INDEX

1

ROBINSON SQUARE
313 HAMILTON STREET
ALBANY, N.Y. 12210

MARC S. GERSTMAN

ATTORNEY AT LAW

TELEPHONE:
(518) 432-4100
FAX (518) 432-4200

April 23, 2004

Honorable Richard Wissler, Administrative Law Judge
New York State Department of Environmental Conservation
Office of Hearings and Mediation Services
625 Broadway
Albany, New York 12233

COPY

Re: Belleayre Resort at Catskill Park; Application Number 0-9999-00096/00005

Dear Judge Wissler:

On behalf of the Catskill Preservation Coalition and the Sierra Club, please accept the enclosed Petition for Party Status for filing in the above referenced matter.

Respectfully Submitted,
Law Office of Marc S. Gerstman

/S/

Marc S. Gerstman, Esq.

cc. Mr. Daniel Ruzow, Esq.
Whiteman, Osterman and Hanna
Attorneys for Crossroads Ventures, LLC
One Commerce Plaza
Albany, New York

Ms. Carol Krebs, Esq.
New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, New York 12561-1620

New York State Department of Environmental Conservation

In the Matter of the Applications of

Application Number
0-9999-00096/00005

CROSSROADS VENTURES, LLC
For The Belleayre Project at Catskill Park
for permits to construct and operate pursuant to the
Environmental Conservation Law

PETITION FOR PARTY STATUS
by the
Catskill Preservation Coalition *
And the Sierra Club

* [The Natural Resources Defense Council, Inc., Catskill Heritage Alliance, Pine Hill Water District Coalition, Theodore Gordon Flyfishers, Inc., Zen Environmental Studies Institute, Friends of Catskill Park, Catskill Center for Conservation and Development, Trout Unlimited, New York Public Research Interest Group and Riverkeeper, Inc.]

Law Office of Marc S. Gerstman, Esq.
Attorneys for the Catskill Preservation Coalition
Robinson Square
313 Hamilton Street
Albany, New York 12210

New York State Department of Environmental Conservation

In the Matter of the Applications of

Application Number 0-9999-00096/00005

CROSSROADS VENTURES, LLC
For The Belleayre Project at Catskill Park
for permits to construct and operate pursuant to the
Environmental Conservation Law

PETITION FOR PARTY STATUS
by the
Catskill Preservation Coalition *
And the Sierra Club

* [The Natural Resources Defense Council, Inc., Catskill Heritage Alliance, Pine Hill Water District Coalition, Theodore Gordon Flyfishers, Inc., Zen Environmental Studies Institute, Friends of Catskill Park, Catskill Center for Conservation and Development, Trout Unlimited, New York Public Research Interest Group and Riverkeeper, Inc.]

Law Office of Marc S. Gerstman, Esq.
Attorneys for the Catskill Preservation Coalition
Robinson Square
313 Hamilton Street
Albany, New York 12210

New York State Department of Environmental Conservation

In the Matter of the Application of

CROSSROADS VENTURES, LLC
For The Belleayre Project at Catskill Park

PETITION FOR PARTY STATUS
Application Number
0-9999-00096/00005

for permits to construct pursuant to the Environmental Conservation Law

---

I Introduction

This Petition for Party Status is submitted by the Catskill Preservation Coalition (hereinafter referred to as the "CPC") which is comprised of the following groups: The Natural Resources Defense Council, Inc., Catskill Heritage Alliance, Pine Hill Water District Coalition, Theodore Gordon Flyfishers, Inc., Zen Environmental Studies Institute, Friends of Catskill Park, Catskill Center for Conservation and Development, Trout Unlimited, New York Public Research Interest Group and Riverkeeper, Inc., by their attorneys, the Law Office of Marc S. Gerstman, Esq. The Sierra Club joins in this Petition for Party Status.

The CPC hereby petitions for Full Party Status pursuant to 6 N.Y.C.R.R. § 624.5 (b) in the above referenced adjudicatory hearing. The CPC represents a wide range of local, regional, statewide and national environmental, conservation, community, landscape preservation and economic development interests which will be adversely impacted by the proposed Crossroads Ventures, LLC project ("hereinafter referred to as the "Belleayre Project").

The Belleayre Project will result in significant and unmitigated adverse environmental impacts which will have a critical bearing on the future of the Catskill Park, the Towns of Shandaken and Middletown, the Route 28 Corridor, the central Catskill communities and the New York City Watershed and Drinking Water Supply. In the hearing, the CPC will present expert testimony and evidence on the substantial and fatal deficiencies in the Draft Environmental Impact Statement ("DEIS"), supporting documentation and applications and on the significant and pervasive adverse environmental impacts which will result from the Belleayre Project.

The State Environmental Quality Review Act, ECL, Article 8 ("SEQRA") requires that the Belleayre Project's significant adverse environmental impacts, reasonable alternatives, and mitigation measures be identified and objectively evaluated. As outlined below, the CPC will present evidence that the DEIS does not provide a reasonable and candid evaluation of the adverse visual, traffic, noise, economic, water quality, ecological, wildlife and habitat, community character and cultural resource impacts. These fatal defects in the DEIS regarding the substantial adverse impacts which will result from construction and operation of the Belleayre Project deprive the Commissioner of the legally necessary environmental analysis and record upon which she must make SEQRA findings pursuant to 6 N.Y.C.R.R. § 617.11. Moreover, multiple aspects of the Belleayre Project do not meet permit standards pursuant to the Environmental Conservation Law.

II Summary of Substantive and Significant Issues

CPC, by this Petition, presents substantive and significant issues for adjudication. CPC's experts will demonstrate that the Belleayre Project will dominate and irretrievably alter the landscape throughout the Towns of Shandaken and Middletown, the Route 28 Corridor, and the Catskill Forest Preserve. Its intrusion will be substantial and unavoidable. The Belleayre Project will degrade the landscape and substantially interfere with the region's economic vitality and renaissance.

CPC will demonstrate that Crossroads Ventures used inappropriate methodologies and standards to assess sediment and erosion control, project alternatives, impacts from project noise, blasting, and traffic, as well as project impacts to aquatic and wildlife habitat, wildlife resources, community character, the Forest Preserve New York City's watershed, and local potable water quality and quantity. The DEIS also fails to take account of cumulative impacts and adverse secondary growth impacts that will result from this Project. As a result, the DEIS artificially minimizes or ignores the substantial impacts from construction and operation of the Belleayre Project.

III Environmental and Statutory Interests of the CPC Members

The members of the CPC view the Belleayre Project and its significant adverse environmental impacts from diverse local, regional, statewide and national perspectives. However, all of members of the CPC possess a common and profound interest in the economic and environmental health of their communities and in the Catskill Mountains.

Members of the CPC submit that the Belleayre Resort project will result in significant adverse environmental impacts on the character of the Catskill Park and the local communities; the forest preserve and New York City Watershed; the area's streams, flora and fauna; community character and quality of life, water supply; roadways and traffic; rural character and viewshed; and the social and economic vitality and base of the area. CPC is further concerned about the multiple impacts of 8 years of construction. CPC 's member organizations submit that a development project of this magnitude will dominate the Central Catskill Region, lead to other large scale commercial development projects, and ultimately transform the area from the unique configuration of mountain park, forever wild forest preserve, historic villages and watershed, to an overcrowded, commercialized tourist area. The loss to New York State would be irretrievable and felt throughout the State

The CPC's interests relate to: DEC's implementation of SEQRA (including the project's impacts to visual, noise, traffic, community character, water quality, secondary, neighborhood, wildlife and habitat); water quality protection, Article 17, Environmental Conservation Law; mining and land reclamation laws and regulations, Article 23, Title 27, Environmental Conservation Law; protection of waters, Article 15, Title 5, Environmental Conservation Law; water supply, Article 15, Title 15, Environmental Conservation Law, Article IX of the New York State Constitution; and fishery and habitat protection, Article 11, Environmental Conservation Law.

A. Trout Unlimited

Trout Unlimited's ("TU") mission is to conserve, protect and restore North America's trout and salmon fisheries and their watersheds. TU accomplishes this mission on local, state and national levels with an extensive and dedicated volunteer network. Locally, the two chapters, Ashokan/Pepacton and Catskill Mountains, have joint responsibility for the Esopus-Ashokan system. They are organized as all volunteer not-for-profit organizations.

Two years ago, they participated in The Birch Creek Project, an on-going effort to reconnect and improve habitat on Birch Creek. Working in collaboration with the U. S. Fish and Wildlife Service, crews of volunteers installed fish-friendly baffles on a double-concrete box culvert in Pine Hill. Crews have also planted trees and willows in the Day Use Area. The two chapters are presently collaborating with DEC's Division of Operations to install a Denil steep-pass fishway for the Belleayre Mountain Ski Center diversion structure, and will buy the fishway with an Embrace-a-Stream grant from TU

National. In respect to Birch Creek and other area streams, the chapters are long-term, committed stake-holders.

Esopus Creek Rainbow Trout are part of Catskill's history. Originally, these fish were brought east from California and introduced in the waters of the Catskills during the 1880s. They have thrived in the Esopus-Ashokan watershed system. As one or two year old fish, they swim down to the Ashokan Reservoir to feed on alewives, then swim up the main stem and tributaries to spawn, entering the Esopus as early as November and lingering as late as June. Theodore Gordon, A. E. Hendrickson, Jim Payne, Roy Steenrod, Everett Garrison, Preston Jennings and other expert sportsmen fished the Esopus and praised its rainbow trout.

The Esopus Rainbows are a self-sustaining, feral population. In addition, the Esopus system contains feral Brown and Brook Trout. Rainbow, Brown and Brook Trout fingerlings are found in Birch Creek and Lost Clove Brook, qualifying both streams for Trout Spawning classification (the records are in Appendix 20 of the DEIS, though not all that were submitted were included) Redds can at times be spotted by walking the banks. These streams are essential to recruitment of all three Esopus drainage species, and the Rainbow and other feral Trout they harbor can legitimately be called a cultural heritage.

B. Natural Resources Defense Council, Inc.

The Natural Resources Defense Council, Inc. ("NRDC") is a New York not-for-profit organization that includes among its principal purposes the protection of the environment in all its aspects, including land, water and air. NRDC is headquartered in New York City and has taken a special interest both air quality and the Hudson River. NRDC has a national membership of more than 500,000, including many members who live or work in the area of the proposed project or who use the Hudson River in the area and its adjoining shores for recreation.

The environmental interests of NRDC in this proceeding are clear. NRDC has and continues to focus on protecting the watershed of New York City. Working on its own and with others, it has advocated for the protection of sensitive lands within the New York City Watershed and has opposed inappropriate incursions into the landscape. Its members include many people who live in the Catskills, New York City and Ulster and Delaware Counties and countless others who hike the hills and other lands. These members, and the organization itself, will be adversely affected by the proposal of Crossroads Ventures to construct the Belleayre Project.

C. Riverkeeper, Inc.

Riverkeeper is a not-for-profit public interest environmental organization organized under the laws of the State of New York. It is dedicated to protecting the Hudson River, its tributaries, and the New York City drinking water supply watershed. Riverkeeper is a surviving corporation that resulted from the 1992 merger with the Hudson River Fishermen's Association, Inc., a private conservation organization founded by fishermen in 1966 to gather, study, and disseminate information about the ecology of the Hudson River as well as other important water bodies in New York.

The proposed project is located in the Catskill and Delaware watersheds. Together, these watersheds provide up to 90% of the unfiltered drinking water supply for nearly 9 million New Yorkers. Riverkeeper was a negotiator of, is a signatory to the 1997 New York City Watershed Memorandum of Agreement, and has worked to protect the New York City Watershed for more than 15 years. Riverkeeper has approximately 5000 members many of whom live in the Catskill Mountains and in New York City and drink water supplied from the Catskill and Delaware watersheds. Adverse impacts from the proposed project could jeopardize the quality of the drinking water produced in the Catskill and Delaware watersheds.

The proposed project also could affect Riverkeeper members that live in or near, fish in, or otherwise use and enjoy the Catskill and Delaware watersheds.

D. The Catskill Center for Conservation and Development

The Catskill Center for Conservation and Development ("Catskill Center") is a not-for-profit membership organization committed to balancing the protection of natural resources with sustainable economic development in the Catskill region. Founded in 1969, the Catskill Center is a regional advocate emphasizing the development and implementation of innovative programs in natural resource conservation, community planning & development, education, and regional arts and culture. The Center's advocacy work has focused on protecting the Catskill Mountain region, with its rich cultural legacy, which encompasses some 6,000 square miles of mountains, small towns, rivers, and farmlands. The area also serves as the primary source of water for the City of New York. The Catskill Center is an advocate for the region's vibrant main streets, beautiful natural resources, cultural assets, working landscapes, and drinking water resources.

Specifically, the Catskill Center has engaged in diverse activities within various Catskill communities in order to achieve its objectives including:

- Protect and conserve natural resources in partnership with other agencies and organizations;
- Monitor, and when appropriate, take action on regional environmental, land use and natural resource issues impacting the region;
- Provide technical assistance, information and leadership to small businesses throughout the region in order to build sustainable communities;
- Developed an interdisciplinary Catskill curriculum for teachers;
- Coordinate a regional stream-monitoring network of school and public volunteer groups;

- Strengthen public awareness of the rich cultural and artistic heritage of the Catskills.
- Sponsor conferences, round-tables, forums and workshops to bring together stakeholders and policy makers.

The Catskill Center believes that the Belleayre Project represents irresponsible land use planning and development and is ill suited to Catskill Park, due, in part, to its scale. The project is unprecedented in size, within not only the Catskill Region but indeed, the entire northeastern United States. A project of this type is not compatible with the character or values of the region's local communities. The Belleayre Project will also require dramatic disruption in a particularly environmentally sensitive and valuable area. Moreover, the Belleayre Project could be the first step towards the requirement for New York City to provide filtration for its water supply which would significantly impact the Catskill communities and undermine the New York City Watershed Agreement.

Development of this Project is in direct contravention to the planning, educational, monitoring initiatives, the advocacy work, and technical assistance the Center has long provided to users of the area's resources and undertaken on behalf of the area. Its members live and work in the affected area and enjoy the resources that will be irretrievably damaged by this Project.

E. Friends of Catskill Park

Friends of Catskill Park ("FCP"), which was organized in April 2001, is an all-volunteer grassroots organization based in Shandaken, New York, which lies within New York's Catskill Park and the New York City Watershed. FCP's mission is to assist in the preservation and enhancement of Catskill Park, the communities within the Park, and to help safeguard the Park as a wild and natural heritage for all New Yorkers to experience and enjoy for generations to come. Friends of Catskill Park was established in response to the proposed Belleayre Resort at Catskill Park which is the largest single development ever proposed for the Central Catskills. FCP is a project of the Open Space Institute, Inc., which serves as an incubator for such projects, conferring 501(c)(3) status and supplying administrative support.

FCP currently has approximately 700 supporters. They include residents of the Central Catskills, the area that would be the most directly impacted by the Belleayre Resort; residents from throughout New York State who frequent the Park and State Forest Preserve and use and enjoy the resources; and residents from New York City who want the New York City Watershed protected from degradation.

The Catskill Park is the second largest accumulation of "forever wild" land in New York State, second only to the magnificent Adirondack Park. It is especially unique because it is a prized wilderness within just 2 hours of one of the largest cities in the world and it contains a substantial part of the New York City Watershed. FCP's mission is to protect the fragile balance that currently exists among the Catskill Park, the New York State Forest Preserve within the Park, the New York City Watershed and the communities within the Park, all which co-exist harmoniously and serve a wide range of needs throughout the state.

F. Zen Environmental Studies Institute

Zen Environmental Studies Institute ("ZESI") is a 501 (c) (3) not-for-profit environmental organization with training facilities on Raquette Lake in the Adirondacks and on the Esopus River in Mount Tremper. ZESI's Mount Tremper facility, which is located within miles of the proposed Belleayre Project is a 35-acre site that contains approximately 15 acres of ecologically fragile wetlands. Much of ZESI's ecological training and studies take place in these wetlands which are in danger due to the proposed creation of the Belleayre Resort by Crossroads Ventures.

ZESI is concerned that the creation of large areas of non-porous surfaces will result in substantially more runoff than the property currently experiences when the Esopus river is in flood stage. As a result, ZESI is concerned that its wetland property will be damaged. ZESI is also concerned that golf course pesticides and fertilizers, chlorinated hydrocarbons and phosphorous-containing chemicals may find their way into the Esopus in spite of the detention ponds and filtration catch-basins proposed by the developer. ZESI's analysis of the DEIS and the Belleayre Project indicates that much of what is being proposed is based on speculation, rather than experimentally verifiable data. If the Belleayre Project were built, both ZESI and its members who use and enjoy the wetlands located on ZESI's property will be adversely affected.

G. Pine Hill Water District Coalition

The Pine Hill Water District Coalition ("Water Coalition") is a 501(c) 4 not-for profit organization formed to protect the water supply and quality of the Pine Hill Water District and to advocate on behalf of people who use and enjoy the water resources of Pine Hill, New York in the Town of Shandaken. The Water Coalition's 70-100 members live in and around Pine Hill; most of them currently have water supplied by the municipally owned Pine Hill Water District which was formed in 2003. Several members of the Water Coalition own or have owned and/or managed water resources in the District which either currently or historically supply water to the hamlet of Pine Hill.

The potable and non-potable water resources proposed for the Belleayre Resort at Catskill Park are inaccurately described. Generally, the DEIS overestimates the supply, especially during drought conditions, and under-estimates current and future use, both of the proposed resort and of the hamlet of Pine Hill. In addition, the water resources considered and proposed for use at the resort include water resources located within the hamlet of Pine Hill have been historically utilized to supply water to the hamlet and are needed to meet Pine Hill's current and future water needs.

H. Catskill Heritage Alliance

Catskill Heritage Alliance ("the Alliance") is an unincorporated membership organization formed for the purpose of preserving the harmony between the villages of the central Catskills and the surrounding wilderness through community revitalization, open space conservation, and environmental protection. The Alliance has approximately 300 members and supporters, most owning property or residing in Shandaken, New York, and others frequenting the Catskill Mountain region for recreational or business purposes.

The Alliance has analyzed and critiqued multiple aspects of the proposal of Crossroads Ventures to build a golf-oriented resort facility on the ridges east and west of the Belleayre ski resort. In opposition to material presented in the Draft Environmental Impact Statement (DEIS), the Alliance claims the following: 1) the economic interests of the communities involved, particularly Shandaken, are not served by the proposed resort; (2) the fiscal impacts and changes in community character engendered by the resort would harm the communities involved by draining resources needed for more sustainable forms of tourism and hamlet revitalization; (3) the DEIS does not adequately describe and quantify potential environmental adverse impacts, including adverse impacts to protected open space, of the proposed resort; 4) the DEIS presents no evidence of broad-based community support for the proposed resort; and 5) the DEIS does not adequately identify and describe potential alternatives to the proposed resort.

The Alliance also claims that the review process of the proposed project has been flawed in major respects, including omission of relevant consideration of other private and governmental developments within the same region (e.g., the Catskill Mountain Railroad and proposed expansions of the Belleayre Ski Center) and other procedural errors (e.g., inadequate time provided for review of the DEIS, which was itself presented in unwieldy and poorly accessible formats). Finally, the Alliance joins with the Pine Hill Water District Coalition in objecting to use by the project of water assets located within Pine Hill and historically utilized by the hamlet and to any water uses that harm current water users or limit the natural and anticipated growth of the hamlet.

I. Theodore Gordon Flyfishers, Inc.

The Theodore Gordon Flyfishers ("TGF"), a dedicated group of five hundred members, including conservationists and anglers, who are deeply concerned with the future of the Esopus Creek and its ecosystem on Belleayre Mountain, including Birch Creek and Lost Clove Brook.

TGF was founded during the 1960's to protect the rivers of the Catskills from potential damage associated with construction and development along their banks. TGF sponsors programs such as "Trout in the Classroom," an environmental education program that has been integrated into the curriculum of over 80 classrooms throughout New York City and State to help develop in children an understanding of the State's shared aquatic resources. TGF's members have served as educators on various subjects and as advocates for many different rivers during the past 40 years. However, TGF considers the rivers of the Catskill region to be its "home waters". Most of TGF's members reside in the tri-state area of New York, Connecticut and New Jersey, some of whom reside within the borders of the Catskill Preserve. TGF considers protection and conservation of the Catskill waters to be its primary goal and purpose.

