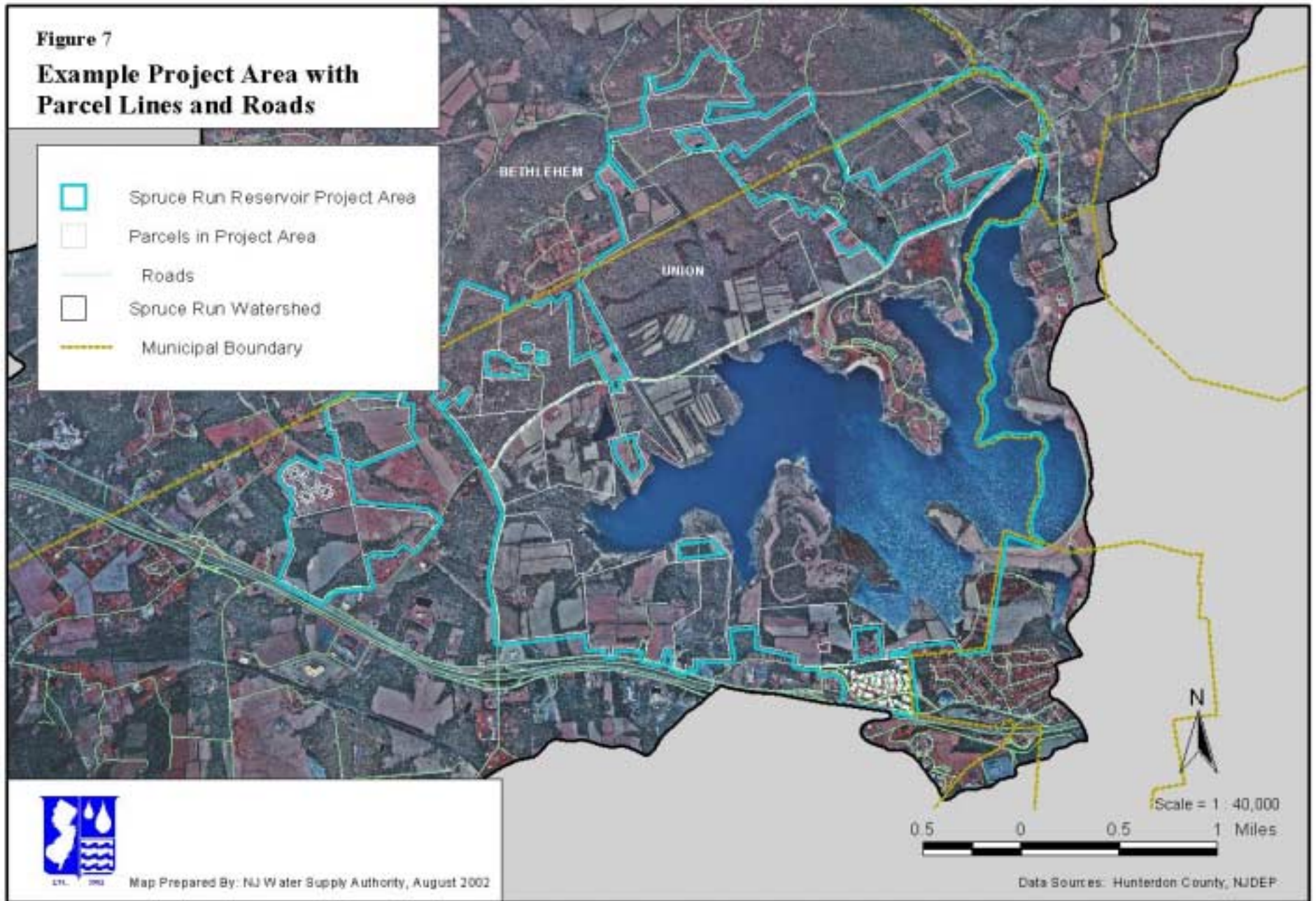


Figure 7

Example Project Area with Parcel Lines and Roads



assessments). The State acquisition program is primarily focused on preservation of natural resources, and can include the purchase of both entire properties (the norm) and conservation easements (usually with right of public access). The local grants program covers both natural resource preservation and recreational area purchases; Green Acres provides up to 50% of the acquisition cost, with the rest coming from local matching funds.

- **State Farmland Preservation Program** – The Garden State Preservation Trust and the NJ Department of Agriculture-State Agricultural Development Board (SADB) operate a program that purchases development rights from farmland owners. Like the Green Acres Program, the SADB can purchase farmland development rights directly or can contribute matching funds to local programs, in this case County Agricultural Development Boards (CADB). Unlike the Green Acres Program, these purchases must be targeted to specific areas – Agricultural Development Areas designated by the CADBs in consultation with municipalities. The SADB also can purchase farms in fee simple, where the current owner has no interest in continuing the farming operation, and then sells the farm (without development rights) to a private buyer.
- **County and Municipal Open Space Funds** – Hunterdon County and all five municipalities in the Initiative area have dedicated open space taxes as part of their property tax programs. These funds are available for open space purchases in the area, both for farmland preservation and natural resources preservation. In many if not most cases, the county and municipal funds are used to match Green Acres grants, allowing the local programs to stretch their own resources.
- **Environmental Infrastructure Financing Program** – Low-interest loans are available for the purchase of lands critical to the protection of water quality, through a combination of Clean Water Act funds from NJDEP and Environmental Infrastructure Trust market-rate loans. The result is loans at half of the market rate, which can be repaid using open space funds, etc. Interim financing is available for projects that are pre-approved for loans, where the loans have not yet achieved Legislature approval.
- **Non-profit Land Trusts** – Several organizations, such as the Hunterdon Land Trust Alliance and the New Jersey Conservation Foundation, have been active within the area. These organizations often have a combination of internal resources (derived from members, foundations and other donors) and Green Acres grants.
- **Voluntary Preservation** – Landowners can donate their development rights or the land itself to a land trust or government to ensure that the land is not developed at a later date. The donation is made part of a deed restriction; the landowner often can gain a tax deduction for the donated easement and may be able to receive a lower tax assessment. One advantage to this easement approach (from the landowner's perspective) is that a conservation easement of this type does not require public access, unlike the sale of conservation easements to Green Acres.
- **Development Restrictions** – Municipalities can use their zoning and subdivision ordinances to preserve critical areas up to a point. Development of some critical areas is well recognized as a potential threat to public health, safety and welfare, and State law authorizes municipalities to impose controls for the protection of those areas (e.g., flood plains, floodways). Freshwater wetlands, on the other hand, are regulated by the State and a municipality has no authority to regulate such wetlands per se. Finally, some critical areas are commonly recognized as important, but a balancing of public and private harm is necessary to determine the extent to which a municipal zoning or subdivision ordinance can mandate their preservation. Non-traditional techniques are available that can reduce the conflict with development expectations. Several municipalities in the area allow, recommend or essentially require that development within a subdivision be sited in a manner that protects critical areas

while allowing the same development density of a “normal” subdivision. These techniques have various names, such as:

- Clustering (usually where development is concentrated in one area, with one or more undeveloped lots being created),
- Lot-size averaging (where some lots are smaller and others larger than the nominal zoning density, but the entire site is contained with lots that are developed), and
- Open space subdivisions (where developed lots are smaller than the nominal zoning density and the remainder of the land is placed in common open space lots, while site design maximizes both natural resource preservation and lot value, rather than clustering lots into one part of the site or conserving only the unbuildable portions of the site).

Application of Protection Methods to Project Areas

A preservation plan has been developed for each of the six project areas. The general approach is to allocate each parcel within a project area as follows:

- **Highest Value for Preservation** – A parcel of 30+ acres with 90+ percent critical area, where the parcel fits well into a large cluster of targeted parcels or would be a key link in an existing or proposed greenway or wildlife corridor. Also a parcel of 30+ acres with 65+ percent critical area, if that parcel is an important link between other top priority parcels or preserved open space or is essentially surrounded by such parcels. In some cases, parcels with 50 – 65 percent critical area are included, if they extend beyond the watershed boundary but the portion within the watershed has very dense critical area coverage. In these cases, the percent critical area may be artificially low due to the GIS mapping process. Finally, a few parcels of less than 30 acres are included as top priority because they have similar attributes (in terms of percent critical area) and serve as important links between other top priority parcels.
- **High Value for Preservation** – A parcel of 30+ acres with 65+ percent critical area, unless the parcel qualifies for top priority as defined above. Also a parcel of 30+ acres with less than 65 percent critical area where the configuration of critical areas does not allow for site development in a manner that protects the critical areas.
- **Preservation by Subdivision Control** – A parcel of 30+ acres within a project area that has less than 65 percent critical area, where the configuration of the critical area would allow site development (using clustering, open space design or lot size averaging) that does not unduly infringe upon the critical areas.
- **Existing Dedicated Open Space** – The plan assumes that all existing, dedicated open space will remain in that condition. It is critically important that preserved farmland soils be maintained for active agriculture, rather than being buried under impervious surfaces. Likewise, preserved lands with natural habitats such as forests should not be diverted to uses that involve significant impervious surfaces or loss of habitat value. Not only do such losses degrade watershed values, they also can reduce public support for further preservation.

These results are available as confidential information to the municipalities for use by their open space programs regarding acquisition negotiations. However, these maps address specific acquisition priorities for specific parcels, and therefore are not included in this report.

Responding to Development of Targeted Preservation Areas

One final issue is critical to project success. Any State acquisition using Green Acres funds must be on a “willing seller” basis – eminent domain powers of the State of New Jersey may not be used. Municipalities and counties can use eminent domain with Green Acres funds, but condemnation of land can be procedurally, politically and financially difficult. A key issue is how a municipality should guide site design to minimize the loss of critical areas if a parcel identified as a highest or high value for acquisition is developed instead. A parcel with 90+ percent critical area cannot be developed under any existing municipal ordinance without some loss of critical area. Initiative members recognized that the answers depend on the types of critical areas involved and their relationship to surrounding parcels and critical areas. The following guidelines are recommended to municipalities for regulation of development:

- 1) In all cases, protection of riparian areas, flood plains and high ground water recharge areas should be maintained. If so much of the parcel is contained within these areas that full protection is not possible, some loss of ground water recharge area can be allowed if the development provides for alternative recharge.
- 2) Wherever possible, the preserved portions of developed subdivisions should link to critical areas in surrounding parcels, so that contiguous habitat, wildlife corridors and greenway opportunities are preserved despite the partial loss of critical areas.
- 3) Within Agricultural Development Areas, the protection of prime agricultural soils from loss to site development should have priority over the protection of forest cover. Northern Hunterdon County has few Agricultural Development Areas, and these areas tend to be important both for the agricultural industry and for grassland bird species. The sole exception is where the forest cover within the parcel is part of a dense forest area – such dense forest areas are rapidly being lost, with international impacts on migratory birds.
- 4) Outside of Agricultural Development Areas, forest cover should have priority over the protection of prime agricultural soils when a preservation target goes to development. In these cases, the prime agricultural soils tend to be small in scale, and the farms are often small, isolated or of limited production capacity. Therefore, protection of forests is more important.
- 5) Where a parcel is mostly covered by critical habitat for threatened and endangered species, greater preference should be given to parts of the parcel that meet multiple critical area criteria (e.g., critical habitat plus other critical area criteria). If all such areas can be preserved within the development, then priority should go to remaining areas that provide habitat for Federal threatened and endangered species, followed by State endangered species and then State threatened species.

Overview of Final Results by Project Area

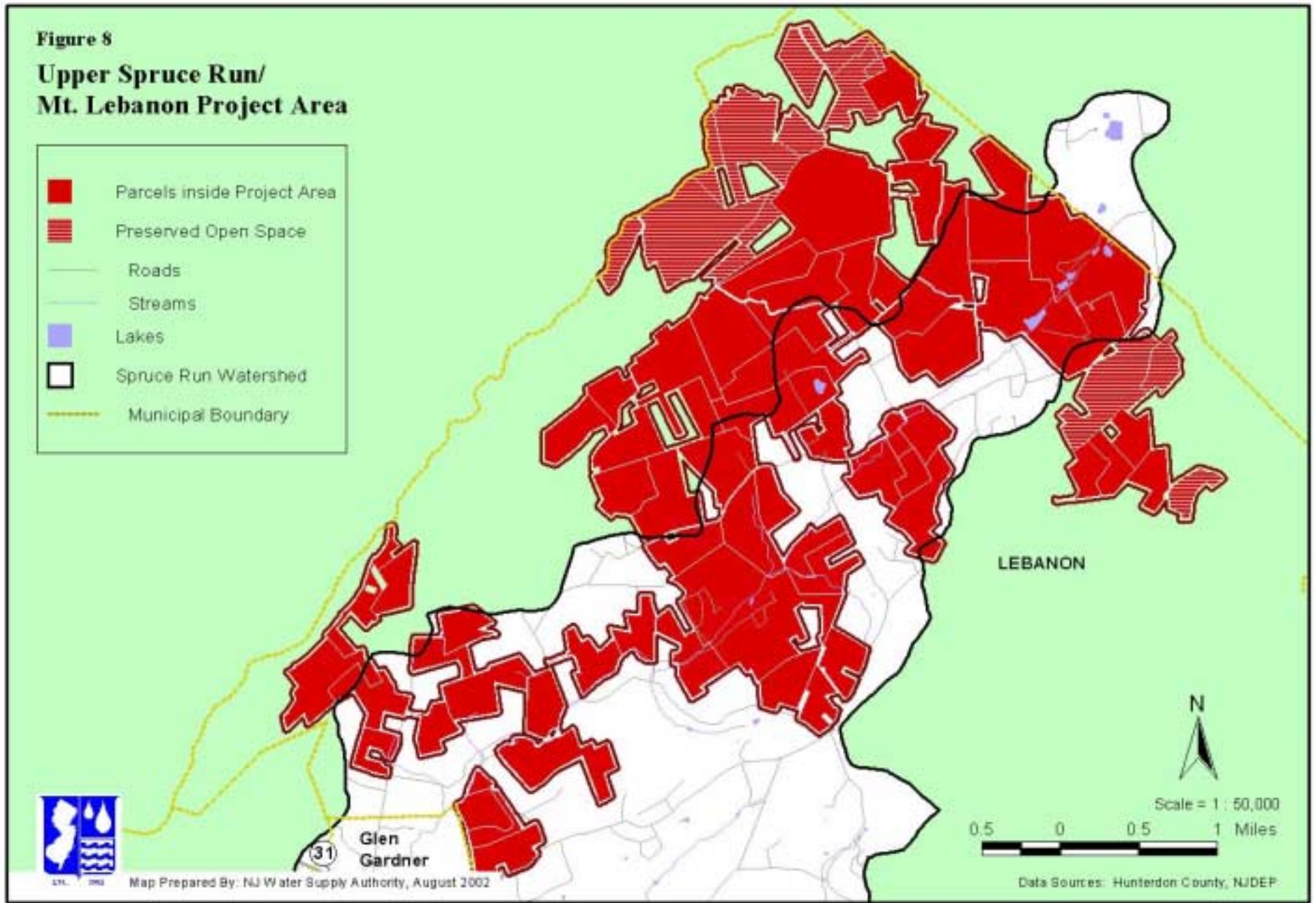
This section provides an overview of results in the six project areas, regarding the project area size, current preserved area, natural resources and preservation approaches. Table 3 summarizes the preservation needs in the six areas.