Nestled in the Catskill Mountains, the Esopus Creek is one of several world class trout streams in this region that support sizable wild trout populations. The trout streams of the Catskills are revered among fishermen across the nation as the birthplace of American flyfishing. As a vital trout producing stream, the Esopus Creek was praised by Theodore Gordon for its significant population of rainbow trout. The Esopus is a historical and recreational treasure of the Catskills that continues to attract thousands of anglers every year and thus, it deserves to be protected.

J. New York Public Interest Research Group

The New York Public Interest Research Group ("NYPIRG") is New York State's largest non-profit, non-partisan student directed research and advocacy organization. NYPIRG's primary areas of focus are on environmental protection, public health and government accountability.

NYPIRG's headquarters are located in New York City, with regional offices in Albany, Buffalo and Long Island, and 20 college campus chapter offices throughout the state, including New Paltz in the mid-Hudson Valley. NYPIRG's environmental project currently focuses on environmental and public health, including drinking water protection, notification and reduction of pesticide use, clean air and energy, and toxic site clean-ups.

NYPIRG has approximately 60,000 citizen supporters and seeks to empower, train and educate students and other community members and encourage their participation in the public decision-making process through organizing and advocacy efforts to address significant problems affecting the health, environment, democratic institutions and quality of life for New York State's residents.

As negotiators of, and signatories to, the 1997 New York City Watershed Memorandum of Agreement ("MOA"), NYPIRG is committed to overseeing the implementation and enforcement of the MOA and working with watershed stakeholders to ensure that the drinking water supply for more than nine million New Yorkers remains high quality.

In addition to the Watershed Agreement, among our other major environmental achievements, NYPIRG was instrumental in passing the Pesticide Neighbor Notification bill, which allows counties to pass local laws requiring commercial lawn applicators to provide written notice to abutting properties at least 48 hours prior to most lawn pesticide applications and led efforts to strengthen and reauthorize the state's toxic waste site clean up law, commonly known as Superfund.

K. Sierra Club

Sierra Club is a national, non-profit environmental and conservation organization incorporated under the laws of the State of California. The Sierra Club is dedicated to the protection of public health and the environment. The Sierra Club joins in the Petition for Party Status on behalf of itself and its adversely affected members. The Sierra Club has more than 700,000 members nationwide, 43,000 of whom live in New York. The Sierra Club is dedicated to enjoying and protecting the wild places of the Earth; to practicing and promoting the responsible use of the Earth's resources and ecosystems; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. Many members of the Sierra Club use and enjoy the Catskills and other resources that would be adversely affected by the Belleayre Project.

The Sierra Club's concerns encompass the enjoyment and protection of the natural and human environment around the area of Catskill Park. The Sierra Club's particular interest in this case stems from the past, present, and future harm to the environment that would be caused by the Belleayre Project. Sierra Club members reside, work, and recreate in the areas impacted by these facilities. Sierra Club members have an interests in protecting New York City drinking water supply. Sierra Club members have participated in agency proceedings related to the permit.

<u>IV. Issues for Adjudication and Offers of Proof</u>
<u>6 N.Y.C.R.R. § 624.5(b)(2)(i) and (ii))</u>

CPC contends that the Belleayre Project will not meet the regulatory or statutory standards set forth in the Environmental Conservation Law and the State Historic Preservation Act and, therefore, its permit applications must be denied.

An issue is adjudicable if it is proposed by a potential party and it is both substantive and significant. In accordance with 6 N.Y.C.R.R. § 624.4 (c)(2), an issue is substantive if there is sufficient doubt about the applicant's ability to meet statutory or regulatory criteria applicable to the project, such that a reasonable person would require further inquiry. An issue is significant if, ". . . it has the potential to result in the denial of a permit, a major modification to the proposed project or the imposition of significant permit conditions in addition to those proposed in the draft permit." The issues presented by the CPC, through its experts, are substantive and significant as defined in 6 N.Y.C.R.R. § 624.4.

Based on the expert testimony offered in the Petition, CPC contends that DEC will be unable to issue findings pursuant to SEQRA for the Belleayre Project. Pursuant to 6 N.Y.C.R.R.§ 617.11 (d) (5), DEC must, "certify that consistent with social, economic and other essential considerations from among the reasonable alternatives available, the action is one that avoids or minimizes adverse environmental impacts to the maximum extent practicable, and that adverse environmental impacts will be avoided or minimized to the maximum extent practicable by incorporating as conditions to the decision those mitigative measures that were identified as practicable." The

DEIS fails to meet the requirements of SEQRA; therefore, the Commissioner will be unable to issue positive findings pursuant to SEQRA.

A. Visual and Aesthetic Impacts

CPC contends that the Belleayre Project presents substantive and significant issues for adjudication since it will result in significant adverse visual impacts which have not been and cannot be mitigated by Crossroads Ventures. Therefore, Crossroads Ventures' permit applications must be denied.

CPC will present the testimony of Mr. Peter J. Smith, AICP, MCIP, RLA; Ms. Mary Kopaskie, AICP, MCIP, RPP and Mr. Danny Sundell, RLA, ASLA, that the Belleayre Project will result in significant adverse visual and aesthetic impacts. The curricula vitae of Mr. Smith, Ms. Kopaski and Mr. Sundell are attached hereto as Exhibits "CV-A", "CV-B " and "CV-C ". Specifically, Mr. Sundell and Mr. Smith will testify to the facts and conclusions set forth in their report, which is attached hereto as Exhibit "A", including but not limited to the following:

1.) The methodology used by the DEIS does not fully comply with the DEC Visual Impact Assessment Policy in that "line-of-sight" profiles are not included; at a minimum, these should have been completed for several of the points along Route 28 that were identified in the DEIS as "potentially visible areas along roadways and from the Village of Pine Hill. As such, the method used in the DEIS Visual Impact Study (Appendix 21) does not include the minimum required by the DEC Policy on Assessing and Mitigating Visual Impacts.

2) Based on a review of the surrounding topography, a worst-case scenario for visual impacts should be completed from across the valley; namely Rose Mountain, Monka Hill and Hog Mountain. The visual impacts from the Village of Pine Hill and

Route 28 would also be the most frequently observed due to the development there and would likely have the greatest impact on community character, however these views have not been included in the DEIS. No visual assessment or simulations were completed from the Pine Hill hamlet, the Belleayre summit and slopes or Route 28, the areas most likely to be impacted within the five-mile radius.

3.) Based on a review of the surrounding topography, the worst-case scenario for visual impacts will be from across the valley; namely Rose Mountain, Monka Hill and Hog Mountain. The visual impacts from the Village of Pine Hill and Route 28 would also be the most frequently observed due to the development there and would likely have the greatest impact on community character, yet none of these views were included in the DEIS.

4.) The following significant adverse visual impacts should have been evaluated in the DEIS but were omitted:

- Visual impacts of blasting the top of a currently forested and undisturbed mountain with no consideration to the changes in topography ;
- Visual impacts and potential erosion of stockpile areas and the lack of a stockpile management plan;
- Visual impacts of clear-cutting over 500 acres and turning much of the area into lawned golf courses and buildings;
- Loss of forest land that includes the destruction of over 278,000 trees;
- Light pollution, including night glow, lighting visible from an elevation perspective and glare from lighting during the winter (snow glare), on an historically "dark" region;
- Impacts on panoramic views and vistas along Route 28 and from other places within a five mile radius of the project site.

<u>Conclusion</u>

The Belleayre Project will result in significant adverse impacts to community character, the economy of the region and to the region's cultural and historic resources which cannot be mitigated and which are not outweighed by the social, economic and other essential considerations. As a result, the Commissioner will be unable to issue the required legal findings pursuant to 6 N.Y.C.R.R. § 617.11(d)(5). CPC requests that the issue of the Belleayre Project's significant adverse impacts on community character should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

B. Groundwater and Surface Water Impacts

CPC will present evidence that the Belleayre Project raises substantive and significant issues for adjudication since it will result in significant adverse impacts to the area's surface and ground water resources which have not been and cannot be mitigated by Crossroads Ventures. The Belleayre Project will result in violation of New York State Water Quality Standards and unduly stress the region's water resources. As a result, the valuable and unique fisheries will be irrevocably degraded and potentially destroyed. Accordingly, Crossroads Ventures' permit applications must be denied.

The offer of proof submitted herewith prepared by Andrew Michalski, Ph.D., CGWP, Michalski & Associates, attests to the significant adverse surface and ground water impacts that will result from the construction and operation of the Belleayre Project. Dr. Michalski's curriculum vitae is attached hereto as Exhibit "CV-D". His report on Groundwater Issues of the DEIS For the Belleayre Resort is attached hereto as Exhibit "B".

Dr. Michalski will testify to the findings and conclusions in his report including but not limited to the following:

1) The proposed groundwater withdrawal rates from Rosenthal wells R2 and R1, required to meet potable and irrigation water demands for the eastern portion of the project (Big Indian Plateau), cannot be sustained over dry weather periods. The Silo A

Spring cannot be used as a backup supply source during such periods because the flow in Crystal Spring Brook would fall below the criterion of 30% of average flow ("the Tennant threshold").

2.) Even at sustainable reduced rates, groundwater pumping at the two portions of the project (the eastern Big Indian Plateau and western Wildacres Resort) would significantly reduce the baseflows in Crystal Spring Brook, Birch Creek, and Emory Brook. Existing streamflow measurements for dry weather months show that Crystal Spring Brook is already losing much of its baseflow along the segment above the confluence with Birch Creek, and Birch Creek is barely gaining any water within its two-mile segment below the confluence with Crystal Spring Brook. The amount of further reduction in the Birch Creek baseflow attributable to the proposed pumping would approach withdrawal rates from the Rosenthal wells, as the wells would subtract water from the creek. The lower segment of Crystal Spring Brook might completely lose its baseflow due to the combined effects of increased pumping rates at the two portions of the proposed resort and at the existing Belleayre Ski Area, and through flow short-circuiting along open holes of numerous deep bedrock wells installed within and adjacent to the project area. This effect will further be exacerbated by the proposed expansion of the Belleayre Ski Center.

3) Extensive lowering of bedrock water levels due to pumping at the Rosenthal supply wells, estimated to exceed 45 to 50 feet within a half-mile radius of the wells, could adversely impact a number of residential wells located outside the Pine Hill Water Company service area. Cumulative impacts of concentrated bedrock pumping at the two portions of the project and at the Belleayre Ski Center include well interference effects and the potential for inducing an upward migration of saline water. Expansion of the Belleayre Ski Center will increase the potential for these impacts to occur.

4) Re-evaluation of bedrock hydrogeology and spring capture areas, with due

accounting for structural effects of a stacked multi-aquifer bedrock and the role of open holes, should be conducted by the Applicant in order to assess and quantify groundwater-related impacts and to develop reliable monitoring of such impacts.

In addition, Dr. James Thaler, author of Catskill Weather, will testify that the use of the Slide Mountain precipitation data overestimates the precipitation which will fall in the area of the Project. Dr. Thaler's curriculum vitae is attached as Exhibit "CV - E". Dr. Thaler's letter supporting the analysis prepared by Trout Unlimited is attached as Exhibit "C ". The report prepared by Trout Unlimited is attached as Exhibit "D ". T

The 60.24 inch Slide Mountain precipitation number is relied on in the DEIS, in terms identical to that of the water budgets, that, "direct precipitation input to the 3.5 acre irrigation ponds, less the expected evaporation losses, will be approximately 3.8 million gallons per year, on average." The further – and critical – claim is that this contribution from runoff will reduce demands on proposed irrigation well Rosenthal no.1, adjacent to Birch Creek. As annual average precipitation for Belleayre Mountain is roughly 28% less than for Slide Mountain, 3.8 million gallons is overly optimistic. As a result, more water over longer periods of time will be pumped from the Rosenthal well in order to make up the shortfall and to keep the Big Indian golf course green in dry weather. However, as indicated in the expert reports, there isn't enough water in the aquifer and (2) pumping the Rosenthal wells will take water from Birch Creek.

C. Water Supply

The CPC contends that the use of the water resources and systems identified in the DEIS (including Water Supply Applications and Water Conservation Programs) for the Belleayre Resort project raise substantive and significant issues for adjudication since the DEIS and water supply applications fail to demonstrate that it can meet the criteria set forth in ECL § 15-1503(2). Neither the DEIS nor the application demonstrate that: the potable water resources proposed for the Big Indian Plateau are adequate as required by, 6 NYCRR 601.5(k)(5) and 601.6 (b) (4); the use of the potable water resources proposed for the Big Indian Plateau are just and equitable (as required by 6 NYCRR 601.5(k)(6) and 601.6 (b)(6)); the use of the potable water resources proposed for the Big Indian Plateau is necessary as required by 6 NYCRR 601.5(k)(1), 601.6 (b) (1), and 601.6 (B)(2). In addition, the DEIS fails to provide essential documentation regarding the applicant's ability to satisfy all of the legal and regulatory prerequisites to use of the identified water supply resources for both the Big Indian Plateau and the Wild Acres portions of the proposed resort.

The CPC will rely on the testimony of Mr. Paul Rubin, principal hydro geologist with HydroQuest, a hydrological consulting firm based in Stone Ridge, New York, and Andrew Michalski, Ph.D., CGWP, Michalski & Associates. Mr. Rubin's curriculum vitae is attached to this Petition as Exhibit "CV-F ". Mr. Rubin's letter to DEC which summarizes the substantive and significant issues concerning the impacts to the potable water supply is attached as Exhibit "E". The CPC will also submit testimony by Richard Schaedle, Chairman of the Pine Hill Water District Coalition and Matthew Persons, a member of the Water Coalition; both Mr. Schaedle and Mr. Persons have extensive experience in the management of the water system and water resources serving Pine Hill.

Since May of 2001, the Alliance and the Water Coalition have contested the data and conclusions of the water supply sections of the DEIS in the context of the SEQRA review of the proposed Belleayre Project and in the context of the SEQRA review of a modification to the water supply permit now held by the Town of Shandaken for the Pine Hill Water District (Permit # 3-5150-00365/00001). The Alliance and the Water Coalition contend that the engineering and hydrological studies supplied in support of the Pine Hill water supply permit contain tables, charts, data, and analyses drawn from, and in many cases, identical to the materials offered in support of the water supply application for the Big Indian Plateau. These groups have argued throughout the DEC's review of this project that there simply is not enough water on the eastern portion of the Belleayre ridge to supply the water needs of the hamlet of Pine Hill, the Belleayre Ski Center, and a new 2,000-acre golf course resort. With the proposed expansion of the Belleayre Ski Center, the available potable water supply will further decrease. Mr. Rubin's affidavit in the prior litigation and his letter to DEC are attached hereto as Exhibit "F ".

Because the water resources in the two permits applications overlap, the Alliance and the Water Coalition, joined by the Natural Resources Defense Council, brought suit against the DEC in November of 2002, seeking an adjudicatory public hearing in regard to the DEC's decision at that time to allow Crystal Spring-Silo A, a water resource now proposed for use by the resort, to be removed from the Pine Hill Water Supply Permit by Mr. Dean Gitter during his ownership of the Pine Hill Water Company. The suit also raised issues of segmentation of review under SEQRA, given Mr. Gitter's role in the three companies (Crossroads Ventures, LLC; Silk Road Organization of NY, and the Pine Hill Water Company) that came to own all of Pine Hill's public water resources during the period between 2000 and 2003. Although the court declined to require a hearing on the modifications to the Pine Hill Water Supply Permit, the ruling was based in part on the opportunity for review of the use of Crystal Spring-Silo A by the resort at a later point: "*Most importantly*, any potential environmental impacts of the proposed Resort on the Pine Hill's water supply will have to be fully addressed during the resort SEQRA review." (Supreme Court of the State of New York, Albany County, Memorandum and Judgment, Index No. 7343-02, February 14, 2003, p. 18; emphasis in original)

The Water Coalition will be submitting, concurrent with the review of the Belleayre Project, a Water Supply Application under 6 N.Y.C.R.R. § 621.14. The application will demonstrate that the current Pine Hills Water Supply Permit (permit number 3-5150-00365/00001) must be modified based on materially false and inaccurate statements in the Pine Hills permit application; newly discovered material information and a material change in environmental conditions; and noncompliance with the Environmental Conservation Law and implementing regulations related to the water supply permit.

Mr. Rubin and Dr. Michalski have evaluated the DEIS and found it to be substantively deficient. They will testify that their analyses have identified substantive and significant flaws, as outlined below:

1) the applicant has not shown that the water resources proposed for the Big Indian plateau are adequate (as required by 6 NYCRR 601.5(k)(5) and 601.6(4)). Specifically, the applicant has failed to document sustained yields of all the wells (and particularly Rosenthal Well # 1 and Rosenthal Well # 2) and of the Crystal Spring-Silo A, proposed as a backup source of potable water supply in the DEIS, during severe drought conditions. Instead, the periods of measurement provided are insufficiently dry, the estimates of flows are overly generous, and the methods of assessing low flow conditions are inappropriate. In addition, the possibility of interconnection of the wells (and possibly with springs in the same aquifer) requires evaluation before the sustained yields of the wells can be considered verified. Finally, even if taken as valid, the flows reported for Crystal Spring-Silo A, especially given the requirement to limit its use during low flow conditions (see DEIS Section 3.2.2.K, page 3-42), show it to fall below the flows required for an auxiliary source as determined by the New York State Department of Health and the applicable Ten States Standards;

2) the applicant has not shown that the use of the water resources proposed for the Big Indian plateau are just and equitable (as required by 6 NYCRR 601.5(k)(6) and 601.6(6)). Specifically, the adverse hydrological impacts of the water uses proposed in the DEIS, both for potable water and for irrigation, have been underestimated; the

possibility of interconnected wells has not been fully evaluated; the effects of additional large withdrawals on the aquifer have not been sufficiently gauged; the impacts of depleting stream flows, especially on fish and fish breeding, have not been fully assessed and mitigated; and the present and future competing water needs of both the hamlet of Pine Hill and the Belleayre Ski Center have not been fully explored. The proposed expansion of the Belleayre Ski Center further emphasizes the need for a thorough evaluation of the water needs of the Belleayre Project and the hamlet of Pine Hills.

3) the applicant has not shown that the use of the water resources proposed for the Big Indian plateau is necessary (as required by 6 N.Y.C.R.R. § § 601.5(k)(1), 601.6(1), and 601.6(2)). Specifically, alternative water sources (i.e., additional wells) have not been fully evaluated, and alternative uses (e.g., smaller resort, redesign as hiking and biking or wilderness retreat center, and others) that are less water-use-intensive have not been seriously considered. A reduced scale alternative will also ease the pressure on the available water supply which will result from the expansion of the Belleayre Ski Center.

None of these points relies on challenges to the applicant's ownership of the Crystal Spring -Silo A. Instead, this analysis rests on the permitting requirements for installing a new water supply system, developing sources of water supply in connection with such water supply system, and entering into contracts or other agreements for the supply of water (6 N.Y.C.R.R. § 601.1-8). The CPC will raise legal questions regarding a covenant on the deed for Crystal Spring-Silo A -- restricting use of its water to Ulster County -- which is invoked by the proposed use of its water for a resort spanning Ulster and Delaware Counties. Finally, the CPC will argue that the DEIS does not supply sufficient legal and engineering detail regarding the Water Supply Application for the Village of Fleischmanns to complete an adequate analysis.

Conclusion

The DEIS fails to provide accurate and sufficient information needed to justify the use of the Rosenthal Wells and Crystal Spring-Silo A for the Big Indian Plateau. It also fails to provide sufficient information to justify use of the water supply system of the Village of Fleishmanns for the Wild Acres and Highmount Estates portions of the resort. As a result, the Commissioner cannot issue the findings required pursuant to 6 N.Y.C.R.R. 617.11 (d)(5). Therefore, Crossroad's Ventures permit applications should be denied.

D. Noise Impacts

CPC contends that the Belleayre Project presents substantive and significant issues for adjudication since it will result in significant adverse noise impacts which have not been and cannot be mitigated by Crossroads Ventures. Therefore, Crossroads Ventures' permit applications must be denied.