Upper Spruce Run/Mt. Lebanon – Lebanon Twp

This project area (see **Figure 8**) describes a rough semicircle from the Spruce Run north of Glen Gardner up to the ridgeline (Musconetcong Mountain) and then back to the Spruce Run in the

Figure 8

**Upper Spruce Run/
Mt. Lebanon Project Area**



Map Prepared By: NJ Water Supply Authority, August 2002

Mount Lebanon Road area, all within Lebanon Township. This area contains some of the largest parcels in the region and also the largest clusters of parcels with more than 90 percent critical area.

Many parcels within this project area have more than 90 percent critical area, especially in the center section (September Farms/Camp Watchung area) and the northernmost area. However, there also are many parcels with 65 to 90 percent critical area and 50 to 65 percent critical area. One of the latter is located toward the southern portion of the project area along Spruce Run (which contain critical riparian areas and will be important to a greenway connection to the southernmost parcels in the project area). These parcels have 50 to 65 percent critical area. Along the ridgeline in the northwestern part of the watershed along Mt. Lebanon Road there are additional parcels that show as having 65 to 90 percent critical area and some that show 50 to 65 percent critical area. Some of these parcels actually have a high density of critical area within the watershed, but the parcels extend into the Musconetcong watershed and so the scores may be artificially low. It also should be noted that some gaps in the project areas could be filled by attention to smaller parcels (in the 15 to 30 acre range) that have similar critical areas.

Table 3 – Preservation Needs by Project Area

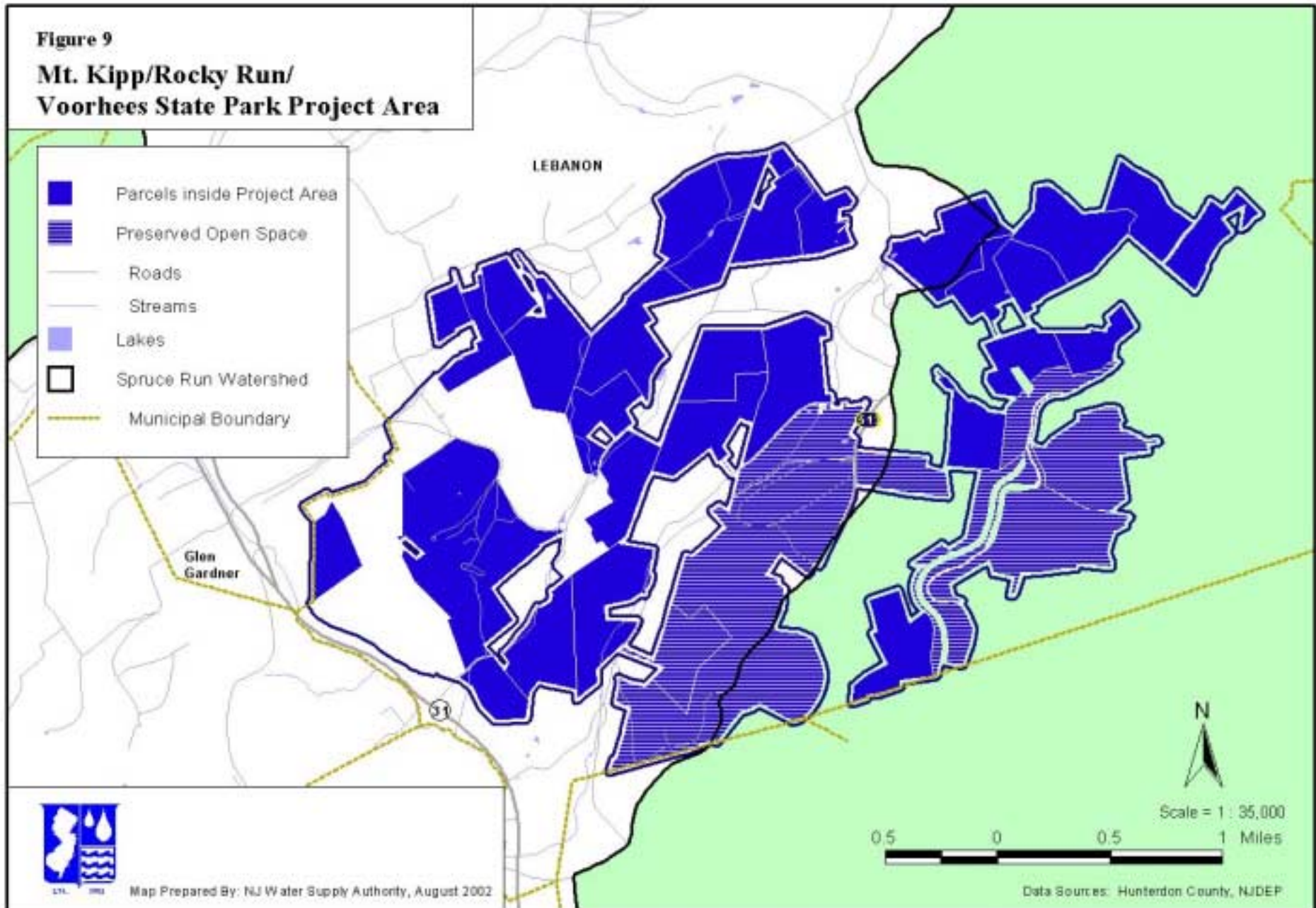
Project Area and Municipality	Targeted Parcels by Preservation Method (in acres) ³				
	Currently Preserved Land	Highest Value Acquisition	High Value Acquisition	Apply Development Restrictions	Total Project Area
Upper Spruce Run/Mt. Lebanon (Lebanon Twp)	2	2,207	398	448	5,334
Mt. Kipp/Rocky Run/Voorhees Park (Lebanon Twp)	1,108	570	191	301	3,020
Spruce Run Reservoir Area (Union Twp)	3,247	696	113	106	4,163
Musconetcong Mountain (Bethlehem Twp)	438	1332	214	0	4,421
Hoffmann Farms Area (Union Twp)	436	265	85	0	787
Mulhockaway Headwaters (Union/Bethlehem Twp)	133	669	0	34	1,513
TOTALS	5,365	5,739	1,001	889	13,397

Mt. Kipp/Rocky Run/Voorhees Park – Lebanon Twp

This project area (see **Figure 9**) is located between and around the Hagedorn State Psychiatric Hospital to the west and Voorhees State Park to the east, on both sides of Rocky Run down near its confluence with Spruce Run. Parts of the Willoughby Creek subwatershed are also included. The targeted parcels would provide valuable protection to the two creeks and a good east-west link between the existing public open spaces.

³ Preserved Land Acreage is within the Spruce Run Reservoir watersheds. Some Highest Value, High Value and Apply Development Restrictions properties overlap into adjoining watersheds – the figures here include full parcels. Additional contiguous lands are located outside the Reservoir watersheds but could be joined to the preservation acreage noted here.

Figure 9
**Mt. Kipp/Rocky Run/
 Voorhees State Park Project Area**



The parcels with the highest percent critical area lie between the Hagedorn Hospital and Voorhees State Park. They can make an effective greenway connection between the northern portions of these two properties. Intervening low-density development on Willoughby Creek prevents much connection between the lower areas. The greenway can be extended out of the watershed (into the South Branch Raritan watershed) to the east, and also north from Hagedorn along Rocky Run. A few parcels could be developed using cluster/open space designs while protecting the critical areas, but most of the parcels have greater than 65 percent critical area.

Spruce Run Reservoir Area – Union Twp

This project area (see **Figure 10**) is primarily located within State lands that constitute the Spruce Run Reservoir and the surrounding lands owned by the NJDEP Division of Parks & Forestry and the Division of Fish & Wildlife. However, there are properties along the northern hillside that would be logical extensions of the preserved areas. These properties lie to the northwest and north of the existing dedicated open space in a number of lots that have more than 90 percent critical area. Remaining properties in the area, while of ecological value, have small parcel sizes for the most part.

Musconetcong Mountain – Bethlehem Twp

This project area (see **Figure 11**) trends southwest-northeast along the ridgeline between the Mulhockaway Creek watershed and the Musconetcong River watershed. The project area has a major Agricultural Development Area (ADA) toward the northeast, and also dense forest areas.

There are scattered parcels of dedicated open space in this project area, primarily the results of cluster development and Bethlehem Township acquisitions. The Agricultural Development Area has significant amounts of prime farmland soils, ground water recharge and riparian areas (along a major tributary of Mulhockaway Creek). The remaining areas are a patchwork of riparian areas, forests and agricultural fields. Nearly all of the parcels are either 65 to 90 percent or greater than 90 percent critical area.

Hoffmann Farms Area – Union Twp

This project area (see **Figure 12**) centers on Hoffmann Farms, a preserved open space area with high value for grassland species that is included within one of two Union Township ADAs within the Mulhockaway Creek watershed. To the west of this property are other properties with equally significant critical areas, including riparian areas around some tributaries to the Mulhockaway Creek.

Mulhockaway Headwaters – Union/Bethlehem Twp

This project area (see **Figure 13**) is located in the southwestern corner of the Initiative area, split between Union and Bethlehem Township, and could easily continue over the ridgeline into the Musconetcong River watershed. It is comprised of a patchwork of farmland and forest, with riparian areas and wetlands threaded through them. It includes the other Union Township ADA of interest, where one farm has been preserved to date, though the ADA actually extends beyond the project area because the other parcels have less than 50 percent critical area. Several parcels in the project area have greater than 90 percent critical area.

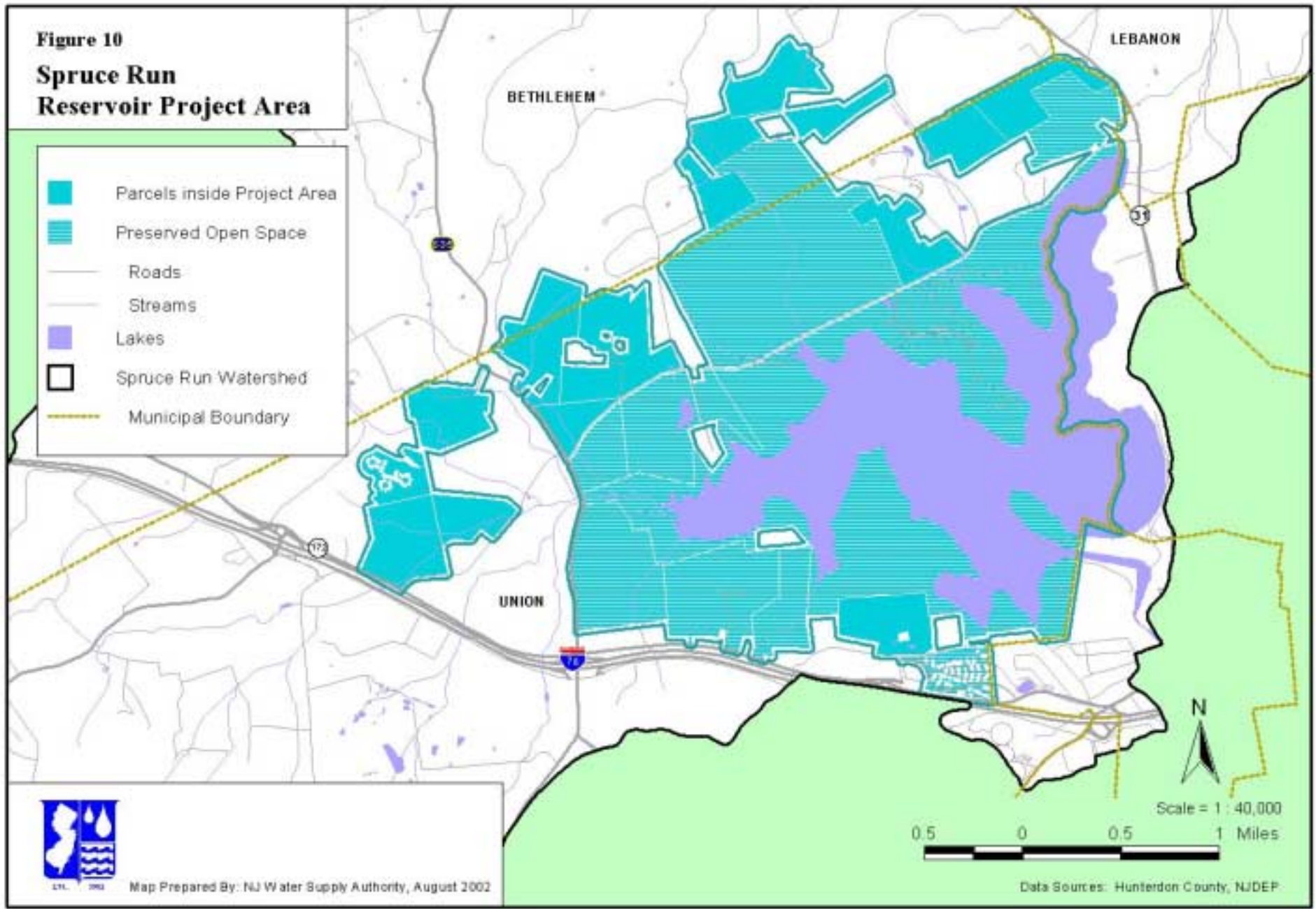


Figure 11
Musconetcong
Mountain Project Area

-  Parcels inside Project Area
-  Preserved Open Space
-  Preserved Farmland
-  Roads
-  Streams
-  Lakes
-  Spruce Run Watershed
-  Municipal Boundary