The CPC will present the testimony of Peter J. Smith and Mary Kopaskie who will testify that the DEIS failed to mitigate the noise generated from the Belleayre Project notwithstanding that the noise impacts will be intrusive. Mr. Smith and Ms. Kopaskie will testify to the following:

1.) The Sound Impact Study (SIS) for the DEIS assumes that increases in existing sound levels of 9 dBA or less are: "insignificant, temporary construction noise"[1]. The DEIS improperly refers to the noise generated at these levels as "insignificant". Pursuant to DEC' Policy Assessing and Mitigating Noise Impacts ("Policy"), DEC refers to these levels as intrusive and may cause complaints. Yet, these impacts are

[1] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 - Sound Impact Study. p. 4-2.

dismissed in the DEIS without any discussion of mitigation. Clearly, according to the DEC Policy, further consideration is needed.

2.) The DEIS states that typical blasting noise levels range between 93 to 94 dBA at a distance of 50 feet. The DEIS also states that blasting noise levels will be only 46 dBA for the proposed project which is 4 dBA below the existing ambient daytime average sound level. The existing daytime sounds, as documented in the DEIS, range from 41 to 50 dBA and are characterized by "wind rustling through the trees" and the sound of a "nearby creek."[2] The DEIS wrongfully implies that, through noise attenuation, these activities will not increase the current noise levels in the area. The DEIS erroneously concludes that: "blasting for this project is not to significantly contribute to overall Project construction noise." Blasting the mountaintop will create an amphitheater effect and the noise levels will be in excess of existing, ambient wind and creek levels. This is one of the factors which the DEC Policy requires that the DEIS consider. See DEC Policy page 10.

3.) Increased noise levels will impact local neighborhoods during construction of the proposed Belleayre Project. The cumulative effects of blasting and construction will increase the noise levels from levels associated with a rural community to those at equal to an urban industrial area. See DEC Policy page 20. Additionally, the noise levels will exceed ambient levels of a rural setting and will have significant impacts on residents. Finally, the noise mitigation plans are not clearly defined and do not state how noise will be regulated to control the impacts. This is required by the DEC Policy. See DEC Policy pages 23-26.

4.) The community character noise impacts that have not been adequately evaluated in the DEIS include:

[2] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 Sound Impact Study. p. 3-10.

- Duration of noise, especially in the summer months when most residents are outside and windows are open
- Noise impacts from trucks hauling fill (over 230,000 cubic yards) and construction materials throughout construction
- Noise impacts from trucks and vehicles to service the Resort once it opens
- Increased traffic noise from Resort users
- Increased traffic noise from Belleayre Ski Center users

Conclusion

The Belleayre Project will result in significant adverse noise impacts which will have long term detrimental effects to the surrounding communities which cannot be mitigated and which are not outweighed by the social, economic and other essential considerations. The DEIS did not take a hard look at these adverse impacts and does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R.§ 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's adverse noise impacts should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

E. Traffic Impacts

CPC contends that the Belleayre Project will result in substantive and significant traffic impacts which require adjudication since the DEIS' traffic impact analysis undervalued the impacts and underestimated the current traffic. CPC's experts will demonstrate that the Belleayre Project's traffic impacts have not been properly evaluated in the DEIS and that significant elements have been omitted from the analysis.

CPC will offer the expert testimony of Brian T. Ketcham, P.E., whose curriculum vitae is attached as Exhibit "CV-G". The report prepared by Community Consulting Services is attached as Exhibit "G ". In addition, Ferrradino & Associates, Inc. evaluated the traffic impact analysis in the DEIS and found that it to be inaccurate and incomplete. The "Ferradino Report" is attached as Exhibit "H". Mr. Ketcham has reviewed the Ferradino report and endorses its analysis and conclusions and is prepared to testify to the issues presented in the Ferradino report, many of which are consistent with and support the findings set forth in Mr. Ketcham's report.

Mr. Ketcham will testify that, in his expert opinion, the DEIS fails to address the actual traffic impacts from the Belleayre Project. He will testify to the findings and conclusions in his report including but not limited to the following.

1.) The DEIS understates the magnitude of traffic associated with the Belleayre Project and the magnitude of background growth which is likely to occur. The underreporting of future conditions is based, in part, on the selection of 2008 as the year of the traffic analysis despite it being only two years into the construction schedule. If the year 2014 were used, which is the completion date, the growth in background traffic on Route 28 would be double the traffic volume considered in the DEIS. Mr. Ketcham's report is attached hereto as Exhibit "I". The DEIS also fails to consider the growth rate projected for the Ski Center from 5,000 skiers in 2003 to approximately 8,000 skiers by 2008. In addition the traffic projections for the Belleayre Project are based on the median to low traffic rates set forth in the Institute of Transportation Engineers ("ITE") Trip Generation Manual. The ITE presents not only average conditions in the field it also includes minimum and maximum rates observed in the field. Notwithstanding that the Belleayre Project will depend on its success in attracting visitors and guests, the DEIS does not consider the traffic generated based on higher occupancy associated with a highly successful resort.

2.) The DEIS also fails to consider the effects of the Belleayre Mountain Ski Center expansion. Use of the Ski Center has increased dramatically since the 1999-2000 baseline season for the DEIS. The increased use of the Ski Center is neither reported in the DEIS nor is the increased use of the Ski Center associated with the proposed expansion.

3.) The DEIS utilizes inappropriate traffic count figures for analyzing the worst case traffic impacts. The use of Martin Luther King, Jr. holiday weekend traffic counts as the worst case scenario does not reflect the significant number of days with a higher volume of ski attendees during the 2002-2003 period. Counts taken by Mr. Ketcham in the February of 2003 and included in Exhibit "I " reinforce this observation. Mr. Ketcham has modeled the intersection of Route 28 and County Road 49A, the entrance to the Belleayre Ski Resort, using both Saturday P.M. peak hour volumes in the DEIS and volumes more likely to occur in 2014 with the full Ski Resort build out and full Resort occupancy. Exhibit "I" presents the results for a signalized intersection: according to the DEIS, traffic at the intersection will operate at a Level of Service (LOS) C; with more realistic 2014 worst case traffic, it will operate at a failed condition, LOS F.

4.) The DEIS fails to account for shuttle bus operation between Big Indian and the Ski Center. Despite the assertion that 80% of trips to and from the Ski Center will be by shuttle bus, the DEIS does not include shuttle bus trips. The DEIS fails to account for a reasonable number of non-shuttle bus trips (i.e., auto trips) based on the desires of skiers to arrive promptly at the Ski Center and avoid undue delays associated with shuttle bus transportation. The Belleayre Project generated trips will likely increase to 1000 trips in the Saturday P.M. peak hour, more than doubling the traffic volumes measured in 2003.

5.) The DEIS fails to assess the potential doubling of parking spaces and potential alternative parking locations proposed by expansion of the Ski Center and the necessary increase in Ski Resort shuttle bus traffic; temporal distribution of trips and the associated impacts during the various times of day and between competing uses; vehicle occupancy factors; current bus service to the Ski Center and existing shuttle bus service; accident and safety impacts or conditions in the Route 28 corridor.

6.) The DEIS does not account for any non-ski trips, such as those that are made to off-site locations to expend the estimated $19.2 million in annual sales, which are forecast to be made each year.

Conclusion

The Belleayre Project will result in significant adverse traffic impacts which will have long term detrimental effects to the surrounding communities which cannot be mitigated and which are not outweighed by the social, economic and other essential considerations. The DEIS did not take a hard look at these adverse traffic impacts and does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R.§ 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's adverse noise impacts should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

F. Aquatic Habitat

CPC contends that the Belleayre Project raises substantive and significant issues for adjudication since the DEIS failed to adequately address the environmental impacts of the water withdrawal on the area's surface waters and aquatic habitat in the vicinity of the project. The CPC will rely on the testimony of Dr. Piotr Parasiewicz to demonstrate that the DEIS fails to adequately address the catastrophic impacts which the water regime for the Belleayre Project will have on the area's aquatic resources. Dr. Parasiewicz' curriculum vitae is attached as Exhibit "CV-H ". Dr. Parasiewicz' expert report is attached as Exhibit "J ".

Dr. Parasiewicz will testify to the findings in his report including but not limited to the following:

1.) The proposed Belleayre Resort at Catskill Park is located in the headwaters of Lost Clove Brook and tributaries to Birch Creek, (third and second order tributaries of Esopus Creek), as well as in headwaters of tributaries to Emory Brook (a second order tributary of the Bush Kill). These high gradient, coldwater streams are classified as *Trout Spawning* streams, or are recommended for upgrade to trout spawning classification, and support a relatively vibrant fish fauna. Electrofishing data collected in 2000 by the NYS DEC (Mike Flaherty, Region 3) show a fish community dominated by trout species. However, differences were noted in the faunal composition between upstream areas dominated by native brook trout and the lower portion of Birch Creek (below the confluence with Crystal Spring Brook), dominated by brown and rainbow trout. The number of juvenile trout recorded indicates healthy reproduction in these streams. The accompanying species include low numbers of slimy sculpin, longnose dace, blacknose dace and white sucker, as is characteristic of New York coldwater streams. The existing electrofishing data provides only a rough assessment of the relative density of species within the fish community, but the overall community appears appropriate for this type of stream.

Upstream of Pine Hill, the habitat quality of Birch Creek appears relatively unimpaired. It has diverse habitat features and is well shaded, meaning low water temperatures can be anticipated. However, the woody debris dams that provide important habitat for brook trout are infrequent. Further downstream, between Pine Hill and the confluence, substantial channel modifications can be observed. Lack of vegetation along some reaches of this section of the stream corridor may result in elevated water temperatures. This would help explain the lower number of brook trout recorded.

2.) The Belleayre Project will result in the following impacts:

- reduction of ground water levels and loss of base flow in adjacent streams;
- increased duration of low flows;
- increased water temperature;
- increased pollution levels;
- modification of stream morphology;
- reduction of fish densities and a shift of community structure from one dominated by trout towards generalist, warm water species (e.g. bluegill). Convincing proof that this will be avoided has not been provided in DEIS documentation.

This habitat will be further stressed by the proposed expansion of the Belleayre Ski Center.

3.) Dr. Michalski's expert analysis indicates that flows in the evaluated streams are flashy, with a relatively low amount of ground water contributing to summer flows. These flashy conditions may be caused by shallow soils due to historic deforestation of the region (Parasiewicz 2000). This pattern is dramatic in the Catskill Mountains because of the high instability of post-glacial till that accelerates topsoil removal. The flashiness of flows is clearly visible on the Big Indian hydrograph. Flows in Catskill mountain streams can increase by a magnitude of 45 (see Exhibit "J ", Figure 1). Because of the low storage capacity of surface soils, another characteristic of the flow regime is an extended duration of low flows.

4.) During four summer and fall seasons recorded at the Big Indian gauge, stream flows remained under the 30% Tennant threshold for 63% of the time. During the drought years of 2001 and 2002, flows fell below the 30% threshold for 90% of the time and for over 70 days without interruption. In addition, flows can stay below the 10 % threshold (delineating poor fisheries) for a period of two weeks continuously. In Birch Creek, low flow durations are likely extended by early withdrawals of water for snow making starting in September. The usual consequences of extended duration and frequency of low flow conditions are elevated temperatures and pollution levels (see Exhibit "J", Figure 2). Canopy cover shading, variability in habitat structure, and a substantial base flow are essential factors in mitigating this impact.

5.) In Birch Creek, the primary impact of the proposed project on aquatic fauna will be through modification of its flow regime. This low flow regime will result from a reduction of flow in the river due to increased ground water pumping and surface withdrawals for snow-making and faster surface runoff due to increased impervious area, removal of forest cover, filling and fragmentation of wetlands and compaction of soils on the ski slopes. Increased runoff can result in higher peak flows, sediment transport and subsequent channel alteration. Despite the proposed detention ponds, increased stream flows could result in additional fine sediments being transported downstream also due to erosion processes below the ponds. Fine sediments reduce the interstitial space in the gravel substrate, reducing macro-invertebrate production as well as the survival of trout larvae (trout larvae actively utilize interstitial spaces immediately after hatching). A secondary effect of detention areas can be elevated temperature of pond water entering streams after a storm event. The removal of forest vegetation and reduction of wetlands will inevitably lead to reduced subsurface water storage capacity within the watershed, also contributing to lower stream flows during the summer months. Reduced storage could also potentially reduce recharge of ground water and lead to lower ground water intrusion into the streams.

6.) Using the data compiled by Dr. Michalski, in comparison with the present situation, the proposed project would conservatively increase withdrawals by 0.3 cfs which will result in a concomitant reduction in flow. Reduced flow means less wetted area (i.e. smaller river) which limits fish mobility and increases the vulnerability of small fish to predation as shallow margins are removed first. Reduced flows increase the separation between juvenile and adult trout habitats, forcing young fish to use high-risk locations. Lower water depth and flow velocities also create habitat that is much less suitable for fluvial specialists that require flowing waters. The expected result is a shift of the fish community structure from specialized species towards habitat generalists. More shallow, slower moving waters also warm faster, especially if ground water contributions are diminished. Reduced intrusions from underwater springs may reduce spawning success of trout and negatively affect their populations not only in Birch Creek but in entire Esopus system. In the winter, ground water intrusions increase water temperature in streams limiting creation of frazil ice. Lack of spring water can lead to creation of anchor ice that can impact fish larvae as well as channel morphology.

Additional impacts to fish habitat are associated with destabilization of the flow regime. Higher peak flows can modify channel geometry creating an over-widen channels as is the case on other rivers in the Catskills including the Beaver Kill. Reduced number of pools leads to less diverse habitat structure and reduction of canopy cover shading elevate summer temperatures even more. Increased sediment transport during higher flows could cause large deposition areas and even impact bridges and culverts in the watershed. These impacts will be exacerbated by the proposed expansion of the Belleayre Ski Center.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the Belleayre Project will cause significant adverse impacts to the aquatic habitat in the area of the Project. Due to the complicated geological nature of the area and the project size, in order to adequately identify the impacts on stream flows and

aquatic habitat, a precise watershed-wide hydrological model is required. In addition, in order to estimate the consequences of flow and morphological changes on resident fish fauna, a quantitative habitat model must be prepared in conjunction with the hydrological simulation. As a result, the Commissioner cannot issue the findings required pursuant to 6 N.Y.C.R.R. § 617.11 (d)(5). CPC requests that the issue of the Belleayre Project's adverse impacts on fish habitat should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

G. Impacts on the Forest Preserve

CPC contends that the Belleayre Project raises substantive and significant issues for adjudication since the DEIS failed to adequately address the significant adverse impacts to the Forest Preserve and recreational opportunities for visitors to the area. The CPC will rely on the testimony of Professor Chad Dawson to demonstrate that the Belleayre Project will result in substantial adverse impacts to the Forest Preserve land and resources due to the large increase in visitors to the area which the DEIS predicts the Belleayre Project will generate. Professor Dawson's curriculum vitae is attached as Exhibit "CV –I". Professor Dawson's letter opinion is attached as Exhibit "K ".

Professor Dawson will testify that the DEIS predictions set forth in Appendix 26 indicate that the projected visitation will be approximately 637,800 visits to the Belleayre Project. The Belleayre Project will generate more than ten times the current annual reported use of the trail visits on all trails in all areas of the Catskill Park. Even assuming that each visitor will spend only one trip per year on Forest Preserve lands, the Belleayre Project will result in a seven hundred (700%) percent increase in use of the Forest Preserve trails. In anticipation that the visitors will be more likely to visit the Forest Preserve lands in proximity to the Belleayre Project, the intensity of the use will result in even greater adverse impacts. The DEIS fails to address these impacts. DEC has already acknowledged that the potential for overuse of the Forest Preserve lands presents its greatest danger even before the Belleayre Project was proposed. The Belleayre Project also undermines many of the values and goals set forth in the Catskill Park Master Plan.

Professor Dawson will testify that the potential biological and ecological impacts include trampled and disturbed vegetation, disturbance of breeding and nesting birds and animal behavior, changes in the ecosystem due to physical changes in the environment; physical changes to the trail system and visitor distribution and the resultant social conditions which will result from increased visitation and use of the Forest Preserve.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the Belleayre Project will cause significant adverse impacts to the Catskill Forest Preserve. Due to the significant increase in visitors expected to at the Belleayre Project, the likely impacts to the Forest Preserve will be significant. Yet, the DEIS fails to evaluate the impacts to the Forest Preserve and the increased use of trails and resources which will result from the Belleayre Project. As a result, the Commissioner cannot issue the findings required pursuant to 6 N.Y.C.R.R. § 617.11 (d)(5). CPC requests that the issue of the Belleayre Project's adverse impacts on the Forest Preserve should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

H Wildlife and Habitat Impacts

CPC contends that the Belleayre Project raises substantive and significant issues for adjudication since the DEIS failed to adequately address the significant adverse impacts on wildlife, habitat and fauna. The CPC will rely on the testimony of

Dr. Erik Kiviat to demonstrate that the DEIS fails to adequately attribute ecological significance to the biodiversity of the project site and the Belleayre Project's off-site impacts. Dr. Kiviat's curriculum vitae is attached as Exhibit "CV-J". Dr. Kiviat's report is attached as Exhibit "L". In addition, Dr. Michael Burger will testify concerning the Catskill Important Bird Area. The Audubon New York letter supporting the listing is attached as Exhibit "M" " and the resume of Dr. Burger is attached as Exhibit "CV-K ". Graham Cox will support the testimony of Dr. Burger. His curriculum vitae is attached as Exhibit "CV-L".

Dr. Kiviat will testify to the findings and conclusions in his report including but limited to the following:

1.) The area provides diversity and rich biological resources. For example, large areas of forest near the Long Clove Trail are dominated or co-dominated by beech which is likely unusual for the Catskill Mountains and may provide special biodiversity values associated with rare specialist insects, fungi or animals that use beech mast as a critical resource. In addition, Dr. Kiviat identified diverse communities of forest floor wildflowers, extensive hardwood forests, spring and seep habitats and streamside habitats. The site is also potential habitat for Northernmonkshood which is designated as a threatened plant species by the federal government.

2.) The zoological surveys in the DEIS were not adequate given the size of the site and its seeming diversity. For example ornithologists typically consider 3-5 visits per habitat to be sufficient to evaluate a site. Given the size of the site, its topography and variety, the 8 day survey undertaken for the DEIS was not sufficient to characterize the site. For example, the DEIS dismissed the possibility of the presence of significant bird species on the site. However, the site is included as part of the Catskill Important Bird Area as identified by scientists associated with Audubon New York.

In 1988, Audubon New York, in its initial round of identifying Important Bird Areas ("IBA") in New York State, which was published in 1998, identified significant parts of the Catskill Park and New York City watershed as Important Bird Areas using internationally recognized selection criteria. The list of criteria can be found in National Audubon's web site attached hereto as Exhibit "N". In its second round of research and analysis, which is on-going, Audubon New York will be modifying the IBA boundaries based on more thorough analyses using, among other tools, GIS data and integrating this information with the "GAP analysis" study prepared by the DEC and Cornell University on behalf of the United States Department of the Interior which indicated "gaps" in the protection of the State's biological resources. This further analysis being undertaken by Audubon New York supports including as part of the IBA tracts of Forest Preserve and adjacent properties to the south of the Route 28 corridor which are centered on the Belleayre Ski Center. However, the site is currently included for consideration and evaluation as part of an expanded Catskill Important Bird Area as identified by scientists associated with Audubon New York. Audubon New York's IBA technical advisory committee is currently evaluating the data prior to issuance of the revised Catskill IBA listing.

Forest fragmentation and parcelization will degrade the intact hardwood forest cover and likely will result in an adverse impact on the assemblage of forest responsibility species; species that rely on the particular habitat of a region for their long-term conservation. This assemblage of forest responsibility species forms the core of the IBA identification for this particular Catskill site. The portion of the IBA on the Forest Preserve lands could be considered in the future for designation by DEC as a Bird Conservation Area (BCA), for which a management plan specific to protection of forest bird species would be prepared.

The Catskill Important Bird Area is one of the largest, most intact contiguous habitats for the assemblage of forest responsibility species in the Appalachian

Mountains Bird Conservation Region of New York State. As mentioned, responsibility species are those that rely on the particular habitat of a region for their long-term conservation because they are found at high relative abundances and/or have a disproportionately high percentage of their populations in the particular Bird Conservation Region. The forest assemblage of the Appalachian Mountain Bird Conservation Region is composed of the following species: Black-and-white Warbler, Black-billed Cuckoo, Black-throated Blue Warbler, Blue-gray Gnatcatcher, Canada Warbler, Cerulean Warbler, Eastern Wood-Pewee, Hooded Warbler, Least Flycatcher, Louisiana Waterthrush, Northern Flicker, Rose-breasted Grosbeak, Scarlet Tanager, Sharp-shinned Hawk, Wood Thrush, Worm-eating Warbler, Yellow-throated Vireo. Many other more common species also nest within the region. While not all of the above-listed species breed within the Catskill Important Bird Area or on Belleayre Mountain, many do and all of the species are likely to utilize the region during migrations before and after the breeding season. The massive proposed Belleayre Resort would cause fragmentation of this habitat and would destroy the functionality of a significant segment of this important Bird Conservation Region.

3.) The zoological survey ignored rare or uncommon mammals which would be expected to be present in the well-developed forests and rocky habitats present at the site. The presence of the endangered Indiana Bat is dismissed notwithstanding that the habitat appeared suitable for maternity roosting. In addition, the site appears suitable for timber rattlesnake habitat which was all but ignored by the DEIS.

4.) The DEIS fails to identify or discuss the potential significance of the Belleayre Project on the extensive forests adjacent to the site. The site forms part of an extensive forest, including the two largest designated wilderness areas of the Catskill Park. The extensive forest, including the site and the adjacent wilderness areas are essential features of the Park and support wide-ranging, area-sensitive or forest interior species.

5.) A rare plant survey should have been conducted as part of the DEIS process in order to identify rare species in the Catskills in flowering and non-flowering form and sedges of statewide or regional significance.

6.) The site survey did not adequately evaluate the site for the presence of Wood and Spotted Turtles, species of special concern and Spring Salamander and Red Salamander which are both regionally rare but which may have been discovered with a thorough analysis.

7.) The streams on and adjacent to the site support trout Brook Trout and slimy sculpin which depend on cool flowing water with high dissolved oxygen content and good water quality. As indicated in the expert reports in the Petition for Party Status, the Belleayre Project will cause significant erosion on steep slopes and elsewhere on the site which will result in increased turbidity nutrient levels and temperature which would decrease the dissolved oxygen in the local streams. In addition, as indicated in reports provided by experts in the Petition for Party Status, pesticides and nutrients from operation of the golf courses will threaten the fish population of the local streams.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the Belleayre Project will cause significant adverse impacts to the wildlife and wildlife habitat. Due to the significant alteration in the topography of the site and its associated dramatic deforestation, the Belleayre Project will result in significant loss of wildlife resources and habitat. The loss will not be limited to the Project site. Rather, the impacts will be felt on adjacent state lands including lands dedicated to natural resource preservation and wilderness experience. The DEIS fails to evaluate the wildlife resource and habitat impacts which will result from the Belleayre Project. As a result, the Commissioner cannot issue the findings required pursuant to 6 N.Y.C.R.R. § 617.11 (d)(5). CPC requests that the issue of the Belleayre Project's adverse impacts on wildlife resources and habitat should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

I. Forestry Impacts

CPC contends that the Belleayre Project raises substantive and significant issues for adjudication since the DEIS failed to adequately address the significant adverse impacts on the extensive forestlands of which the site forms one component. On either side of the Big Indian site are extensive tracts of wilderness areas of the New York State Forest Preserve. Yet, the DEIS does not account for private forest fragmentation which will result from development of the site including habitat and biological impacts. In addition, notwithstanding that private forest land continues to be lost at an alarming rate in the Catskill region, the DEIS does not account for the cumulative loss of this significant resource.

The CPC will rely on the testimony of Dr. Myrna Hall and Ms. Mary L. Tyrrell to demonstrate that the DEIS fails to adequately address the loss and fragmentation of private forestland and the forest impacts which will result from the Belleayre Project. Dr. Hall's curriculum vitae is attached as Exhibit "CV-M" , Ms. Tyrrell's curriculum vitae is attached as Exhibit "CV-N " and their report is attached as Exhibit "O". Dr. Kiviat and will also testify concerning the impact of fragmented forest on the biodiversity of the region.

Dr. Myrna Hall and Dr. Kiviat will testify to the findings and conclusions in their reports including but not limited to the following:

1.) Private forest land, now estimated to account for 1.4 million acres of land within the study area defined as a portion of the New York City Catskill and Delaware Watersheds is disappearing at a rate of 16,187 acres per year for a total of 145,685 acres between 1992 and 2001. The rate is likely to proceed over the next decade which would result in the loss of another 162,000 acres of private forestland and a significantly fragmented forest resource. Fragmentation, parcelization and loss of private forest lands in the areas near the site will be accelerated with the construction and operation of the Belleayre Project.

2.) The largely forested Catskill/Delaware Watersheds are under tremendous pressure from development. Two prominent features of the Catskill region are the nearly 300,000 acres of public forest land and the 1,854 square miles of catchment known as the Catskill/Delaware watersheds. Forest fragmentation and parcelization will degrade the biodiversity of this important area of second growth forest and will diminish the biodiversity of the regional forest. The Belleayre Project will result in the loss of intact forestlands which now extend on either side of the Big Indian parcel. This loss will result in an increased edge effect, with the associated introduction of weeds, nuisance species, loss of breeding habitat and the loss of woodland bird species.

3.) Given the extensive tract of forest land on the site and adjacent thereto, it is reasonable, and consistent with the known literature concerning forestlands of this expanse and type, that it supports wide-ranging, area sensitive and forest interior species such as black bear, fisher, bobcat, barred owl, diverse bird species and the timber rattlesnake. The DEIS fails to assess the impact that fragmenting the forest will have on these and other species.

4.) As indicated in section I of the Petition for Party Status, and in the correspondence from Audubon New York, the site will likely be included as part of the

Catskill Important Bird Area as identified by scientists associated with Audubon New York. The Catskill Important Bird Area is one of the largest, most intact contiguous habitats for the assemblage of forest responsibility species in the Appalachian Mountains Bird Conservation Region of New York State. The massive proposed Belleayre Resort would cause fragmentation of this habitat and would destroy the functionality of a significant segment of this important Bird Conservation Region.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, the Belleayre Project's significant adverse impacts on the extensive forestlands of the region of which the site forms one component. Due to the dramatic deforestation of the site, the Belleayre Project will result in forest fragmentation and a significant loss of wildlife resources and habitat. The loss will not be limited to the Project site. Rather, the impacts will be felt on adjacent state lands including lands dedicated to natural resource preservation and wilderness experience. The DEIS fails to evaluate these wildlife resource and habitat impacts which will result from the Belleayre Project. As a result, the Commissioner cannot issue the findings required pursuant to 6 N.Y.C.R.R. § 617.11 (d)(5). CPC requests that the issue of the Belleayre Project's adverse impacts on the forestlands should be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

J. Alternatives

CPC will present evidence that none of the alternatives considered by the applicant are discussed in a way that provides a meaningful basis to evaluate the environmental impacts of the proposed action, because of the utter lack of detail in the evaluation of alternatives considered, the absence of smaller scale alternatives, and critical deficiencies in the analysis of impacts for the applicant's preferred plan (Sections 3 and 4). According to 6 NYCRR § 617.9(b)(5)(v): "The description and evaluation of each alternative should be at a level of detail sufficient to permit a comparative assessment of the alternatives discussed."

The DEIS falls far short of this standard, since the necessary detail either is absent or very limited, thereby utterly thwarting the requisite comparative assessment of alternatives. CPC will identify a number of substantive deficiencies in the DEIS's analysis of the impacts of the proposed action, particularly as this information relates to the comparative evaluation of alternatives. CPC will offer the testimony of John Ellsworth, Manager of Environmental Programs for Cashin Associates, P.C., and John Altschuler, Hamilton, Rabinovitz and Altschuler, whose curriculum vitae are attached as Exhibit "CV-O" and Exhibit "CV-P" respectively. Mr. Ellsworth and Mr. Altschuler will testify to facts and conditions set forth in their reports attached as Exhibit "P" and "Q" , including:

1. The applicant's analysis and conclusions regarding a one golf course/one hotel option as required by the scoping document is flawed. The applicant's conclusion that a one golf course/one hotel option is not financially feasible is erroneous, and further ignores the natural resource benefits and other benefits of such an option.

2. The applicant has completely failed to analyze any other reasonable alternatives of smaller scale or magnitude. Among the alternative uses for the subject property that should be examined in the DEIS is a facility, scaled down significantly from the proposed plan, which focuses primarily on addressing the local shortfall of lodging identified in the DEIS. Such an alternative could be designed to provide a range of lodging options, similar to the proposed project, and also could include suitable amenities (e.g., one or more restaurants, lodging-related shops and recreational facilities, to name a few). It would be appropriate for this alternative to include a number of variants, which examine a range of options for lodging facilities and amenities.

3) The analysis of reasonable alternatives must be evaluated as a means to eliminate, avoid or mitigate the significant adverse impacts which will result from the proposed Belleayre Project. In light of the significant adverse environmental impacts associated with development on the east side of Belleayre Mountain, a western alternative must be evaluated.

According to the Applicant's consultant (HVS), while the calculated expected return for Scenario 1 (development of the entire program on east and west parcels) was the highest at 14.7% and Scenario 5 (development of only the Wildacres golf club and resort) produced an expected IRR of 10.7%, both are marginal returns. The consultant's report further stated that Scenario 1 would require the stronger yields associated with the detached lodging units to counterbalance the risk of investment in the hotel and country club components. Given the applicant's stated strong expected returns produced by the detached lodging unit component, it is reasonable to expect that a program that includes the development of Wildacres in its entirety, including the detached lodging units could produce an acceptable risk-adjusted return, and is worth careful consideration.

The two components of the Applicant's program involve two very different parcels of land, the development of which have varied implications for the environment. The western parcel is already partially developed with existing infrastructure and its runoff flows to the less-threatened Pepacton reservoir. The eastern parcel is undeveloped forestland and runoff from development there would flow to the more sensitive water body, Esopus Creek. Limiting the development to the western parcel would decrease infrastructure investment costs, risks, and the overall environmental impact. The following examples should be evaluated through SEQRA and adjudication of the alternatives.

- **The Wildacres Alternative** - Development of only the western parcel of the site, comprised of the 'Wildacres' component, with the detached units. The inclusion of the detached units in the analysis may counterbalance the risk associated with the hotel/spa and golf amenities. Under this alternative, the eastern portion of the property could be sold to New York City or State or fully protected as forest lands, with conservation easements.

- **The Reduced Scale Residential Alternative** - An all-residential development of a reduced scale that capitalizes on the remaining land by selling either to a public entity or to individual owners or by setting it aside as a preserve as an amenity to the development. A residential community could be centered on a single golf club and the remaining portion of the site could be sold to a public entity that would create a nature preserve.

- **The Natural Amenity Alternative** - A destination development focused on alternative outdoor activities or recreational attractions that take advantage of the natural amenity of the unique pristine wilderness of upstate New York. This alternative might include a hotel/spa resort that offers an equestrian center, mountain biking and hiking trails or yoga retreat, offering a combination of amenities that would contribute a higher profit margin than a golf course and result in less environmental impact than a golf course.

- **The Single Golf Course (on western parcel) Alternative** - A mixed vacation and residential development. This alternative would capitalize on shared amenities such as a single golf course on the western parcel of the site, club and possibly a golf school, with a nature preserve, developed over possibly a smaller site assemblage.

4.) The applicant's analysis and conclusions regarding a "no-action" alternative are flawed because they assess only as-of-right development possibilities in absence of the proposed project. The "no-action" alternative is also inadequate because it speciously concludes that the proposed project will provide conservation benefits beyond maintaining the status quo. The absence of analysis on a no-build alternative is further evidence that the full range of reasonable alternatives has not been addressed.

<u>Conclusion</u>

The DEIS fails to provide sufficient information to assess, or take a hard look at a full the range of reasonable alternatives. In addition, as a result of the cumulative impacts associated with the proposed expansion of the Belleayre Ski Center, a reduced scale alternative must be evaluated in a manner which allows a comparison of environmental impacts and mitigation measures. Due to the lack of reasonable alternative analysis, DEC will not be able to make the requisite findings under SEQRA that the selected alternative minimizes or avoids adverse environmental impacts to the maximum extent practicable. The inadequate alternatives section does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R. § 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's alternatives be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

K. Cumulative Impacts

The CPC will present evidence that the DEIS does not address the cumulative impacts which will result from construction and operation of the proposed Belleayre Project and the proposed expansion of the Belleayre Mountain Ski Center. Although the Belleayre Project is wed to the proposed expansion of the Belleayre Mountain Ski Center, the DEIS fails to acknowledge the synergistic and cumulative impacts which will occur. The two projects will result in cumulative impacts on the availability and adequacy of potable water supplies, surface water flow and aquatic habitat, traffic, use of Forest Preserve lands, and secondary growth. A discussion of these cumulative impacts by CPC's experts is set forth in this and the other sections of the Petition for Party Status

According to the DEIS, the most recent version of the Ski Center's unit management plan calls for increasing snowmaking capacity, adding parking spaces, expanding the lodge, and constructing new ski trails. See DEIS at 1-7. These ambitious improvements are aimed at substantially increasing annual skier visits to the Ski Center. Annual visits at the Ski Center between 1998 and 2002 ranged from 75,000 to 142,000 visits; according to the DEIS with future plans calling for an increase in the usage to 225,000 skier visits. See HVS Economic Evaluation at 2-5. A higher goal of 250,000 annual skier visits has been attributed to Ski Center Superintendent Tony Lanza in the local media. See Jay Braman Jr., "Belleayre seeks trails into Pine Hill Community," CATSKILL MOUNTAIN NEWS, Mar. 5, 2003. According to the DEIS, "The Belleayre Resort at Catskill Park will bring to fruition the creation of a four season world-class Resort associated with the Belleayre Mountain Ski Center as contemplated in State and regional planning studies prepared over the last 40 years. The project is designed to complement both the active and passive recreational opportunities provided by the Belleayre Mountain Ski Center surrounding New York State Forest Preserve lands." DEIS page ii.

Moreover, the planned improvements are cited as a factor critical to the success of the Project. The HVS Economic Evaluation states:

> An important consideration here is the potential for future improvements to the [Belleayre Mountain] Ski Center. In order for the Ski Center to truly function on the level of the proposed Resort (and not, in fact, detract from the Resort's market orientation), a major redevelopment of the lodges and other supporting facilities should be completed. Although the facility is currently state-owned, the current management team appears to be aware that a major upgrade will be necessary for the Ski Center to function in this regard. See DEIS at 1-5 to 1-7.

Although future improvements at the Ski Center are cited in the DEIS as support for the Project's "purpose, need and benefits," the DEIS makes no effort to otherwise identify and assess how the simultaneous development of the Project and expansion of the Ski Center will cumulatively impact the environment. Pursuant to SEQRA regulation, an EIS is required to assess significant cumulative impacts. 6 N.Y.C.R.R. 617.9(b)(5)(iii)(a). "Cumulative impacts" are defined as "impacts on the environment that result from the incremental or increased impact of an action(s) when the impacts of that action are added to other past, present and reasonably foreseeable future actions."

The failure of the DEIS to incorporate an assessment of the expansion planned for the Ski Center is confounding, given that the Ski Center is State-owned and operated by the DEC. The DEC is itself responsible for the planned upgrade, which is not speculative but certain. The DEC's Ski Center expansion plans, which call for "ambitious expansion of the size of the facility," have existed as at least a "rough draft" since at least May 2002. See Jay Braman Jr., "Belleayre Planning Underway," CATSKILL MOUNTAIN NEWS, May 22, 2002 (attributing information to Ski Center Superintendent Tony Lanza.

On information and belief, DEC has, in its possession, a draft unit management plan ("UMP") for the Belleayre Mountain Ski Center expansion. The Director of the Ski Center, Mr. Tony Lanza, has on numerous occasions lead discussions on the nature of the proposed expansion as reported in several newspaper articles which are attached as Exhibit "R". As early as March 2003, Mr. Lanza stated that the draft UMP would be released for public comment in short order. In fact, these expansion plans were discussed at a public meeting at the Ski Center in March of last year.[3] On March 28, 2004, a Freedom of Information Law request was submitted to DEC for the draft UMP which considers the proposed Belleayre Ski Center expansion. DEC has not yet made this record available. DEC, as lead agency for the Belleayre Project, must require consideration of the cumulative impacts of these two projects.

The proposed expansion is consistent with, and goes beyond, the 1998 final

UMP for the Ski Center which lists 24 management objectives for modernization and expansion. In 1998, the UMP indicated that the skier carrying capacity increased to 4,500 skiers daily. Currently, according to Mr. Lanza, "We at (sic) 6,000 per day and we are planning for 7,000 to 9,000 per day. That would mean over 250,000 skier visits per year with an estimated secondary economic impact on the surrounding communities of $88 million." The 1998 UMP lists the 24 management objectives including: replacing lift # 8, increasing snowmaking; expanding Overlook Lodge; adding several new ski trails; and, adding a reception lodge and tubing park.

As guardian of the Forest Preserve, DEC has a higher responsibility to ensure that the Ski Center expansion and its associated impacts are fully disclosed and considered in connection with the Belleayre Project. The Commissioner must be fully informed concerning the proposed expansion before any decision can be made on whether the SEQRA findings can be issued in accordance with 6 NYCRR § 617.11.

The Traffic Impact Study noted, however, that traffic in the area varies significantly by season, time of day, and day of the week (Traffic Impact Study at 44; DEIS at xiv) and concluded that the greatest increases in traffic will occur during the morning and evening hours of the peak ski season. SeeTraffic Impact Study at 3. To accommodate these increases, the consultants recommended numerous improvements and mitigation measures, including additional turn lanes at two intersections on NY Route 28 and a new traffic signal. See Traffic Impact Study at 44-45; DEIS at xiv-xv.

In its present form, the traffic study addresses the traffic generated by the Ski Center in only two respects. First, a weekend of record attendance at the Ski Center in year 2000 was used to develop the background traffic level during the peak seasons. See Traffic Impact Study at 3. Second, the study noted that annual traffic volumes on Route 28 have been increasing two percent annually; to account for "some additional growth that is expected at the Belleayre Ski Resort," the consultant used a three percent annual growth rate to project the background traffic volume for 2008, the year the proposed Project is expected to be fully open. With respect to this latter modeling assumption, the consultant noted that the extra one percent added to the annual growth rate in background traffic accounted for only "some" additional growth at the Ski Center. According to the consultant, "[a]ny specific developments proposed for the [Ski Center] would typically require the completion of a traffic impact analysis specific to the Project ... the additional one percent added to the background growth rate is not meant to replace the SEQR requirements of an additional development."

As the traffic consultant itself acknowledged, to the extent that additional development is planned at the Ski Center, such development undermines the sufficiency of the DEIS' present projections and requires additional SEQRA analysis. As noted above, additional development is most certainly planned for the Ski Center, including increased snowmaking capacity, additional parking spaces, expansion of the lodge, and construction of new ski trails. According to the DEIS, the aim of these improvements is to attract 200,000 to 225,000 skier visits annually. Because annual skier visits between 1998 and 2002 ranged from 75,000 to 142,000 visits,[4] and year 2000 data was used to develop peak traffic estimates, (Traffic Impact Study at 4) the reported development plans of the Ski Center represent a substantial increase in visits and related traffic that have not been accounted for in the DEIS' impact analysis. The DEIS is thus incomplete until appropriate cumulative impact analysis is completed. Such analysis must account for the traffic increases associated with the expansion of the Belleayre Mountain Ski Center, as well as any other environmental impacts expected to result from the development and increased attendance.