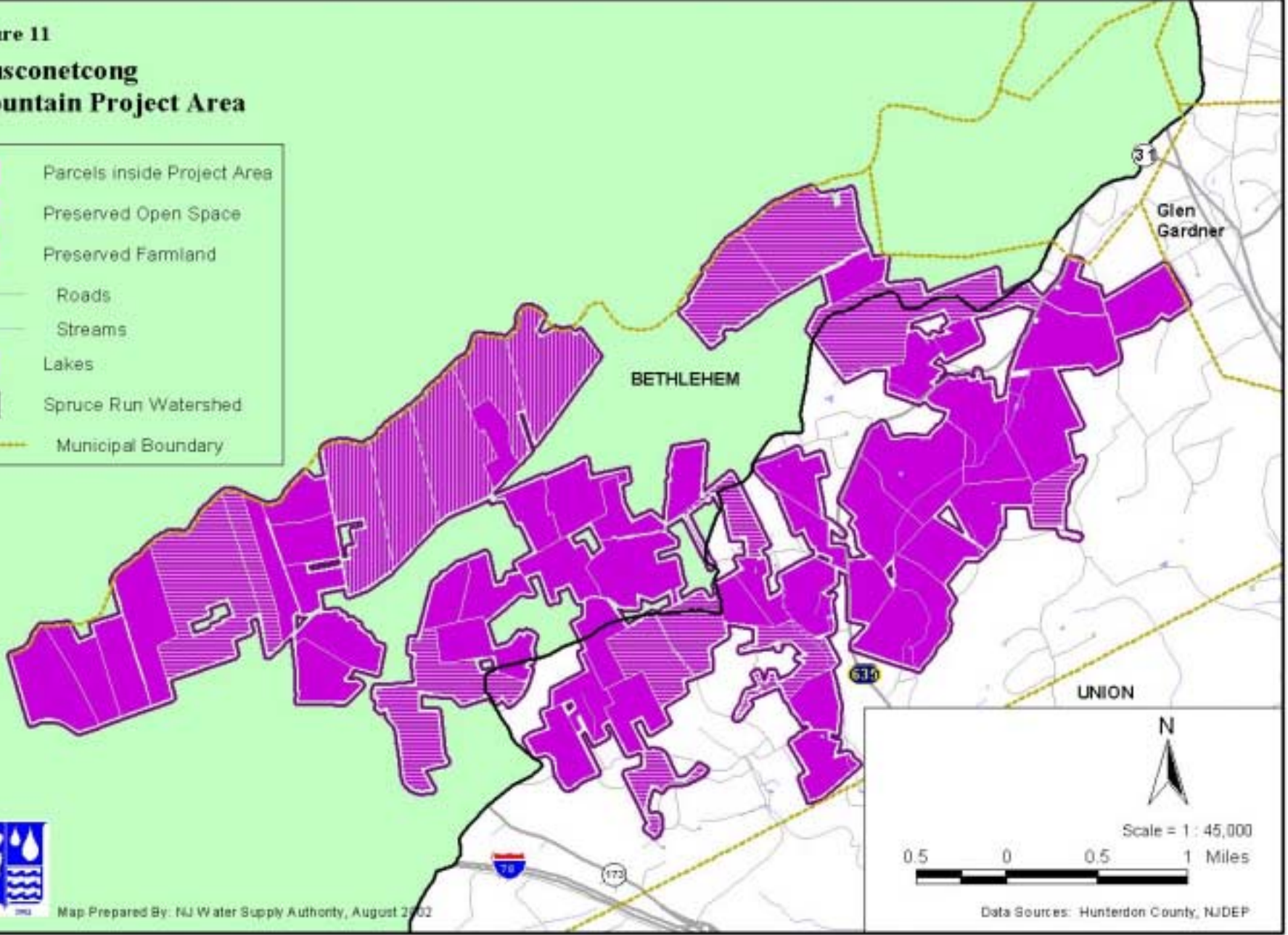


Figure 12
Hoffmann
Farms Project Area

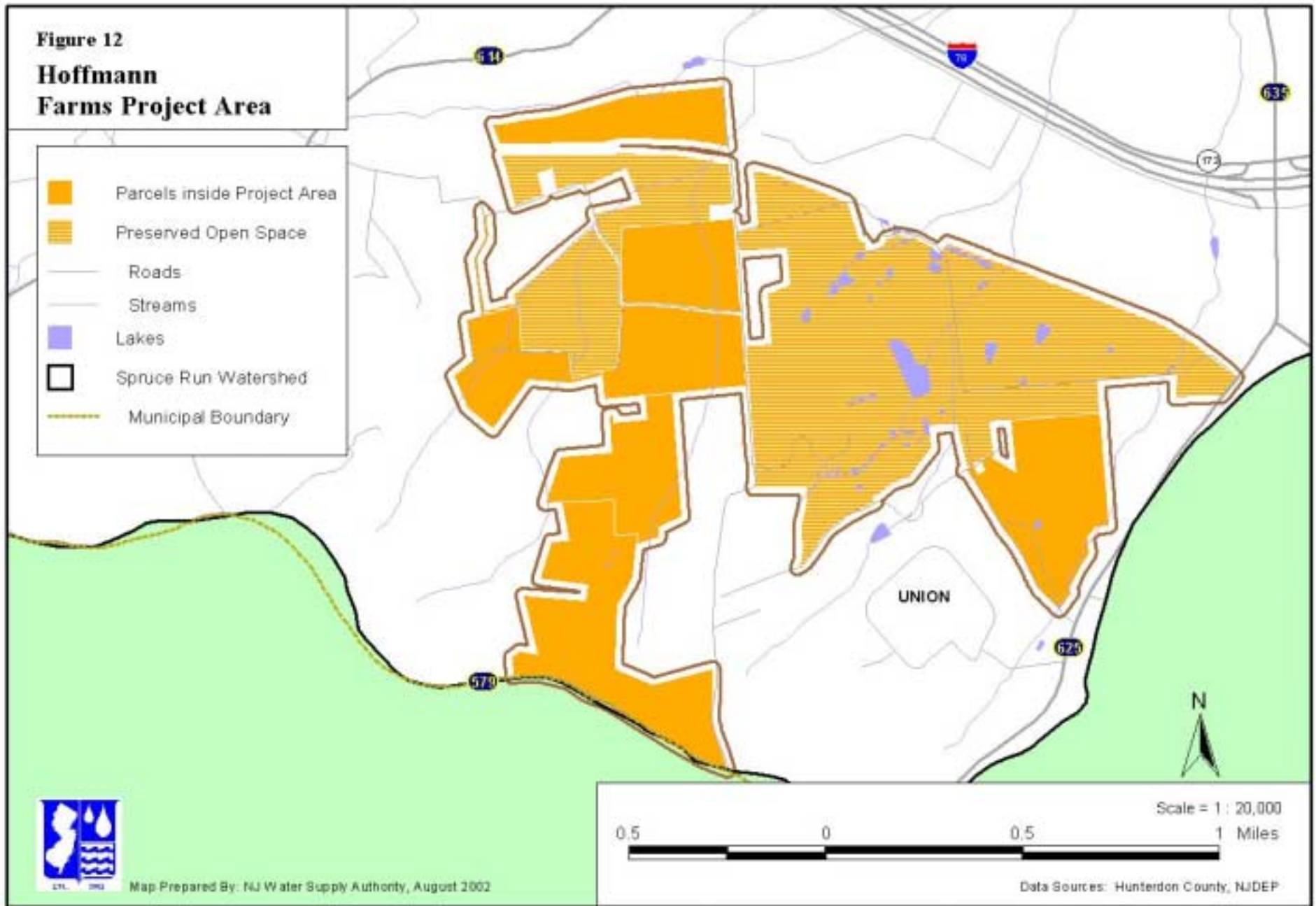
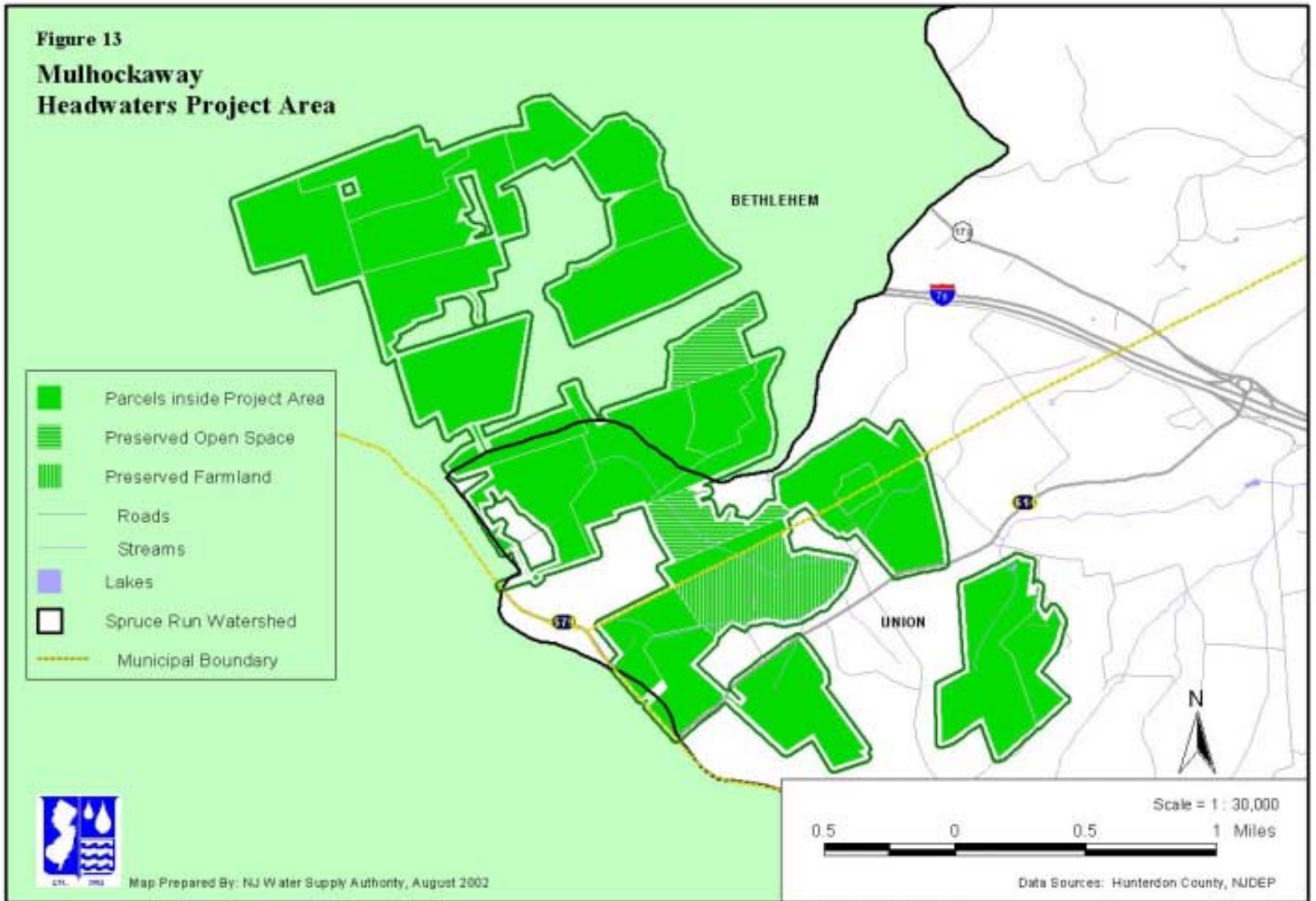


Figure 13
Mulhockaway
Headwaters Project Area



Key Provisions of Existing Municipal Ordinances

Morris Land Conservancy prepared an analysis of existing municipal land use ordinances, which is provided as Appendix A. The three townships (Bethlehem, Lebanon and Union) comprise most of the Spruce Run Initiative area, and nearly all of the undeveloped land. Glen Gardner is located entirely within the area (the only municipality that is), but the borough is nearly all developed. High Bridge only has a small corner within the area, but that land is nearly all undeveloped and zoned commercial or residential. A brief summary of ordinance provisions, as they pertain to the preservation of critical areas, is provided below.

- Bethlehem Township – The land use ordinances provides for clustering in the Mountain Residential District, with a minimum lot size of 1.5 acres in a zone of 5 acres, and 70% of the lot being dedicated open space. Developers must cluster unless clustering is proven to be infeasible on that property. Critical areas to be protected through clustering include wetlands, steep slopes, woodlands, pastures, historic/archeological sites and buffering for agriculture. Even where clustering is not used, these critical areas and flood prone areas can be protected by requiring that the disturbed area of the lot be contained within non-critical areas of 1 acre or more. Additional features can also be protected through subdivision and site plan review.
- Glen Gardner Borough – Development is limited in environmentally sensitive areas through the use of conservation ratios for steep slopes and wooded areas. Cluster and performance subdivision options (with specified minimum open space requirements depending on the zone and type of subdivision) are available in two zones, with 2 acres minimum lots in a 5 acre zone, and 1 acre minimum lots in a 3 acre zone.
- High Bridge Borough – Clustering is available in the R-1 zone, with 1 acre minimum lot sizes in a 2.41 acre zone. The developer must prove the environmental advantage of clustering in terms of preserving natural areas, and it must not damage aquifer recharge. Preservation of trees, hilltops, views, natural terrain, critical areas and natural drainage ridge lines must be maximized in all subdivisions, and conservation easements may be required to protect natural features.
- Lebanon Township – Clustering, lot size averaging and open space subdivisions are provided for in the lower density residential zones, with minimum lot sizes of 2 acres and minimum open space conservation of 60% to 65%, depending on the tract size. Stream corridors are protected by ordinance, as are steep slopes. Other critical areas are identified and inventoried.
- Union Township – Development is limited in environmentally sensitive areas through the use of conservation ratios for steep slopes, wooded areas and shorelines. Floodplains and floodplain soils may not be developed. Clustering is a conditional use in the Conservation Management Zone (1.5 acre minimum lot size in an 8.3 acre zone), a permitted use in the Agricultural Preservation District (0.688 acre minimum lot size) but not allowed in the Watershed Management Zone.

Recommended Improvements for Municipal Ordinances

Based on the preservation needs identified through this process and the review of existing ordinances, several key recommendations can be made to improve the management of new development in the Spruce Run Reservoir watersheds.

- No current ordinance contains all the critical area criteria used in this plan. For this reason, all ordinances will need to be modified to integrate the criteria. In addition, many technical changes will be needed in ordinances to address site-specific data needs (in recognition that regional GIS data cannot substitute for site-specific information), use of the plan in site review proceedings, etc.
- Some ordinances have critical area criteria that are not used in this plan. When the new criteria are added to the ordinances, the affected municipality must decide where the other criteria fit with regard to preservation priorities as discussed above. In addition, measures to ensure that each lot contains enough non-critical area to support a building (a Bethlehem Township provision), and to ensure a minimum level of dedicated open space in the subdivision (a provision used by several towns) will be important.
- The use of zoning mechanisms to provide for the movement of development away from critical areas and into non-critical areas is extremely important. However, the best techniques are not equivalent to the popular conception of “clustering” where all development is shoved to a corner of a lot, or into the center, and the open space is comprised primarily of those areas unsuitable for development anyway. The Spruce Run Initiative supports instead methods of arranging development that begin with the open space critical areas criteria, and defining the portions of a site that should be preserved (see Conservation Design/Open Space Subdivisions, below). Allowable development (based on the zoning) is then fit into the appropriate, non-critical parts of the site. This approach is variously known as conservation subdivision design or open space subdivisions. For smaller lots or where there is no desire to have a dedicated parcel of common open space, lot-size averaging also works.

Therefore, the Spruce Run Initiative strongly recommends that the conservation subdivision design or open space subdivision approach be used to protect the most critical resources first and arrange the resulting development in ways that maximize natural resource preservation. The region will benefit to the extent that these techniques are maximized in developments, but the best approach for each municipality may differ. However, there is little need for incentives for such approaches, as municipalities have the ability to strongly favor such approaches, and subdivisions using these techniques can avoid expenses for land sculpting, roads and utilities. Evidence exists that such subdivisions also sell faster, and can provide a greater profit depending on the site and the costs of project approval. There are several options available:

- Use conservation subdivision design/open space subdivisions unless the site makes them infeasible. This is essentially the approach used in Bethlehem Township.
- Allow these techniques as a by-right option for subdivisions. This is essentially the approach used in most municipalities. The new Lebanon Township ordinance provisions provide a good example of this approach.
- Allow these techniques as a condition use. This is essentially the approach used in Union Township for one of its zones.

In each case, the ordinances must make very clear what is to be preserved, how development may and may not be oriented within the site, methods for siting ancillary facilities such as septic systems and roads so that critical areas are preserved, what types of critical areas have greater or lesser priority than others (see Responding to Development of Targeted Preservation Areas, above), and preferences for the orientation of lots to maximize community amenities and site value. Municipalities can benefit from ordinances that maximize development value while simultaneously maximizing environmental protection – the ratable value of each house will be higher and easier to maintain, the community ambiance will benefit, and a profitable development is more likely to allow for better construction practices if compliance is assured through local action.

Municipal and Public Education Opportunities

The Spruce Run Initiative representatives from the five municipalities are all at high levels, allowing for a good flow of information to and from the municipalities and ensuring that the final plan has a good chance for implementation. However, it is important that education about the plan and its development goes well beyond those involved directly in the planning process.

During the course of this project, presentations on the project and related information from the Raritan Basin Watershed Management Project were given in most of the municipalities. This report will be formally presented to each municipality, and technical and planning assistance will be provided by the Authority to help the municipalities become more familiar with the results and use them in their planning and acquisition efforts.