L Community Character

The CPC will present evidence that the DEIS does not address the adverse impacts to community character which will result from construction and operation of the proposed Belleayre Project. The DEIS omits consideration that the Project will result in any community character impacts by narrowly defining the concept. However, SEQRA defines the term "environment" broadly to include, "the physical conditions which will be affected by a proposed action, including ... existing patterns of population concentration, distribution, or growth, and existing community or character." ECL § 8-0105(6). Accordingly, "the impact that a Project may have on population patterns or existing community character ... is a relevant concern in an environmental analysis." Staff and Workers Ass'n v. City of New York, 68 N.Y.2d 359, 366 (1986).

The DEIS concludes that, with respect to the existing use of the Project site and the land use and community character of adjacent land, no mitigation measures are required because no adverse or significant impacts have been identified. See DEIS at 3-135, 3-140. The DEIS' conclusion that there will be no impact upon community character is based upon its assertions that: (1) "the Resort will be fairly self-contained [and thus] there will not be an affect on community character;"[5] and (2) the Project will merely "re-introduce resort development uses into an area that historically supported such development locally and on a large scale."[6]

CPC will present evidence that DEIS treatment of community character is critically flawed. Mr. Peter Swift will testify concerning smart growth and the Belleayre Project's impacts on policies designed to achieve sustainable development. Mr. Swift's curriculum vitae is attached as Exhibit "Q ". Mr. Peter Smith and Ms. Mary Kopaski will testify in accordance with their report (which is attached hereto as Exhibit "A"), including but not limited to the following:

1.) One of the most important characteristics of the Catskills is its vast amount of

---

open space. Approximately 500 acres of forested, open space will be directly altered if the Belleayre Project is approved. The Catskill Mountains have been recognized as a significant natural resource in New York State. The Catskill Forest Preserve Public Access Plan recognizes that the Catskill Forest Preserve is an invaluable asset to the quality of life and economic vitality of the Catskill region and management of the Preserve is imperative.

The open space impacts that have not been evaluated in the DEIS would include:

- Source of topsoil has not been identified which will impact the loss of agricultural land;
- Cumulative impacts and secondary growth impacts from construction of the Belleayre Project and the expansion of the Belleayre Ski Center;
- The potential over use of the Forest Preserve lands, trails and resources;
- Loss of the wilderness and forest character of the area;
- Land use changes from forested land to more intensive development that will result in more impervious materials and a loss of the open space on the mountain top;
- Potential loss of an additional 1,387 acres with no guarantees from the applicant on specific ways the remainder of the property is to be protected;
- Impact on Route 28 as a scenic drive – and potentially as a State designated Scenic byway;
- The scale and design of the hotels is out of context with the immediate area and the evolution and development of the Catskills.

2.) The DEIS inaccurately portrays the benefits and impacts of the Belleayre Project on community character. For example, the economic impacts of the proposed project will have a significant adverse impact on the existing community character as they will impact the number and type of jobs available, future surrounding land uses and the need for additional housing. These economic impacts are improperly assessed in the DEIS including:

- The source of topsoil has not been identified and the impacts of loss of agricultural land;
- Land use changes from forested land to more intensive development;
- Problematical methodologies used in the economic analysis of the DEIS (boundaries, assessment of economic benefits, use of “average household income”);
- The use of all of New York State (including the New York City Metropolitan Area) rather than eliminating this area that skews the economic analysis;
- Characterization of the local economy and labor force is inaccurate and the area is, in fact, a growing and vibrant portion of the State;
- Overstatement of the number of quality or living wage jobs and potential salary impacts that the proposed project will have on the region;
- Overstatement of existing unemployment rates and the need for this project as a “catalyst” for new development;
- Understatement of average household incomes to make the area appear to be in a depressed state when, in fact, the area has experienced economic improvement over the past ten years and especially since 9/11;
- Lack of Per Capita Income analysis to illustrate the economic condition of the region when compared to the rest of the State;
- No recognition of the changing tourism industry and, in particular, the local movement away from large scale, all inclusive resorts to niche market providers;
- The potential impacts on hamlets by creating one “large-scale” development that would be allegedly self-contained and compete “head-on” with existing businesses;
- Secondary growth impacts (second/vacation homes, new housing construction, impacts on Route 28, economic impacts on the hamlets, cumulative impacts with

the expansion of Belleayre Ski Center and overall fiscal impacts) are not considered.

3.) Community character impacts of the proposed Belleayre Project are tied to the probable population growth that can be expected from the project, yet this population growth is ignored in the DEIS. This population growth will impact community character of the region and, in particular, the Towns of Shandaken and Middletown The community, neighborhood and social impacts that have not been evaluated in the DEIS include:

- Increased truck traffic and traffic generated by the project;
- Increased cost for road maintenance (Route 28) because of increased truck use in hauling fill, construction materials, landscape materials and the other traffic generated by the project;
- Inclusion of "gated communities" to create exclusive enclaves in an area historically known as open and inclusive;
- No consideration given for population growth and the need for additional housing for lower paid employees;
- Meeting the broad definition of "in harmony" from either zoning code as the standard for special use permit requirement;
- The community vision as outlined in the community survey and workshops;
- Population growth potentials are not considered and are likely to have impacts on schools, fire, police and other services.

The cultural and historical impacts which will result from the Belleayre Project have not been adequately identified or evaluated by the DEIS. The area of the Catskills which will be impacted by this Project has a long and rich cultural history. Often referred to as "America's First Wilderness" because scholars trace the beginnings of conservation to this area, the region has long be renowned as a vacation and recreation area for recreational pursuits directly related to the beauty and aesthetics of the area. (http://www.catskillcenter.org/region.html). Ironically, because of the sheer size of the Belleayre Project and the highly water intensive nature of its recreational use, i.e. golfing, this project will undermine the very natural and cultural attributes that have made this area unique resource that it is today.

In celebration of the one hundredth anniversary of the Catskill Park, Christopher Olney of the Catskill Park Centennial Committee made the following observation regarding the Park:

- The Park's great value, appeal and uniqueness lies in this mix of public and private land across the landscape, manifesting itself as untouched wilderness areas and public recreation facilities intermingled with working farms and forests, scattered residences, and small-town communities. This mix forms both a diversity of land cover types across the region, benefiting many types of wildlife, and a diversity of scenery and beauty in the region, benefit residents and visitors alike.
- Indeed, the beauty of the Catskills lies not only in the pristine spruce-fir summits, rugged road outcrops, vast forest tracts, hidden lakes, boulder studded trout streams, and graceful waterfalls, but also in the open hay meadows and dairy pastures, magnificent reservoirs, secluded homes in quiet hollows, undulating railroads, old barns and stone walls alluding to our agrarian past, and bustling, colorful main streets. All these things together and in close proximity to each other give the Catskill region its charm and identity. The Catskill Park is certainly a grand experiment in how human communities can coexist with wilderness; geographically intermingled and historically entwined. *The Catskill Park Centennial Celebrating 100 years in 2004*, Christopher Olney.

- This area truly represents a unique intermingling of land uses. The Catskill Park is truly one of the Nation's unique "parks" because it encompasses both public and private lands, unlike most other public parks. According to Alf Evers, renowned Catskill historian, with the creation of the Catskill Park, "the word 'park' took on an extended meaning to the people of the region…the new kind of park…was owned by the people and might be used by them except in ways that might damage the conservation goals of the park." (www.catskillpark100.org/history/cp.htm). Indeed, of the Catskill Park's 705,500 acre area, approximately 41 percent of the Park's land area is public and 59 percent is private. Id.

- Contrary to the DEIS, the Belleayre Project does not represent a continuation of the area's resort history and culture. Rather, this proposal will overwhelm and destroy the diverse and intermingled land uses that currently characterize the area.

- CPC will present evidence that DEIS' treatment of cultural resources is critically flawed. Mr. Peter Smith and Ms. Mary Kopaski will testify in accordance with their report, that among other issues, "The scale and design of the hotels is out of context with the immediate area and the evolution and development of the Catskills".

- Furthermore, the DEIS fails to adequately consider impacts to historic resources despite the fact that the following sites listed on the National Register of Historic Places are located within the affected project area: the Zen Mountain Monastery (Camp Wapanachki), Old St. Rt. 28 at junction with Miller Road, Temper, New York; District School No. 14, Academy Street, South of junction with Birch Creek Road, Pine Hill, New York; Elm Street Stone Arch Bridge, Elm Street, over Alton Creek, Pine Hill, New York…..

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at the significant adverse impacts to community character. Due to the lack of consideration of community character and neighborhood impacts, the Commissioner will not be able to make the requisite findings under SEQRA that the selected alternative minimizes or avoids adverse environmental impacts to the maximum extent practicable. The inadequate community character evaluation does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R. § 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's impacts on community character be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

M. Sediment and Erosion Control

The CPC contends that the failure of the DEIS and application to adequately address stormwater controls, erosion and sedimentation of the areas surface waters raises substantive and significant issues for adjudication. The DEIS fails to describe, anticipate, and mitigate the effects of large areas of land disturbance (up to 25 acres at a time) in connection with the particular soils and geology of the project sites.

The CPC will rely, in part, on the testimony of Mr. Paul Rubin, Principal hydrogeologist with HydroQuest, a hydrological consulting firm based in Stone Ridge, New York. Mr. Rubin's resume is attached to this Petition. Steven R. Garabed, a senior engineer from Carpenter Environmental Associates, Inc., whose curriculum vitae is attached as Exhibit "CV-R", will testify that the Applicant has not provided sufficient information to justify a waiver of the 5-acre disturbance limit. The Carpenter

Environmental Associates Report is attached hereto as Exhibit "S". CPC will also rely on the testimony of Dr. Paul S. Mankiewicz, Ph.D. whose curriculum vitae is attached as "CV –U". Dr. Mankiewicz' report is attached hereto as Exhibit "V". Mr. Garabed. Dr. Mankiewicz and Mr. Rubin will testify to the following:

1.) As indicated, the applicant's phased construction plan proposes to disturb up to 25 acres of soil at one time during Phase I and up to 16.4 acres during Phase II. Disturbances of this magnitude would likely cause severe water quality impacts and are not in compliance with permit limits. The New York State General Permit for Stormwater Discharges Associated with Industrial Activities from Construction Activities, Permit No. GP-02-01, limits areas of unprotected, exposed soil to no more than 5 acres at any given time without prior written approval from DEC. Limiting the phasing of construction activities to disturb less than 5 acres or less at a time reduces sediment loadings to wetlands and watercourses; however, exposure of 16-25 acres of bare soil on a mountainside will compromise the effective management of stormwater runoff and may result in catastrophic sediment loading of receiving waters during rain events. The sensitivity of the site including the nature of the soils on the site, the steep slopes and its location amidst important trout streams and the Catskill/Delaware watershed justify a condition that not more than one acre be disturbed at any one time.

2.) According to EPA, sediment from one acre of a construction site can be equivalent to 1000-2000 times the sediment loading from one forested acre. In addition, clay particles often remain suspended for 6-9 months and even longer which could allow these particles to enter the New York City water supply distribution system. Elevated turbidity and suspended sediment present public health concerns for unfiltered water supplies. This will also be of concern due to the discharge to the Esopus Creek which is an impaired water body listed on the New York State list pursuant to section 303 (d) of the Clean Water Act. The DEIS fails to provide the public and interested parties with the level of information required for review under SEQRA.

3.) The DEIS does not consider and evaluate the impacts of the region's lacustrine clay (lake clay) deposits. In the vicinity of the project area there are two distinct clay-rich glacial units that may readily be entrained into turbulent stream flow and into runoff over exposed sediments which will occur during project construction. Lacustrine clays are concentrated in the valley bottoms of relict glacial lakes such as Shandaken and Peekamoose, and clay-rich sediments pose the greatest water quality threat in the Esopus Creek basin. The DEIS does not give adequate attention to the nature and specific hydrogeology of these clay deposits, resulting in underestimates of sediment increases following storm and other high water events. The DEIS fails to incorporate inadequate mitigation for this significant impact.

4.) The Applicant has stated that the CP series of plans exemplify the level of planning and phasing that will be completed for all phases of the project. However, the CP series of plans do not possess sufficient detail to warrant granting of a waiver. For example, CP-15 contains a table that lists the various erosion control technologies, which can be used at the site based on the slope of the specific area requiring mitigation. Based on this plan twenty different technologies could be used in an area with slopes greater than 100%.

5.) The Applicant does not show which technology has been selected for use. Prior to starting work in an area, the Applicant, the DEC and the public must know exactly what erosion controls will be used. Without knowing which technology is being used, it is impossible to assess the potential environmental impacts of the waiver.

6.) The Applicant should be required to show exactly how erosion and sediment control would be addressed in an area. The Applicant is requesting that NYSDEC waive its disturbance requirement, but the Applicant has not properly demonstrated that proper erosion and sediment controls will be used to protect these large areas of soil disturbance. Without specific erosion control plans and details the Applicant's waiver request should be denied.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the Belleayre Project will cause significant adverse impacts to the sediment and surrounding water bodies that will be affected by erosion off the site. The DEIS did not take a hard look at the adverse impacts and does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R.§ 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's adverse impacts on sediment and erosion control be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

N. Stormwater Management Plan

The CPC will present evidence that the DEIS and the applications do not contain sufficient information to analyze stormwater impacts from the proposed Belleayre Project. CPC will demonstrate that the use of the WinSLAMM model to characterize pre-development conditions related to stormwater runoff at the project site was improper and that operation of the effectiveness of the stormwater management infrastructure will not achieve the results predicted by the applicant.

The CPC will also demonstrate that the neither the DEIS nor the applications and supporting documentation show whether the project will meet the Total Maximum Daily Load (TMDL) for phosphorous.

CPC will rely on Steven R. Garabed, a senior engineer for Carpenter Environmental Associates, whose curriculum vitae is attached as Exhibit "R" and

Professor Robert Pitt, Ph.D., M.S.C.E. whose curriculum vitae is attached as Exhibit "CV-S" Mr. Garabed's report is attached as Exhibit "S". Professor Pitt's report is attached as Exhibit "T".

Professor Pitt will testify that the WinSLAMM model employed erroneous assumptions as inputs into the model; that the model was not properly calibrated and the data was not properly verified. Without use of the appropriate local calibration and verification data, errors in pollutant discharge estimates cannot accurately be made. In support of CPC's position, Professor Pitt will testify that:

1.) The WinSLAMM model should not have been used to predict pre-development conditions relating to stormwater runoff. The model was developed to predict stormwater runoff from post-development conditions.

2.) Neither the DEIS nor the supporting documents describe the data and assumptions used as input to the model. Good modeling practices were not employed by the applicant; therefore, the model cannot be relied on to predict the Belleayre Project's impacts.

3.) Due to their poor design, the stormwater detention ponds will not achieve the volume of stormwater reduction or pollutant mitigation claimed by the applicant.

4.) The DEIS did not accurately predict the pollution loading from snowmelt. Studies have demonstrated that pollution loads from snowmelt can exceed pollution loads from mild weather storm events. Adequate mitigation, therefore, has not been included in the design of the stormwater detention ponds.

5.) The impacts from stormwater runoff on nearby trout and trout spawning streams have not been addressed.

Mr. Garabed will testify that the DEIS must reflect the phosphorus loading from the site using current data; discharge permits, and planned or completed projects, so that an accurate and up to date assessment of compliance with the TMDL can be completed. In support of CPC's position, Mr. Garabed will testify to the following:

1) The NYSDEC has developed a Total Maximum Daily Load (TMDL) for phosphorus within the Ashokan Watershed. According to Appendix 10 of the DEIS, there is flexibility in the loading assigned to non-point sources since as of 1996, the actual phosphorus loading from non-point sources was less than the allocated loading. Data from 1996 is not sufficient to make a determination as to whether there is available loading within the Ashokan Watershed today.

2) After over eight years, there has likely been additional development, which has increased the phosphorus loading within the watershed. The cumulative impact of all projects since 1996 and any proposed projects, which would be concurrent with the construction phase of the Belleayre project, must be considered in determining whether the TMDL will be complied with. For example, the NYSDEC recently released the Draft SPDES permit for the Shandaken Tunnel. This permit includes the Shandaken Tunnel as an additional point source within the watershed and allocates 10,457 kg/yr to the Shandaken Tunnel.

3) Since the discharge from the Tunnel was unaccounted for in the original TMDL allocations, the proposed allocation of 10,457 kg/yr exceeds the 8,026 kg/yr margin of flexibility for non-point sources, meaning that no additional inputs of phosphorus would be allowable.

<u>Conclusion</u>

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the Belleayre Project will meet the TMDL for phosphorous in the stormwater management plan. The DEIS did not take a hard look at the adverse impacts and does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R.§ 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's adverse impacts on phosphorous loading be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

P. Stormwater Treatment – Chitosan Acetate

CPC will present evidence that the applicant proposes to treat captured stormwater in detention basins with an allegedly "environmentally-friendly" flocculent called chitosan acetate before pumping the treated stormwater into forested land. CPC will present expert testimony to show how there is conflicting information on the toxicity of this flocculent to rainbow trout. Since there is a genuine question as the toxicity of this flocculent, the Applicant must be required to evaluate the potential toxicity of Storm Klear under site specific conditions. Steven R. Garabed, senior engineer at Carpenter Environmental Associates, whose will testify that in his expert opinion:

1) The information found in Appendix 2 of the DEIS claims that Chitosan used at the proposed dose of 1 to 2 mg/l is not toxic to rainbow trout. In fact, toxicity to cultured rainbow trout was observed at concentrations as low as 0.075 mg/l after 24 hours of exposure.

2.) The applicant should evaluate the potential toxicity of this flocculent by completing bioassay testing on a stormwater sample collected from the first stormwater/sediment basin installed at the project site. Without such testing, the use of Storm Klear at the site may cause an adverse impact to the trout population of the receiving waters.

Conclusion

The DEIS fails to provide sufficient information to assess, or take a hard look at, whether the use of Chitosan for the Belleayre Project will be toxic to fish. The DEIS did not take a hard look at the adverse impacts and does not provide the Commissioner with an adequate legal or technical record on which to predicate findings pursuant to 6 N.Y.C.R.R.§ 617.11(d) (5). Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's use of chitosan be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

Q. Mining Permit

Crossroads Ventures has not applied for a Mined Land Reclamation Permit. Pursuant to the New York State Mined Land Reclamation Law and its implementing regulations, a mining permit is required for the proposed Belleayre Project. See ECL §§ 23-2701 et seq. The Mined Land Reclamation Law requires that: "any person who mines or proposes to mine from each mine site more than one thousand [1,000] tons or seven hundred fifty [750] cubic yards, whichever is less, of minerals from the earth within twelve successive calendar months ... shall not engage in such mining unless a permit for such mining operation has been obtained from the [DEC]." ECL § 23-2711(); 6 NYCRR 421.1(a). The statute defines "mining" as "the extraction of overburden and minerals from the earth" and "mineral" means "any naturally formed ... solid material located on or below the surface of the earth," including peat and topsoil. See ECL § 23-2705(7), (8); 6 NYCRR 420.1(j), (k). Although the Mined Land Reclamation Law does not require a permit for the excavation, removal and disposition of minerals from construction Projects or excavations in aid of agricultural activities, this exception is "exclusive of the creation of water bodies." See § 23-2705(8); 6 NYCRR 420.1(k).

According to the DEIS, development of the proposed Belleayre Resort will necessitate the cutting and filling of nearly 1 million cubic yards of soil and bedrock. See DEIS at 3-6. The mining activity for the Belleayre Project will necessitate the stripping of 6,800 cubic yards of soil and the blasting of 18,200 cubic yards of rock to create the Project's detention ponds for treated wastewater. See DEIS at 2-55. These plans, which involve the mining of 25,000 cubic yards of minerals (more than 30 times statutory threshold) within a 12-month period for the creation of a water body requires a mining permit.

Given the immense quantities of rock to be blasted and soil to be stripped, there may be additional mining activities planned for the Project that require mining permits. This failure to apply for the requisite permit and meet the requirements of the Mined Land Reclamation Act precludes any finding that the DEIS is complete. Significantly, all mining permit applicants must develop a land-use plan and furnish a financial surety. See 6 N.Y.C.R.R. § § 422.1, 423.1. A mined land use plan sets forth in detail the applicant's mining and reclamation methods; the financial surety, established as a condition precedent to the issuance of a permit, is conditioned upon conformance with the applicant's mined land-use plan. 6 N.Y.C.R.R. § 422.1 and 423. The surety—which may be furnished in the form of a bond, irrevocable letter of credit, or certificate of deposit—is intended to insure that a Project Sponsor does not begin extractive activities without the financial wherewithal to complete the appropriate reclamation. 6 N.Y.C.R.R. § 423.1(c), (d).

Remarkably, despite this enormous amount of proposed blasting and earthmoving, the DEIS concedes that the financing is not yet in place for the Project's construction. The HVS Economic Evaluation notes, for instance, that the developer intends to affiliate both components of the proposed resort—eastern and western—with nationally recognized hotel chains. However, brand affiliation (and the accompanying financing) has not yet been established for the Project. See DEIS at 1-2.

Project approval in the absence of a financial surety raises the possibility that construction of the Project might begin—entailing the blasting of bedrock and the stripping of soil on a scale never before seen in the region—without any guarantee that the Project will ever be finished. The present terms of the DEC's draft permits therefore leave open the possibility that substantial damage may be done to the mountain without any degree of accountability if the Project does not come to fruition. Accordingly, a mining permit and the attendant financial surety is an absolute must for this Project.

Conclusion

The application for permits to construct and operate the Belleayre Project must be denied due to the failure of the DEIS to include an evaluation of the requirements of the Mined Land Reclamation Law and a permit application and mined land use plan pursuant to ECL, Article 23, Title 27. Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's failure to apply for a mining permit and provide financial security for mining and reclamation be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

R. Pesiticides

The CPC contends that the DEIS did not adequately address the potential impacts from pesticide use on the proposed Belleayre Project Golf Courses. CPC offers the testimony of Dr. Walter Knisel, Ph.D and Dr. Paul Mankiewicz in support of the Petition for Party Status. Dr. Knisel's curriculum vitae is attached as "CV-T". Dr. Knisel's report is attached as Exhibit "U".

1.) The LEACHM model the Applicant used to evaluate post-development pesticide transport was run using an inaccurate assumption about the depths of soils at the site after development. The modeling was based on erroneous assumptions and data concerning soil depths at the site. The model also greatly overestimates the attenuation of pesticide loading to transport to surface and groundwater.

2.) The pesticide discharges will exceed the limits set forth in the Wildacres Draft SPDES permit due to the defective stormwater plan as designed. The Big Indian Draft SPDES Permit does not include any effluent limits for the pesticides and therefore the permit provides no protection against violation of the water quality standards as established in 6 NYCRR § 703.5 or water quality criteria as described in DEC T.O.G.S. 1.1.1 are exceeded in surface or groundwaters.

3.) The modeling of pesticide leaching to groundwater erroneously uses a default assumption of 2.5 meters of soil above the water table or bedrock. The Belleayre Project plans require only 6 inches of topsoil on the golf course over gravel and sand underdrains, or, in some areas, other boundary conditions such as bedrock. These conditions will likely channel pesticide-laden runoff into the micro-detention ponds and to surface water resources, or into bedrock fractures and then into groundwater.

4.) The pesticide monitoring wells set forth in the Draft SPDES Permits will not ensure the protection of water quality. Water quality monitoring must not only occur on a regularly scheduled basis, but samples must be taken from sources that actually reflect any water quality impacts that are occurring since the monitoring requirement is designed to protect drinking water and sensitive trout-spawning habitat from pesticides which can harm human and aquatic life if not detected. The Draft SPDES Permits at issue here, however, designate groundwater monitoring wells that are entirely insufficient to detect such impacts. The monitoring wells will be installed into bedrock 400-700 feet below the golf course, therefore, they will not serve as adequate monitoring wells because pesticides are unlikely to reach that deep into the aquifer. To monitor infiltration and pesticide contamination of groundwater, the Applicant should use shallow overburden wells. Moreover, only 15 of the 31 pesticides listed on the SPDES permits can be analyzed by currently Certified Laboratory methods.

Conclusion

The application for permits to construct and operate the Belleayre Project must be denied due to the failure of the DEIS to include an adequate evaluation of the pesticide impacts to ground and surface waters in violation of ECL, Article 17 and SEQRA. Consequently, the Belleayre Project's permit applications must be denied. CPC requests that the issue of the Belleayre Project's adverse impacts to water quality be adjudicated pursuant to 6 N.Y.C.R.R. § 624.4.

V. Conclusion

For the foregoing reasons, the Catskill Preservation Coalition requests that it be granted party status in the adjudication of the significant adverse impacts which will result from the Belleayre Project. Alternatively, in the event that the Catskill Preservation Coalition is denied party status, the CPC requests that each individual member organization listed above be granted individual party status based on the substantive and significant issues which have been set forth in this Petition of Party Status.

To: Honorable Richard Wissler, Administrative Law Judge
New York State Department of Environmental Conservation
Office of Hearings and Mediation Services
625 Broadway
Albany, New York 12233

Dated: April 23, 2004

Albany, New York

Respectfully Submitted,

Law Office of Marc S. Gerstman

Marc S. Gerstman, Esq.
Attorneys for the Catskill
Preservation Coalition
313 Hamilton Street
Albany, New York
518-432-4100

Mr. Daniel Ruzow, Esq.
Whiteman, Osterman and Hanna
Attorneys for Crossroads Ventures, LLC
One Commerce Plaza
Albany, New York

Ms. Carol Krebs, Esq.
Assistant Regional Attorney
New York State Department of Environmental Conservation
Region 3
21 South Putt Corners Road
New Paltz, New York 12561-1620
040330petition for party status.doc

2

New York State Department of Environmental Conservation

In the Matter of the Applications of

Application Number
0-9999-00096/00005

CROSSROADS VENTURES, LLC
For The Belleayre Project at Catskill Park
for permits to construct and operate pursuant to the
Environmental Conservation Law

EXHIBITS to the PETITION FOR PARTY STATUS
by the
Catskill Preservation Coalition *
And the Sierra Club

* [The Natural Resources Defense Council, Inc., Catskill Heritage Alliance, Pine Hill Water District Coalition, Theodore Gordon Flyfishers, Inc., Zen Environmental Studies Institute, Friends of Catskill Park, Catskill Center for Conservation and Development, Trout Unlimited, New York Public Research Interest Group and Riverkeeper, Inc.]

Law Office of Marc S. Gerstman, Esq.
Attorneys for the Catskill Preservation Coalition
Robinson Square
313 Hamilton Street
Albany, New York 12210

LIST OF EXHIBITS

A. Community Character – DEIS Evaluation: Belleayre Resort at Catskill Park. NYSDEC. 4-23-04
B. Andrew Michalski PhD - Comments on DEIS: Groundwater Issues For the Belleayre Resort
C. Letter dated January 29, 2004, from Jerome S. Thaler, Hudson Valley Climate Service Re: Precipitation.
D. Precipitation Data As A Basis For Calculating Water Budgets, With Implications For Irrigation And Storm Water Management.
E. Letter from Paul Rubin, Catskill Heritage Alliance to NYSDEC Region 3 Re: Pine Hill Water Supply; Town of Shandaken. 10-3-03
F. Affadavit - In the Application of The Pine Hill Water District Coalition PHWDC, et. al. v. NYSDEC et. al. 11-11-02
G. Letter from Brian Ketcham, Community Consulting Services to Mr. Ciesluk NYSDEC Re: Crossroads Ventures, LLP: DEIS Traffic Comments. 1-10-04
H. Ferrandino & Associates – Excerpts from DEIS/Traffic Executive Summary pages 1-20
I. Community Consulting Services: Simulation Modeling of the Traffic Impacts of the Belleayre Resort. 4-22-04
J. The Potential Impact On Fish Habitat Of The Proposed Belleayre Resort At Catskill Park By Piotr Parasiewicz PhD.
K. Letter from Chad Dawson to Neil Woodworth, April 19, 2004
L. Review of the DEIS for the Proposed Crossroads Ventures Bellearyre Resort at Catskill Park, Ulster & Delaware County, NY with Respect to Biodiversity By Erik Kiviat. April 21, 2004
M. Comments of Audubon New York, as revised April 23, 2004
N. IBA Designation Criteria: NY Audubon Criteria for Important Bird Area
O. Dynamic Models of Land Use Change In the Northeastern USA By Mary Tyrell, Myrna Hall, and R. Neill Samson, USDA Forest Service. January 2004
P. Memo from John Ellsworth, Cashin Associates: DEIS Comments Bellearyre Resort at Catskill Park. 4-21-04
Q. HR& A Belleayre Resort EIS Review Process- Alternatives Assessment

R. Articles:
  1. Belleayre Receiving More Money For Next Season Ulster County Townsman 5-23-02
  2. Belleayre Seeks Trails into Pine Hills Community" Catskill Mountain News 3-5-03
  3. Belleayre Planning Underway" Catskill Mountain News 5-22-02
  4. Belleayre Officials Asking For Input From Public" Ulster County Townsman 3-6-03
  5. "Ski Resort gets $5 Million Boost" Times Union 2-1-98

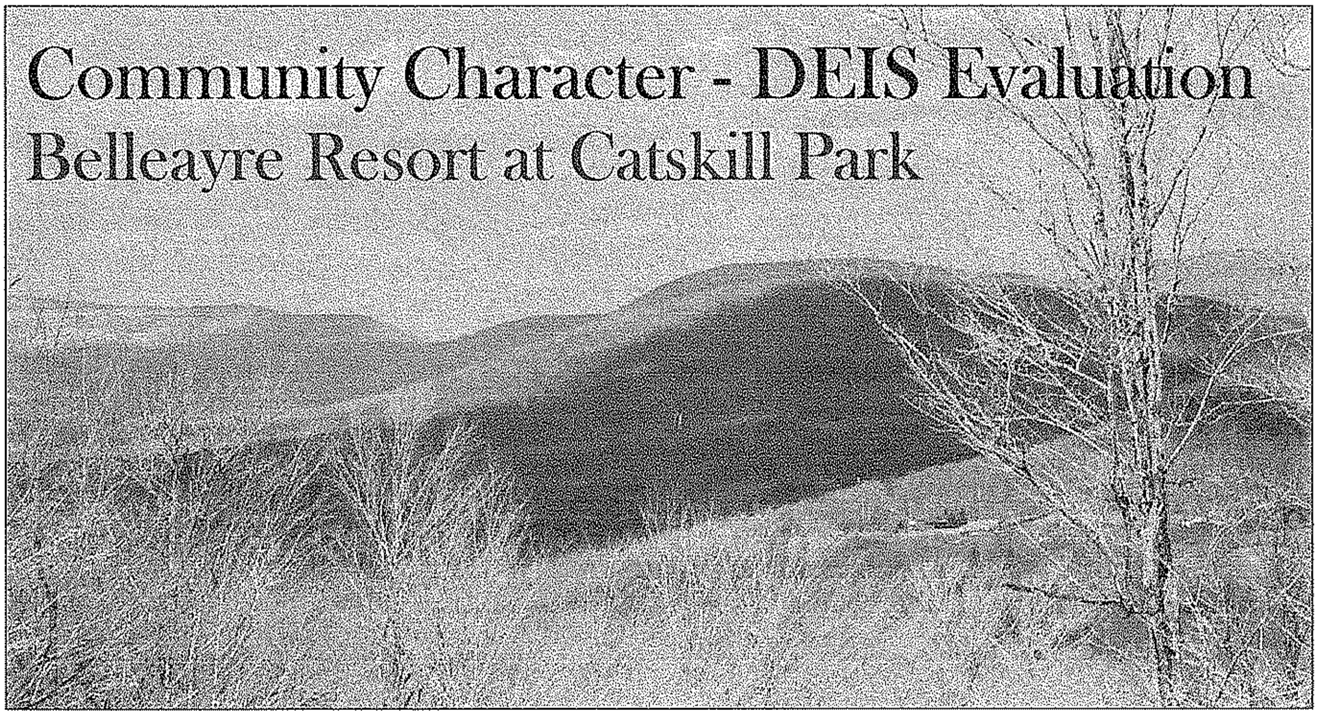
S. Letter from Steven Garabed to Mr. Ciesluk CEA : DEIS Comments 4-20-04

T. Memo dated April 4, 2004 from Robert Pitt to Robin Marx

U. Knisel Report

V. Letter dated April 23, 2004 to Alexander Ciesluk from Paul Mankiewicz

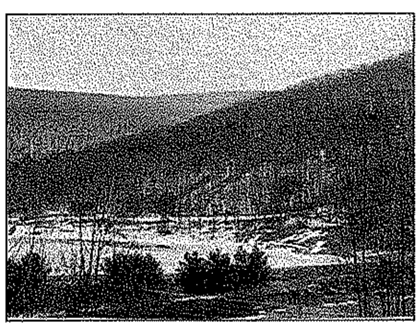
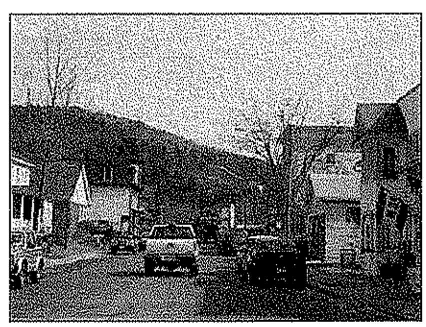
Community Character - DEIS Evaluation
Belleayre Resort at Catskill Park



Submitted:

April 23, 2004

New York State Department of Environmental Conservation

Prepared for Friends of Catskill Park by peter j. smith & company, inc.

Table of Contents
Community Character Analysis
Impacts of Proposed Belleayre Resort at Catskill Park

1.0 Executive Summary

The Belleayre Resort at Catskill Park is proposed in the Catskill Region, specifically, the Towns of Shandaken and Middletown. The project's community character impacts are vast and essentially, unconsidered, in the DEIS prepared for the project. The following summarizes the community character impacts and the deficiencies of the DEIS in addressing these issues:

1.1 Visual Impacts

Visual impacts resulting from construction of the Belleayre Resort will be significant and will adversely affect community character. The DEIS materially underestimates these impacts. The methodology used by the DEIS does not fully comply with the DEC Visual Impact Assessment Policy in that "line-of-sight" profiles are not included; at a minimum, these should have been completed for several of the points along Route 28 that were identified in the DEIS as "potentially visible areas along roadways" and from the Village of Pine Hill. As such, the method used in the DEIS Visual Impact Study (Appendix 21) does not include the minimum required by the DEC Policy System Program Policy on Assessing and Mitigating Visual Impacts.

The DEIS Visual Impact Study for Belleayre Resort does not comply with the DEC Program Policy on Assessing and Mitigating Visual Impacts because of the following reasons:

- DEC requires that the worst-case scenario for visual impacts be explored, which was not done. This would likely be from hilltops directly adjacent to the proposed resort.
- The minimum requirements of a Visual Impact Analysis include "line of sight" profiles, which were also not done.

Based on a review of the surrounding topography, a worst-case scenario for visual impacts should be completed from across the valley; namely Rose Mountain, Monka Hill and Hog Mountain. The visual impacts from the Village of Pine Hill and Route 28 would be the most frequently observed due to the development there and would have the greatest impact on community character, as identified on figure 3-25A of the DEIS, however these views have not been included in the DEIS. Impacts to both Pine Hill and Route 28 were dismissed without any visual simulations or line-of-sight drawings being completed to illustrate how clear-cutting the mountain and the introduction of mowed fairways would change the forested character of the mountain.

The visual impacts that have not been adequately evaluated in the DEIS would include:

- Visual impact analysis within five miles of the project, specifically from Pine Hill and Route 28 are not adequate
- Visual impacts of blasting the top of a currently forested and undisturbed mountain with no consideration to the changes in topography
- Visual impacts and potential erosion of stockpile areas and the lack of a stockpile management plan
- Visual impacts of clear-cutting over 500 acres and turning much of the area into lawned golf courses and buildings
- Loss of forest land that includes the destruction of over 278,000 trees
- Light pollution, including night glow, lighting visible from an elevation perspective and glare from lighting during the winter (snow glare), on an historically "dark" region
- Impacts on panoramic views and vistas along Route 28 and from other places within a five mile radius of the project site

1.2 Noise Impacts

The Sound Impact Study (SIS) for the DEIS assumes that increases in existing sound levels of 9 dBA or less are: "insignificant, temporary construction noise"[1]; there is no clear indication of how they will mitigate the noise impacts because the DEIS offers an evaluation of noise, not a mitigation plan for the noise that will result. To cal these levels "insignificant" downplays the level that DEC calls intrusive and may cause complaints. These impacts are dismissed in the DEIS and further consideration is needed.

The DEIS states that typical blasting noise levels range between 93 to 94 dBA at a distance of 50 feet. The DEIS also states that blasting noise levels will be only 46 dBA for the proposed project which is 4 dBA below the existing ambient daytime average sound level. The existing daytime sounds, as documented in the DEIS, range from 41 to 50 dBA and are characterized by "wind rustling through the trees" and the sound of a "nearby creek."[2] The DEIS is implying that, through noise attenuation, they will not increase the current noise levels in the area. The determination by the DEIS is that: "blasting for this project is not to significantly contribute to overall Project construction noise." Blasting the mountaintop will create an amphitheater effect and the noise levels will be in excess of existing, ambient wind and creek levels.

Increased noise levels will impact local neighborhoods during construction of the proposed Belleayre Resort at Catskill Park. The cumulative effects of blasting and construction will increase the noise levels from a rural community to that equal to an urban industrial area. Additionally, the noise levels will exceed ambient levels of a rural setting and will have significant impacts on residents. Finally, the noise mitigation plans are not clearly defined and do not state how noise will be regulated to control the impacts.

The community character noise impacts that have not been adequately evaluated in the DEIS would include:

- Duration of noise, especially in the summer months when most residents are outside and windows are open
- Noise impacts from trucks hauling fill (over 230,000 cubic yards) and construction materials throughout construction
- Noise impacts from trucks and vehicles to service the Resort once it opens
- Increased traffic noise from Resort users
- Increased traffic noise from Belleayre Ski Center users

[1] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 - Sound Impact Study. p. 4-2.
[2] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 Sound Impact Study. p. 3-10.

1.3 Open Space Impacts

One of the most important characteristics of the Catskills is the presence of a vast amount of open space. Approximately 500 acres of forested, open space will be forever altered upon approval of the proposed project. The Catskill Mountains have been recognized as a significant natural resource in New York State. The Catskill Forest Preserve Public Access Plan recognizes that the Catskill Forest Preserve is an invaluable asset to the quality of life and economic vitality of the Catskill region and management of the Preserve is imperative.

The open space impacts that have not been evaluated in the DEIS would include:

- Source of topsoil has not been identified impacts the loss of agricultural land
- Cumulative impacts and secondary growth impacts
- The intensive use of the Forest Preserve
- Loss of the wilderness and forest character of the area
- Land use changes from forested land to more intensive development that will result in more impervious materials and a loss of the open space on the mountain top
- Potential loss of an additional 1,387 acres with no guarantees from the applicant on specific ways the remainder of the property is to be protected
- Impact on Route 28 as a scenic drive – and potentially as a State designated Scenic byway
- The scale and design of the hotels is out of context with the immediate area and the evolution and development of the Catskills

1.4 Land Use, Neighborhood and Economic Impacts

The economic impacts of the proposed project could have the biggest impact on the existing community character as they will impact the number and type of jobs available, future surrounding land uses and the need for additional housing. These economic impacts are assessed in the DEIS, yet much of the analysis contains inconsistencies and errors with data sources. The economic analysis must be clear, concise and accurate to paint a true picture of the existing and projected economy. This is the only way that the economic benefits and costs can be assessed for the proposed project.