In addition, presentations have also been made to the Hunterdon Economic Alliance, the Hunterdon County Green Table and (in October 2002) the ANJEC Environmental Congress. The Authority will continue to make public presentations about the Spruce Run Initiative and this plan. Consideration will be given to some kind of display that could be moved among the municipal buildings and local libraries, although funding for this effort is not within the project budget. Finally, local newspapers have shown an interest in this process; a press briefing will be given after report completion.

Additional ideas for public education and outreach include: take home packets for landowners (both absentee owners and those who live on large lots); neighborhood meetings; videos for library use and loans on environmentally sensitive property management; and information in municipal newsletters and mailings.

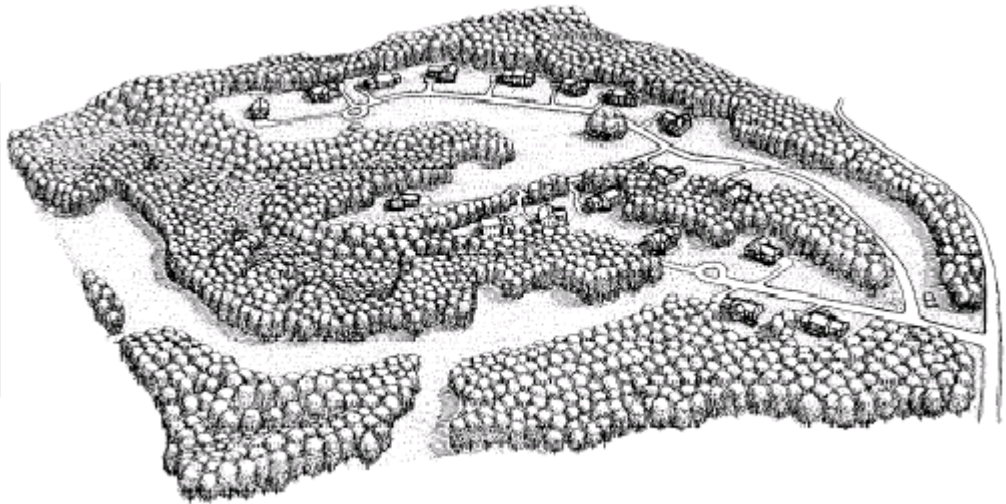
Conservation Subdivision Design/Open Space Subdivisions

Randall Arendt of the Natural Lands Trust has developed, compiled and presented a great deal of information on alternative methods for designing subdivisions and developments in zones ranging from rural to village or town commercial (see www.natlands.org). The State of Pennsylvania co-sponsored a book on these techniques, "Growing Greener: Putting Conservation into Local Plans and Ordinances," as part of the Growing Greener program cosponsored by Pennsylvania and the Natural Lands Trust. The concept revolves around identifying critical community resources (e.g., farmland, woodlands, riparian corridors) and providing for lot size flexibility that is directed toward preserving these features in a manner that also preserves or even enhances the profitability of the development. In "Growing Greener," Arendt cites an example in Delaware County, Pennsylvania, where the subdivision design resulted in lot premiums for many subdivision lots. However, he notes, "The first lots sold tended to be those adjoining the open space, despite the premiums added because of that proximity." Through this technique, potential perceptions of diminished property value (due to the smaller lot sizes for each home) are overcome by the lot amenities – views of open space that minimize the visual interference of other homes. In other words, actual lot size becomes unimportant because the homeowners don't really pay much attention to the actual size of their lot – it is their perceived lot size (as established by sight lines, lack of noise, etc.) that really matters.

Some of these same techniques tie into a relatively new concept for site design called Low Impact Development, an approach pioneered in Prince Georges County, Maryland. Low Impact Development focuses more on the environmental impacts of the actual site development, while conservation subdivision design focuses more on the layout of the subdivision. However, these concepts are clearly complementary. Conservation subdivision design can be used to ensure that

the critical natural resources are preserved while protecting the amenity value of the proposed lots and therefore developer profit. Low impact development techniques can then protect natural resources both within the development envelope and outside the disturbed area through appropriate lot design, stormwater reduction measures, landscaping, construction practices, etc. The Low Impact Development Center in Maryland is a good source of information on these practices (see www.lowimpactdevelopment.org/).

A sample conservation design subdivision from "Growing Greener" (Arendt, 1999) showing a birds-eye view of the subdivision without lot lines delineated.



Next Steps

The following steps, plus educational efforts, are critical for implementation of this plan:

- 1) Use of this plan by Spruce Run Initiative municipalities as the basis for preservation of parcels within the project areas for both farmland conservation easements and open space purchases.
- 2) Consideration and adoption by the Spruce Run Initiative municipalities of this plan as a component of their Municipal Master Plan's Conservation Plan Element, in support of improved subdivision design. The adoption of this plan as part of the Open Space Plan or an open space component of the Master Plan is also beneficial for state funding purposes.
- 3) Allocation of sufficient financial resources, include special funds that are not currently available through State programs, to fully implement this preservation plan.
- 4) Use by Hunterdon County of this plan as the basis for preservation of parcels within the project areas for both farmland conservation easements and open space purchases.
- 5) Use by the NJ Water Supply Authority of this plan as the basis for preservation of parcels within the project areas, as part of its partnership with the Green Acres Program.
- 6) Use by the Green Acres Program of this plan as the basis for preservation of parcels within the project areas.
- 7) Use by the Farmland Preservation Program of this plan as the basis for purchase of farmland conservation easement on parcels within the project areas.
- 8) Use by local and regional land trusts of this plan as the basis for preservation of parcels within the project areas.

- 9) Use by local landowners of this plan as justification for preservation of their lands, or of critical areas on their lands, within and outside of the project areas. Spruce Run Initiative members especially encourage landowners to preserve the riparian areas running along streams of the area (see **Figure 4**), as these lands have a direct and important impact on stream health.

Summary

The Spruce Run Initiative members have identified critical areas that should be preserved through a combination of acquisition, donation and subdivision controls. The targeted parcels are nearly all more than 30 acres in size, and are located within six major project areas (including some smaller areas that are close by but not physically connected) ranging from 787 to 5334 acres. The six project areas total 13,397 acres (both within and outside of the Spruce Run Reservoir watersheds), of which 5365 acres within the watersheds are already preserved. If all targeted lands in the project areas were preserved, approximately 43% of the total watershed would be in dedicated open space (e.g., conservation easements and public ownership).⁴ Although not a criterion for project area selection, the project areas are widely distributed, emphasizing that the overall watershed has a very high value for water resources, critical habitat for threatened and endangered species and prime farmland soils.

It should be emphasized that the six project areas do not encompass all of the critical areas within the Spruce Run Reservoir watersheds – far from it. Some critical areas (such as riparian areas, see **Figure 4**) exist on portions of developed lands. This region has considerable area in low-density zoning, and so many lots have houses on the road but the back portions are still forested and will probably remain so. In addition, some critical areas can be protected in part or in whole by existing or improved land use ordinances. However, the most common reasons for having critical areas outside of the six project areas are small parcel size (a 30 acre threshold was used to help focus preservation efforts) and parcel isolation (parcels that meet the 30 acre threshold must also be part of a cluster of such parcels that exceed 100 acres). There are 240 parcels targeted for preservation within the six project areas, a major preservation initiative that will require a great deal of effort.

The Initiative members also encourage others to protect critical areas wherever they occur, as a complementary effort. Such efforts could include: landowner education where the property is fully developed according to zoning but critical areas exist on site; cooperative management of critical areas with landowners; donation of conservation easements for critical areas outside of the project areas; and acquisition of smaller parcels that protect critical areas.

References

Arendt, Randall. 1999. *Growing Greener: Putting Conservation into Local Plans and Ordinances*. Island Press, Washington, DC.

Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq.

Reiser, Robert. 2001. "Evaluation of Permitted and No permitted Loads in the Raritan River Basin, Water Years 1991-97." NJ Water Supply Authority, Clinton, NJ.

PL2002, c.76, regarding open space preservation. Signed into law by Governor James McGreevey on 29 August 2002. New Jersey Legislature.

⁴ Approximately 19% of the watershed was developed as of 1995, leaving 32% of the watershed that was undeveloped as of 1995 and is not targeted for preservation by this plan.

APPENDIX A – SUMMARY OF EXISTING LAND USE ORDINANCES

Provisions in Watershed Towns ordinances that provide preservation potential by directing the location of development.

Bethlehem Township		
Environmental Constraint Regulations	Environmental Impact Statement	Not included in materials provided
	Design Standards	The “Natural Features” section of the ordinance gives the planning board the ability to require that trees, hilltops, views, natural terrain, open waters and natural drainage ridge lines will be preserved whenever possible.
	Critical Area Regulations	Critical areas restrictions protect flood prone areas, steep slopes and wetlands. This is accomplished with a requirement that each new lot contain an acre of non-critical land while impervious coverage on the non-critical portion of the lot can be as high as 70%.
Clustering Provisions	Change in lot area requirement	In the Mountain Residential District clustering provisions provide that minimum lot size can be reduced from 5 acres to 1 and ½ acres.
	Requirement for open space	70% of a clustered development must be set aside as open space.
	Provisions for locating development outside of critical or environmentally sensitive areas.	The planning board can mandate that a development be clustered to protect wetlands, steep slopes, woodlands, pastures, historic or archeological sites and to create buffers for agricultural operations.
Borough of High Bridge		
Environmental Constraint Regulations	Environmental Impact Statement	Developers must identify soil types, topography, low depth to bedrock, and major rock outcroppings, vegetation, unique habitat, subsurface water, and distinctive and historic features.
	Design Standards	<ul style="list-style-type: none"> • These provisions require that developers preserve, to the greatest extent possible, trees, hilltops, views, natural terrain, open waters, critical areas, and natural drainage ridge lines in designing any development. • The Board may require conservation easements to protect natural features.
	Critical Area Regulations	<ul style="list-style-type: none"> • Floodways, flood hazard areas, wetlands, and steep slopes are considered critical areas. No construction activity can take place in critical areas, except that for 15%-25% slopes, 15% of the slope can be disturbed. • Each new lot must have a useable land area equal to the lot area requirement in the zone containing no wetlands, floodways, flood hazard areas, surface water bodies, slopes greater than 15%, depth to seasonal high water table that is less than four feet, or depth to bedrock that is less than 10 feet.
Clustering Provisions	Change in lot area requirement	In the R-1 zone clustering is permitted with a minimum tract size of 15 acres. Minimum lot size can be reduced from 2.41 acres to 1 acre. (Gross density remains the same.)
	Requirement for open space.	A minimum requirement for open space is not specified.
	Provisions for locating development outside of critical or environmentally sensitive areas.	The cluster provision requires a developer to establish that, among other things, the cluster arrangement will cause less destruction to wooded or natural areas than development utilizing a conventional development pattern and that the aquifer recharge area or the surrounding properties will not be adversely affected.

APPENDIX A (CONT'D)

Borough of Glen Gardner		
Environmental Constraint Regulations	Environmental Impact Statement	Each development application shall include maps delineating the natural and historic features of the site.
	Design Standards	An earth disturbance plan and conservation easement is required for all subdivision applications that are within resource protection lands. These lands must be protected with a conservation easement.
	Critical Area Regulations	Ratios and percentages are used to limit development in environmentally sensitive areas. No development is permitted in the floodplain or on floodplain soils, in wetlands or in water bodies. Steep slopes and wooded areas are also regulated. 50% of slopes between 10% and 20% can be graded or stripped of vegetation. Only 20% of slopes between 20% and 30% can be graded or stripped of vegetation while no such activity is permitted on slopes greater than 30%. Development is restricted to 50% of the area that is vegetated within an upland woodland association, to 30% in meadow associations and to 10% in floodplain associations.
Clustering Provisions	Change in lot area requirement	In the CM and RR zones, both the cluster option and a performance subdivision option are offered. Lot sizes are reduced from 5 acres to 2 acres and from 3 acres to 1 acre respectively with use of the cluster option. Smaller lot sizes are permitted in both zones with performance zoning and special housing styles.
	Requirement for open space.	The minimum open space requirement is for 50% and 60% for cluster and performance subdivisions respectively in the CM zone. This requirement is 25% and 50% in the RR zone. These percentages will be higher if extent of resource protection lands on the tract is greater.
	Provisions for locating development outside of critical or environmentally sensitive areas.	Ratios are utilized to limit development in critical areas. Ratios are applied to natural resource protection lands for the calculation of net buildable area.
Lebanon Township		
Environmental Constraint Regulations	Environmental Impact Statement	An environmental inventory requires that a developer identify soils, geology, flood hazard areas, wetlands, stream and water bodies, slopes, tree groupings, endangered species, historic and cultural resources as well as stone rows, bridges and entrance gates.
	Design Standards	The ordinance protects stream corridors and includes a 100 foot stream buffer. The buffer extends one hundred feet beyond the flood plain on either side and includes all of the adjacent slopes that are greater than 15%.
	Critical Area Regulations	No disturbance is permitted on slopes greater than 25%, limited disturbance (15% of the area in question) is permitted on slopes that are between 15% and 25%.
Clustering Provisions	Change in lot area requirement	A new clustering ordinance permits open lands clusters and lot averaging at a density of 1 unit per 7.5 acres and minimum lot size of two acres.
	Requirement for open space.	65% and 60% of a tract must be set aside for open space when development is clustered on tracts greater than 30 acres and less than 30 acres, respectively.
	Provisions for locating development outside of critical or environmentally sensitive areas.	The cluster ordinance does not specifically prohibit development from critical areas, however, the restrictions limiting development in stream corridors and on steep slopes should apply here as well.

APPENDIX A (CONT'D)

Union Township		
Environmental Constraint Regulations	Environmental Impact Statement	Each development application shall include maps delineating the natural and historic features of the site.
	Design Standards	An earth disturbance plan and conservation easement is required for all subdivision applications that are wholly or partly within resource protection lands. These lands must be protected with a conservation easement.
	Critical Area Regulations	Ratios and percentages are used to limit development in environmentally sensitive areas. No development is permitted in the floodplain or on floodplain soils or in water bodies. Shorelines, steep slopes and wooded areas are also regulated. 70% of shorelines to a width of 50 feet must remain as open space. Only 10% of slopes greater than 20% can be graded or stripped of vegetation. Development is restricted to 50% of the area that is vegetated within an upland woodland association, 30% for meisc associations and 10% for floodplain associations.
Clustering Provisions	Change in lot area requirement	Union Township's clustering provision is not applicable in the Watershed Management Zone. It is a conditional use in the Conservation Management Zone. In the CMZ, the minimum lot size, which is 8.3 acres, is reduced to 1.5 acres for a single family detached cluster use with a minimum open space ratio of 0.65. Single family detached cluster is a conditional use in the Agricultural Preservation Districts. For these districts the net buildable portion of the lot is 30,000 square feet in a minimum lot area of 1.5 acres with a minimum open space ratio of 0.80.
	Requirement for open space.	An open space minimum or a requirement that is established by applying a formula (whichever is greater) is used to determine the amount of open space. The formula takes into consideration both natural resource value lands and lands for recreational purposes.
	Provisions for locating development outside of critical or environmentally sensitive areas.	The specified intent of the single family detached cluster use is that each parcel goes through a performance calculation in order to determine the proportion of net buildable and conservation areas. The purpose is to steer development away from critical areas. These areas become part of "resource protection area" calculation that determines buildable area.