The economic impacts that have not been evaluated in the DEIS would include:

- Source for topsoil has not been identified and the impacts of loss of agricultural land
- Land use changes from forested land to more intensive development
- Problematical methodologies used in the economic analysis of the DEIS (boundaries, assessment of economic benefits, use of "average household income")
- The use of all of New York State (including the New York State Metropolitan Area) rather than eliminating this area that skews the economic analysis
- Characterization of the local economy and labor force is inaccurate and the area is, in fact, a growing and vibrant portion of the State
- Overstatement of the number of jobs and potential salary impacts that the proposed project will have on the region
- Overstatement of existing unemployment rates and the need for this project as a "catalyst" for new development
- Understatement of average household incomes to make the area appear to be in a depressed state when, in fact, the area has experienced economic improvement over the past ten years and especially since 9/11
- Lack of Per Capita Income analysis to illustrate the economic condition of the region when compared to the rest of the State
- No recognition of the changing tourism industry and, in particular, the local movement away from large scale, all inclusive resorts to niche market providers
- The potential impacts on hamlets by creating one "large-scale" development that would be self-contained and compete "head-on" with existing businesses
- Secondary growth impacts (second/vacation homes, new housing construction, impacts on Route 28, economic impacts on the hamlets, cumulative impacts with the expansion of Belleayre Ski Center and overall fiscal impacts) are not considered

1.5 Social Impacts

Social impacts of the proposed project are tied to the probable population growth that can be expected from the project, yet this population growth is ignored in the DEIS. This population growth will impact the social aspects of the region and, in particular, the Towns of Shandaken and Middletown. The DEIS states that because the project is "self-contained", there are no community character impacts. This statement ignores the social costs of the proposed project.

The social impacts that have not been evaluated in the DEIS would include:

- Increased truck traffic and traffic generated by the project
- Increased cost for road maintenance (Route 28) because of increased truck use in hauling fill, construction materials, landscape materials and traffic generated by the project
- Inclusion of "gated communities" to create exclusive enclaves in an area historically known as open and inclusive
- No consideration given for population growth and the need for additional housing for lower paid employees
- Meeting the broad definition of "in harmony" from either zoning code as the standard for special use permit requirement
- The community vision as outlined in the community survey and workshops
- Population growth potentials are not considered and are likely to have impacts on schools, fire, police and other services

2.0 Community Character Assessment

2.1 Proposed Project and Purpose of this Report

Crossroads Ventures, LLC has proposed a large-scale resort development in the Catskill region and specifically, the Towns of Shandaken and Middletown. The Belleayre Resort at Catskill Park development is proposed for the mountaintop area on both sides of Belleayre Ski Center. According to the DEIS, this large-scale development, over 500+ acres of disturbed mountaintop, generally includes:

- Two 18-hole golf courses
- Two hotels (150 rooms and 250 rooms)
- Clubhouses
- Four restaurants in new buildings (75, 150, 150 and 300 seats)
- Restaurant in existing Marlow Mansion (150 seats)
- Various Recreational Facilities – tennis courts, pools, driving range
- Two full service spas
- Conference Center (500-seat ballrooms, meeting rooms)
- Children's Center
- 88 units in 22 quad buildings (2 bedroom)
- 60 units in 20 triplex buildings (3 bedroom)
- 168 units in 21 octoplex buildings (2 bedroom)
- 35 units (4 bedroom)
- 21 lot subdivision – single family

The scale of this development will forever impact the entire Catskill region. The impacts on these communities must be carefully assessed and evaluated as part of the DEIS presented to the NYS Department of Conservation during the review and approval process. The DEIS fails to address the community character impacts in an appropriate way.

This report includes a general description of community character and how it is defined. By researching various sources, a general definition of community character is developed. From this, a description of community character, as it specifically relates to the Catskill region was determined; for the purposes of the community character analysis, the Catskill Region will include, but not be limited to the Town of Kingston, Town of Hurley, Town of Olive, Town of Shandaken, Town of Hardenburgh, Town of Middletown and all hamlets and villages within these communities. The Re-Assessment of the DEIS evaluates the document from the perspective of community character, and how the proposed development may impact the Catskill region, and specifically, the Towns of Shandaken and Middletown; closer scrutiny is given to these communities because the project is located within their municipal boundary. The impacts identified are correlated to the Long Form EAF and are discussed as they relate to the two communities.

2.2 Defining Community Character

> The Catskills are one of God's better creations and we are blessed to live in the heart of it. And what we savor and respect in this treasured landscape has had a birth of relevance among the people who live and labor in the great metropolitan areas around us.[3]

Consideration of the "community character" of the Catskill region and Towns of Shandaken (Ulster County) and Middletown (Delaware County) is essential when considering the proposed development of Belleayre Resort at Catskill Park. Unlike so many other aspects of the DEIS prepared for Crossroads Ventures, LLC, defining community character is not a "science" with a specific answer. *Community character is something that is experienced, seen, felt and cherished by people that live in a community and those that visit.* We all know what the community character is when we experience it and we know when it has been impacted by changes.

The Merriam-Webster Dictionary defines "community" as:

- The people with common interests living in a particular area
- An interacting population of various kinds of individuals in a common location
- A group of people with a common characteristic or interest living together
- A group linked by a common policy
- A body of persons or nations having a common history or common social, economic, and political interests

"Character" is defined as:

- One of the attributes or features that make up and distinguish an individual
- A feature used to separate distinguishable things into categories
- Main or essential nature especially as strongly marked and serving to distinguish

Based on these definitions, community character can be defined as the traits or attributes, both tangible and intangible, of a region that are identifiable and bind residents and visitors together. These include both physical and psychological bonds within the historic, cultural, natural, built, political and economic environments. Community character is often referred to as a "sense of place". "Geographers have…examined both the character intrinsic to a place as a localized, bounded and material geographical entity, and the sentiments of attachment and detachment that human beings experience, express and context in relation to specific places."[4] The Catskills Mountains are what defines the community character of the Catskill region.

[3] Route 28 Corridor Committee Transmittal Letter – March 1994.
[4] The Dictionary of Human Geography. "Sense of Place". p. 731.

3.0 SEQRA and Community Character

The State Environmental Quality Review Act (SEQRA) process requires that impacts on community character be considered for all proposed developments. SEQRA and its regulations define "environment" as "the physical conditions which will be affected by a proposed action, including land, air, water, minerals, flora, fauna, noise, objects of historic and aesthetic significance, existing patterns of population concentration, distribution or growth and existing community or neighborhood character.[5] In the SEQRA regulations, §617.7(viii) includes impacts that must be addressed, such as those that include a substantial change in the use or intensity of use of land, including agricultural, open space or recreational resources.

The courts of New York and NYS DEC have explicitly held that neighborhood character is a "physical condition of the environment under SEQRA."[6] For example:

- The Appellate Division (New York State's intermediate appellate court) upheld a decision to deny a hard rock mine permit based on adverse impacts to the historical and scenic character of the community including visual and other community impacts that could be sufficiently mitigated.[7]
- The Appellate Division found that he examination of adverse economic impacts from a proposal to build a new Wal-Mart was proper "in the context of assessing the probability and extent of the change it would work on the overall character of the community, as a result of an increased vacancy rate among commercial properties in the downtown area – an entirely proper avenue of inquiry, even within SEQRA."[8]
- In an Interim Decision agreeing that community character was an issue for adjudication, the NYS DEC Commissioner made the following observation regarding community character: At times, the issue of community character may intertwine and overlap with issues such as noise, aesthetics, traffic and cultural resources, and a commissioner's final determination may "necessarily involve a judgment that integrates all the relevant facts with respect to all those issues."[9]

[5] ECL §8-0105 and 6 NYCRR 617.2.
[6] Chinese Staff Workers v NYC, 68 NY2d 359, (1986).
[7] Land Construction Company v Cahill.
[8] Wal-Mart v North Elba.
[9] In the Matter of Palumbo Block Company

3.1 Existing Community Character of Catskill Region

The Catskill Mountains have been recognized as a significant natural resource in New York State. Over 100 years ago, New York State recognized the uniqueness and beauty of the Catskill region, which has been an attraction to visitors for over a century. New York State describes the area in the following way:

> The Catskill Park is a **mountainous region** of public and private lands in Ulster, Greene, Delaware and Sullivan Counties – "the forest preserve" counties. Ninety-eight peaks over 3,000 feet high form an impressive skyline. Its blend of public and private lands is typical of large parks in Europe, where people and unique lands have coexisted for centuries. The Catskill **Forest Preserve** is the state land within the Catskill Park. Since its creation in 1885, it has grown from 34,000 to almost **300,000 acres**."[10]

The Catskill Forest Preserve Public Access Plan completed in August 1999 by the NYS DEC and NYS DOT recognizes the importance of the Catskill region for all of New York when it states:

> The quality and character of the lives of people of New York depend upon the quality and **character of the natural resources**, which support our lives. The Catskill Forest Preserve is one of New York's great natural resources...The biological and economic value of the forest preserve is rooted in the quality of its **natural resources** – clean water, land and air – and the inestimable beauty of the **landscape**.

Tourism groups have long recognized the value of the Catskills within New York State. This statement by the Hudson Valley Network is how many would describe the Catskill region and, specifically, the Towns of Shandaken and Middletown.

> **Quaint, historic towns**, from Phoenicia and Pine Hill to Fleischmanns, Margaretville, and Andes, offer unique flavors of relaxed, comfortable living along gurgling streams, beneath **imposing peaks**, and bathed in crisp mountain air. Outstanding, one-of-a-kind restaurants off all flavors (no chains here) present palate-pleasing fare, and charming cabins, motels, B&Bs, and lodges offer weary travelers snug sleeping in **serene settings** at the end of the day... **Small villages and towns**, Phoenicia, Margaretville, Pine Hill are home to shops offering charming gifts, local crafts, specialty foods...We are the guardians of a well-kept secret. [11]

[10] http://www.dec.state.ny.us/website/dlf/publands/cats/index.html#SpecialAreas.
[11] http://catskills.hvnet.com/route28.htm.

Officials and residents in the Catskills also understand the uniqueness and beauty of the Catskills. The Route 28 Corridor Study completed for the Town of Shandaken recognizes the character of the Catskill region, and the desire to direct development to existing nodes and "developed" areas.

> The **various hamlets** along the [Route 28] corridor provide services to the visitor and should serve as the **hubs for future concentrated development**, other than that which requires a location with specific physical features. Development in the two communities has tended to **respect the topography and unique natural feature** – the mountains – by nestling small clusters in the villages and hamlets that exist. Private lands are almost exclusively confined to the narrow **stream valleys** and hollows below the **higher peaks**.[12]

Local, not-for-profit organizations have been working for decades to protect the Catskills. The Catskill Center remains committed to protecting the outstanding natural, cultural and historic resources of the Catskill Mountain region.[13] They describe the Catskills as:

> Encompassing greater than six counties and over 6,000 square miles of **mountains, forests, rivers, and farmland**, the Catskills are often referred to as America's First Wilderness because scholars trace the beginnings of the **environmental conservation** movement to this beautiful area. With almost three dozen mountain peaks over 3,500 feet in elevation and six major river systems, the Catskills are an **ecological resource of significant importance**. Pure air and water, rich farmland, parks and forests, clear-flowing streams, cascading waterfalls, grand panoramic views, and historic villages characterize the Catskills. Long renowned as a prime vacation destination, the Catskills offer a variety of recreational opportunities including hiking, skiing, snowmobiling, camping, biking, rock and ice climbing, canoeing, fishing, hunting, bird-watching, or just plain rubber-necking.

[12] Route 28 Corridor Study. p. 8.

[13] http://www.catskillcenter.org/center.html.

While each group or individual will define specific aspects of community character that impact them directly, there are several obvious aspects of the communities that bind them together and that all can agree upon. For the Catskills region and, specifically, the Towns of Shandaken and Middletown, these would include:

- **Peaks and Valleys** – The Catskill region is characterized by peaks and valleys and includes some of the most spectacular mountains in New York State. In much of the Catskills, the mountaintops have remained virtually undeveloped while the valleys, induding the Route 28 corridor, have experienced small-scale residential, commercial and tourist-related development. The mountains are covered with forests that blanket the mountaintops with green in the summer, vibrant reds, orange and yellows in the fall and white snow caps in the winter.

- **Scenery** – The mountains in the Catskill region are generally second growth forests. Local, County and State residents and officials recognize these forests as a significant resource. The clear flowing streams, crisp mountain air, grand panoramic views and waterfalls all add to the natural experience that characterizes the Catskill region. The natural state enhances the scenery of the entire Catskill region.

- **Rural** – Driving through Shandaken and Middletown along Route 28 in the valleys of the Catskill mountains, the experience includes a winding, valley road that follows the natural topography of the region. In most of the Catskill region, there are no large-scale, high-density developments located on the mountaintops in the region, but rather sparsely populated areas with small-scale commercial and large-lot residential development located in the valleys. Open space characterizes the rural character of the Catskill region and impacts the quality of life for all residents.

- **Small Villages and Hamlets** – The Catskill region has had a history as a "resort destination"; this included small-scale developments centered in and around the villages and hamlets that are located in the valleys. These population centers have been important to the social and economic well-being of residents and have also served the visitors to the region. The villages and hamlets have evolved through a history that has helped define the community character. Much of history of the Catskill region can be found in many of these small villages and hamlets as they evolved over many years.

These characteristics must be considered in assessing the proposed Belleayre Resort at Catskill Park and its community impacts. The project will impact the Catskills region, and because of its location in Shandaken and Middletown, the two Towns specifically. An assessment of these impacts will help determine if the development is appropriate in the location and at the scale it is proposed.

3.2 Community Character Impacts Defined in SEQRA

The NYS DEC's Full Environmental Assessment Form lists many potential impacts that a project could have; these include impacts on land, water, air, agricultural resources, aesthetic resources and community character to name a few. As each impact is addressed, several issues or topics must be evaluated as they relate to the proposed project. The following issues identified in the Full EAF, relate to community character the Catskill region and are considered in further detail as part of this report:

- Will the Proposed Action result in a physical change to the project site?
  - Construction that will continue for more than 1 year or involve more than one phase or stage

- Will Proposed Action affect aesthetic resources?
  - Proposed land uses, or project components obviously different from or in sharp contrast to current surrounding land use patterns, man-made or natural
  - Proposed land uses, or project components visible to users of aesthetic resources, which will eliminate or significantly reduce their enjoyment of the aesthetic qualities of that resource
  - Project components that will result in the elimination or significant screening of scenic views known to be important to the area

- Will proposed Action affect the quantity or quality of existing or future open spaces or recreational opportunities?
  - A major reduction of an open space important to the community

- Will Proposed Action affect the character of the existing community?
  - The permanent population of the city, town or village in which the project is located is likely to grow by more than 5%
  - Proposed Action will conflict with officially adopted plans or goals
  - Proposed Action will cause a change in the density of land use
  - Development will create a demand for additional community services (e.g. schools, police and fire, etc.)

"The proposed project will involve development of approximately 29% of the assemblage, or only approximately 573 acres. The project will provide for most of the needs of its guests, including lodging, dining, recreation, spa facilities, etc. Because the Resort will be fairly self-contained, there will not be an affect on community character."[14] Statements such as this in the DEIS for the Belleayre Resort at Catskill Park clearly indicate that there is a lack of understanding of what community character is, specifically in the Catskills region and Towns of Shandaken and Middletown, and what this community character means to residents and visitors.

[14] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xvi.

The project has significant external impacts - aesthetic, physical and social - that will impact the two communities. The impacts considered involve the community character, as it exists today and the potential impacts this type of development would forever have on these two municipalities and the Catskill region.

4.0 Specific Community Character Impacts

4.1 Physical Changes to the Project Site

4.1.1 Construction that will continue for more than 1 year or involve more than one phase or stage

The DEIS states that the project would be completed over an 8 year period. The duration of the construction schedule could have several impacts on the rural community character in the Catskill region and, in particular, the Towns of Shandaken and Middletown.

A) DEIS Noise Impact Assessment

According to NYS DEC sound pressure level (SPL) impact is a significant issue based on two aspects; these include the sound pressure level and the increase in the sound pressure level (noise). The sound pressure level is the measurement of noise above the ambient sound pressure level. By comparison "a quiet seemingly serene setting such as rural farm land will be at the lower end of the scale at about 45 dBA"[15] while urban industrial noise levels will be on the scale approximately 79 dBA. The increase in the sound pressure level is the variation between ambient and the produced sound. According to the NYS DEC[16]:

- Most humans find a sound level of 60–70 dBA as beginning to create a condition of significant noise effect.
- In non-industrial settings the SPL should probably not exceed ambient noise by more than 6 dBA at the receptor.
- Increases in SPL between 5–10 dBA is considered "Intrusive"

The above are used in evaluating the DEIS prepared for the Belleayre Resort at Catskill Park. The Sound Impact Study (SIS) for the DEIS assumes that increases in existing sound levels of 9 dBA or less are: "insignificant, temporary construction noise"[17]. There is no clear indication of how the noise impacts will be mitigated because the DEIS offers an evaluation of noise, not a mitigation plan for the noise that will result. To call these levels "insignificant" downplays the level that DEC also calls intrusive and may cause complaints. These impacts are dismissed in the DEIS and further consideration is needed.

[15] Assessing and Mitigating Noise Impacts. NYS DEC Program Policy. p.20.
[16] Ibid. p.14.
[17] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 Sound Impact Study. p. 4-2.

This evaluation does not challenge the science of the DEIS Sound Impact Study, but the assumptions and logic that lead to the conclusion that noise level increases will not have a significant impact on the Catskill region, and specifically, the Towns of Shandaken (and Pine Hill in particular) and Middletown. These impacts will occur over a period of eight years during construction and will directly impact on the quality of life of the local residents.

Noise Impacts From Blasting

One issue in the construction of Belleayre Resort at Catskill Park will be the impact of noise from blasting. The blasting will cause the mountain face to form a single sided quarry wall and therefore accentuate the sound levels by forming an amphitheater effect. The DEC states: "At a hard rock mine, curved quarry walls may have the potential to cause an amphitheater effect while straight cliffs and quarry walls may cause an echo".[18] No consideration has been given to this impact on the quality of life for the residents within the blast area.

The DEIS states that typical blasting noise levels range between 93 to 94 dBA at a distance of 50 feet. The DEIS states that blasting noise levels will be only 46 dBA for the proposed project at the location of their designated receptor, located at a distance greater than 50 feet, which is 4 dBA below the existing ambient daytime average sound level. The existing daytime sounds, as documented in the DEIS, range from 41 to 50 dBA and are characterized by "wind rustling through the trees" and the sound of a "nearby creek."[19] The DEIS is implying that, through noise attenuation, they will not increase the current noise levels in the area. The determination by the DEIS is that: "blasting for this project is not to significantly contribute to overall project construction noise." Blasting the mountaintop will create an amphitheater effect and that the noise levels will increase and be in excess of existing, ambient wind and creek levels

Duration of Noise

Another issue in the construction of Belleayre Resort at Catskill Park is the duration of noise during construction. The DEIS states: outdoor construction…is expected to occur during the construction season of April to November, six days per week, 10 hours per day (daytime hours only). "Due to the nature of construction in New York State most of the outdoor construction will occur in the summer months. This increases the noise during the time when people tend to spend more time outdoors and have their windows open". The DEC states: "Summer time noises have the greatest potential for causing annoyance because of open windows, outside activities, etc. … Building walls [combined] with the window open [during the summer months] allow for only a 5 dB reduction in SPL."[20]

---

[18] Assessing and Mitigating Noise Impacts; NYS DEC Program Policy. p. 10.
[19] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. Appendix 22 Sound Impact Study. p. 3-10.
[20] Ibid. p. 10.

Increased Noise Levels

In addition to the duration of the noise, the level of noise during construction is also an issue. Table 4-2 of Appendix 22 of the DEIS outlines the construction sound levels for the Project. The construction of hotels and major facilities ranges from 78-89 dBA and the construction of Residences and Small Buildings ranges from 81-88 dBA. Both construction activities exceed the NYSDEC standard for "a condition of significant noise effect" and exceed the level of urban industrial noise.

The Sound Impact Study (SIS) for the DEIS states that at Big Indian Plateau "...other construction is estimated to result in temporary increases in sound level of 9 dBA or less; this would indicate an intrusive noise level change (between 5-10 dBA). At Wildacres Resort, the SIS states temporary increases in sound level of 9 dBA or less which indicates, according to the DEIS, an acceptable level of noise impacts. However, based on DEC standards, this increase would be considered intrusive as the noise level changes (between 5-10 dBA).

The DEIS states the actual construction of the earthen berms, which are constructed to mitigate the noise of blasting and construction, "may temporarily exceed significance criteria" and could impact the existing rural community character in the Region. In addition, "... construction noise at each receptor may temporarily exceed significance criteria" which would also impact the rural community character. The DEIS also states that an increase in: "ambient sound by more than 10 dBA significance level is possible" from the construction of the Highmount Estates lodging units. The Sound Impact Study (SIS) for the DEIS states: "maximum sound levels, if all activities are conducted simultaneously and assuming the mitigation previously specified is estimated to increase ambient sound levels by 10 dBA which slightly exceeds noise significance limits." All of these impacts, individually and combined, could be significantly higher than the NYS DEC standards of "Intrusive" and according to the DEC's human reactions to SPL's would be "Very Noticeable" and possibly "Objectionable".

Increased noise levels will impact local neighborhoods during construction of the proposed Belleayre Resort at Catskill Park. The impacts of construction on noise levels in the region surrounding the proposed Belleayre Resort at Catskill Park would include:

- The cumulative effects of blasting and construction will increase the noise levels from a rural community to that equal to an urban industrial area
- Noise levels will exceed ambient levels of a rural setting and will have significant impacts on residents
- That noise mitigation plans are not clearly defined and do not state how noise will be regulated to control the impacts

B) Visual Impacts from Blasting

The DEIS states that the depth to bedrock is only 12 to 22 inches throughout the proposed development area; there are some places on the project site where the landscape is bare ledge. Water lines are generally installed 48 inches below grade and sewer is generally installed 24 inches below grade to avoid freezing. In addition to blasting for services, the DEIS states that blasting will be necessary for the retention ponds and building foundations.

The existing depth to bedrock is obviously shallow for these services and to accommodate the ponds and foundations. Blasting and filling would be required for all portions of the project development. Blasting and regrading the mountaintop would have visual impacts on the Catskills region that have not been adequately considered. The visual impacts to accommodate the proposed Resort and golf courses will be evident as the existing contours and vegetation on the mountain will be changed; the DEIS visual simulations clearly show these impacts even from 1-2 miles away. The mountain contours would be changed to accommodate the proposed project and no consideration is given to these visual impacts from locations close to the project site and specifically, from Route 28. The DEIS fails to illustrate the visual impacts from this vantage point.

Increased Traffic – Hauling Fill

The DEIS indicates that at Wildacres Resort, the net fill will be 39,317 cubic yards. But the DEIS also states that these raw earthwork values do not include the topsoil that "will be imported when constructing the two golf courses and for landscaped areas around buildings. Approximately 108,000 cubic yards of topsoil will be used on each golf course and 11,000 cubic yards will be used at each Big Indian Plateau and the landscaped areas at the Wildacres Resort."[21] This would, in all likelihood, require trucking the topsoil along Route 28 to the site. The number of trucks could exceed 15,100 (assuming 15 cubic yards of top soil per truck) during this part of the project construction. The traffic and noise impacts on the two communities, and all communities along Route 28, will be adverse and the DEIS does not adequately address these traffic and related noise impacts.

Once the project is completed, there will be an increase in the number of vehicles along Route 28; this includes guests at the Resort and trucks/vehicles that service the site. The DEIS does not include or address the vehicles that will be required to serve the site (garbage trucks, maintenance vehicles, supply trucks, etc) in terms of the volume of traffic on Route 28.

[21] Ibid. p. 2-38.

Noise Impacts

"Noise from the motors and exhaust systems of large trucks provides the major portion of highway noise impact."[22] The following outlines samples of various decibel levels to illustrate the impacts the truck traffic from the proposed Resort will have on the Catskill region:

Table 4-1 Noise Levels

Decibel Level	Example
40 (Very Quiet)	Quiet Rural Area
70 (Annoying)	Freeway Traffic
90 (Loud)	Diesel Truck
100 (Very Loud)	Garbage Truck

Source: Sound and Noise: Generation, Propagation and Reduction – Kevin Surace, March 2004. Quiet Solution.

The decibel level of a diesel truck is approximately 90 decibels; this is more than double the decibel level of a quiet rural area, which would characterize the Catskill region. The area would go from a "very quiet" decibel level to a "loud" decibel level as over 15,000 trucks roll along Route 28.

Additional Road Maintenance

There is no consideration for the fiscal impacts associated with the cumulative presence of construction traffic over the 8-year period; this would include truck hauling fill, equipment and materials to the site, as well as worker traffic. In addition to the noise and traffic increases, there would likely be road degradation as topsoil is imported and construction equipment is brought to the site. This could result in an increased need for road maintenance and repaving and should be considered in the DEIS.

Once the project is completed, the volume of traffic on Route 28 will always be greater than what it is today. This will require on-going maintenance of the corridor because degradation will occur at a faster rate.

C) Source of Topsoil

A related issue associated with the topsoil required for the project is the source of the topsoil. Generally, topsoil is harvested from agricultural lands within an area proximate to the project site; the cost of trucking imported topsoil usually dictates this. This would result in the loss of local agricultural lands, which are a non-renewable resource. Almost 250,000 cubic yards of topsoil are expected to be imported to the site, as outlined in the DEIS. The impacts on the loss of agricultural lands is an important impact on the local, regional and state economy that should be addressed in the DEIS.

[22] http://www.nonoise.org/library/suter/suter.htm

D) Visual Impacts and Potential Erosion from Stockpile Areas

There are many references to identifying "suitable stockpile locations" for the excess cut generated in Phase 1. Not only would these areas be susceptible to erosion because a forested mountain covered with thick organic matter has a better capacity for stabilizing soils than a mowed fairway, but also they would be visually intrusive for a period of 8 years. While erosion control measures are being proposed, there is always a potential for negative impacts. The removal of vegetation deprives the soil of the stabilizing function of roots as well as the moderating effects on wind and water erosion. A stockpile management plan for all stockpile areas that illustrate the location of the proposed areas, the visual impact mitigation measures and the erosion control mechanisms that will be used, should be prepared.

The visual impact on the undisturbed mountaintop will be noticeable when combined with the tree removal and bare soils on the development site. "Degradation of hillsides also destroys a community's character. The surrounding hills are an aesthetic resource which gives the community its distinctive setting."[23] These visual impacts, as well as the clear cutting of 500+ acres, are not adequately addressed as they relate to the peaks/valley and scenic community character in the Catskill region. The impacts of clear cutting are dismissed by simply stating the site will be revegetated.

[23] Land Use Plan for Ulster County. p. 14.

4.2 Impacts on Aesthetic Resources

4.2.1 Proposed land uses, or project components obviously different from or in sharp contrast to current surrounding land use patterns, whether man-made or natural

A) Land Use Changes Impact Catskill Experience

The DEIS quotes a 1955 brochure from the archives of the Skene Library in Fleischmanns showing a year-round resort climate offering skiing, hunting, golfing and summer fun. The website goes on to state: "The brochure mentions that the chair lift on Belleayre is operated not only for skiers but also in summer and fall to facilitate sightseeing."[24] Even when this area of New York State was in it's heyday as a destination and resort area, people that visited the central Catskills were attracted to the region, and made this their vacation destination, because they recognized the pristine environment and magnificent views of the mountains.

B) Gated Communities

People that purchase time-shares and stay at the Resort will be the primary users of the proposed project. The DEIS states that a "gate house is proposed on the main access road above Friendship Road."[25] Although gated communities are developing throughout the United States, especially around golf and ski communities, the concept of a gated community in the Catskill region, and specifically, the Towns of Shandaken and Middletown, is in direct contrast to the hamlet community character that creates communities. While residents will not expect access to any private lands without permission or an invitation, the concept of gating portions of the two Towns is foreign to this region. The exclusive enclaves built on top of the mountain will, in all likelihood, create a divide between long-term residents and those that frequent the proposed project. "Outsiders" will be viewed as coming into the Catskill region and isolating themselves in this gated community rather than integrating themselves in to the existing culture.

The American Planning Association has adopted a "Smart Growth Policy Guide" that states "efficiency is enhanced when there are consistent and adequate street connections that allow people and goods to move with as few impediments as possible. Gated communities, private road systems, and the introduction of disconnected cul-de-sac systems promote disconnections."[26] This is true in both a physical and psychological sense for those that live, work and recreate in the Catskill region.

---

[24] http://www.skenelib.org/dpq/hotel.php.
[25] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. 2-43.
[26] http://www.planning.org/policyguides/smartgrowth.htm.

In addition, the NYS Qualities Communities Initiative has developed several policies that statewide, demonstrate "New York State's commitment to working with local government leaders and community organizers to find smart, innovative solutions to strengthen our economy and environment and improve the quality of the place we call "home"."[27] Two specific policies adopted by the State include:

- The protection and enhancement of our air, land and water resources are important to the stability and diversity of ecological systems while also contributing to the health and well being of all New Yorkers. **Appreciation for our natural landscapes, such as mountains, forests, lakes, rivers, and coastlines, adds beauty and value to our lives.**
- The architectural variety, history and unique characteristics of our cities and downtown areas provide a **special sense of place** —— and of home —— for all of us. New York communities also see their **downtowns as an opportunity for future growth**. Keeping existing developed areas economically vibrant and environmentally healthy and breathing life into abandoned downtown areas are critically important to the quality of life of New Yorkers

The Belleayre Resort at Catskill Park, and the introduction of gated communities into the Towns of Shandaken and Middletown, would be in conflict with these two goals. The impact of transforming a mountain top by clear cutting and blasting shows little appreciation for the natural landscape – mountains – that add beauty and value to the residents and visitors in the Catskill region. Additionally, the special sense of place that characterizes the Catskills – mountains, scenery, rural and hamlets – would be greatly impacted by the development that has no relationship to any of these characteristics. The hamlet downtowns could be economically impacted by a large-scale development that has no physical or visual links with these historic areas. In addition, the gated communicates would discourage people from visiting by placing gates atthe entrances of the proposal and would become exclusive enclaves that are not linked to the rest of the community.

[27] www.dos.state.ny.us/qc/home.shtml.

4.2.2 Proposed land uses, or project components visible to users of aesthetic resources, which will eliminate or significantly reduce their enjoyment of the aesthetic qualities of that resource

"Today, the concern over view protection is being rediscovered and reawakened with a vengeance. Polls show that protection of viewsheds, view corridors and scenic roadways enjoys widespread political support."[28] The DEIS does not adequately address the aesthetic impacts of the proposed development on the peak/valley, scenic or rural community character of the Towns of Shandaken and Middletown. The Statewide Comprehensive Outdoor Recreation Plan (SCORP) recognizes the importance of scenic resources, and is referenced in the following section.

A) DEIS Visual Impact Assessment Methodology

The DEIS Visual Impact Study for Belleayre Resort does not comply with the DEC Program Policy on Assessing and Mitigating Visual Impacts because of the following reasons:

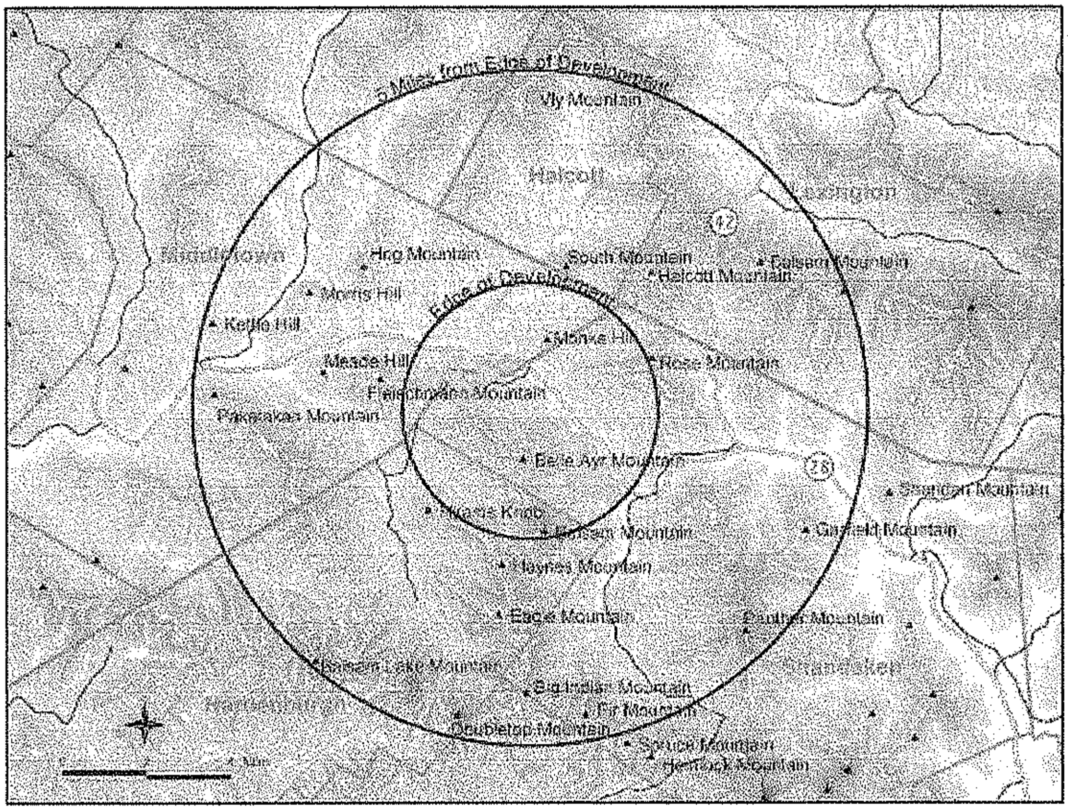
- DEC requires that the worst-case scenario for visual impacts be explored, which was not done. This would likely be from hilltops directly adjacent to the proposed resort.
- The minimum requirements of a Visual Impact Analysis include "line of sight" profiles, which were also not done.

Visual impacts resulting from construction of the Belleayre Resort will be significant and will adversely affect community character. The DEIS materially underestimates these impacts. The methodology used by the DEIS does not fully comply with the DEC Visual Impact Assessment Policy in that "line-of-sight" profiles are not included; at a minimum, these should have been completed for several of the points along Route 28 that were identified in the DEIS as "potentially visible areas along roadways" and from the Village of Pine Hill. As such, the method used in the DEIS Visual Impact Study (Appendix 21) does not include the minimum required by the DEC Policy System Program Policy on Assessing and Mitigating Visual Impacts.

[28] Aesthetics, Community Character and the Law. APA and Scenic America. p. 40.

The five-miles is stated in DEC policy to be, "largely considered "background", i.e. distances at which most activities are not a point of interest to the casual observer". Logically, the visual impacts seen at distances of five, ten and fifteen miles would be sequentially lessened. The view to the proposed development at a distance of five-miles or greater would largely be considered background and that the more significant visual impacts would be closer to the development within the five-mile radius.

Figure 4-1 Edge of Project and 5 Mile Radius
Illustrating Highpoints surrounding Proposed Project



Source: peter j. smith & company, inc.

Based on a review of the surrounding topography as indicated in the Figure above, the worst case scenario for visual impacts would be from across the valley: namely Rose Mountain, Monka Hill and Hog Mountain. The visual impacts from the Village of Pine Hill would be the most frequently observed due to the development there and would likely have the greatest impact on community character, however these views have not been included in the DEIS. Line-of-site drawing complying with DEC's minimum requirements should be developed from these points, from Route 28 and from Pine Hill to demonstrate visibility and to allow a reasonable review of impacts. It would also then be possible to determine if any mitigation measures are necessary.

B) Visual Impacts of Clear Cutting Over 500 Acres

The DEIS states "this clearing of [529 acres of] forest represents a short-term, local, adverse impact. Once hotels, detached lodging units and other buildings along the associated infrastructure are constructed (covering only 85.16 acres within the project site), natural regrowth and landscaping will occur, returning the vast majority of the cleared area to a vegetated state."[29] The DEIS reiterates several times that the "remaining 444 acres of disturbance will be revegetated by tree planting, ornamental planting or golf courses."[30] The "vast majority" returning to a vegetated state does not address the loss of forested land on this significant mountaintop. The fairways and greens at the golf course would never be reforested, and would forever be a visible variation and disturbance to the existing natural mountain range.

The views of the Catskills, both short and long distance, are wooded areas with few man-made disturbances. The State Constitution recognizes that importance of protecting the views to the Catskills Mountains in placing limitations on mountaintop development; these findings are reiterated in the Statewide Comprehensive Outdoor Recreation Plan[31]. The Catskill Park, which includes over 700,000 acres of both publicly and privately owned land, is recognized as an important resource in the SCORP.

The New York State Constitution allows for only limited tree cutting on Forest Preserve lands to create ski trails in the vicinity of the proposed project. Belleayre Mountain is limited to up to a total of 25 miles of ski trails with trail widths up to 200 feet; no more than 2 miles of trails in excess of 120 feet wide.[32] This is done to protect the peak/valley, scenic and rural character of the communities and the forestland located on the mountaintops. The proposed Resort will include clear cutting over 500 acres surrounding this Ski Center, which will increase the visual impacts. The DEIS visual assessment does not consider the clear cutting impacts of the project or illustrate how the layout of the golf courses, which will be mostly mowed lawns, will visually change the mountain from appropriate high points across the valley, Route 28 or Pine Hill.

29 Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xii.
30 Ibid. p. 3-86.
31 SCORP. p. 4-6.
32 Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p 1-6.

C) Loss of Forest Land

According to the USDA, in the Catskills region of New York State, there are approximately 555 trees per acre within the forested lands.[33] This includes almost 400 trees with a diameter at breast height (dbh) of under 5 inches and 155 with a dbh over 5 inches. The DEIS states that 81.5% of the project site is in beech-maple forest and 13.9% is hemlock-northern hardwood forest, for a total of 95% of the 529 acre site. This would mean approximately 502 acres would be clear-cut and approximately 278,915 trees would be eliminated.

The DEIS states that "site plans call for the planting of over 4,100 indigenous trees on the project site plus a substantial amount of ornamental trees and shrubs in the formal landscape."[34] The clear-cutting of almost 280,000 trees of various sizes would have a significant visual impact on the landscape of the Towns of Shandaken and Middletown. Planting "over 4,100 indigenous trees" results in less than 8 trees/acre on the 500+ acres. This does not "return the vast majority of the cleared area to a vegetated state" as stated in the DEIS. This has an impact on both the visual and wildlife habitats impacts that are not adequately addressed in the DEIS.

D) Lighting and Light Pollution

Another significant issue, from an aesthetic approach, would be lighting on site. "The Milky Way is dimming, not because the end of the Universe is near, but rather as a result of light pollution: the inadvertent illumination of the atmosphere from street lights, outdoor advertising, homes, schools, airports and other sources."[35] This dimming of the stars would result as the project is constructed over the next 8 years. Belleayre Ski Center does not offer night skiing and is lit on a limited basis for making snow and trail grooming. Recently, the Ski Center has cut back on lighting because of complaints received from residents in the community; the lights are not on every evening and this impact occurs only during the ski season.

The proposed development, with internal roads, parking, hotels and time-shares, would require lighting for safety reasons; this is contradictory to the existing conditions within the project site and the surrounding area. This lighting, even if sensitively placed, will create light pollution and would be visible when looking directly at the mountain even if up lighting can be minimized. The DEIS states that "with the use of "metal halide, sharp cut-off fixtures with house shields, to reduce the amount of light pollution beyond the edges of areas intended to be lighted" illustrates that light will not "spill" from one lot to the next, yet some glare from lighting will be visible from Pine Hill and the Route 28 Corridor. This is especially true in winter when the reflection of the light on the snow will increase the glare; the DEIS does not address these specific conditions or the impact that lighting will have on the region.

---

[33] USDA Forest Service - Forest Inventory and Analysis. USDA Forest Service Forest Inventory and Analysis.
[34] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xiii.
[35] http://science.nasa.gov/headlines/y2001/ast01nov_1.htm.

Any lighting on site will increase light on the mountaintop and impact the "night sky" enjoyed by residents that have chosen this rural area for their home. Lighting in the two Towns now is primarily limited to the valleys – primarily in the villages and hamlets – and along the Route 28 corridor. No lighting simulations have been included in the DEIS to illustrate these lighting impacts.

4.2.3 Project components that will result in the elimination or significant screening of scenic views known to be important to the area

A) Panoramic Views and Vistas Impacted

Clear-cutting for the proposed development negatively impacts the scenic community character that is characterized as wooded, mountainous and rural. The DEIS does not adequately address the loss of vegetation on the local, panoramic views to the mountains in these two and adjacent communities and, in fact, states that "[b]ecause the Resort will be fairly self-contained, there will not be an affect on community character."[36]

The DEIS states that the forest stands observed on the site are "secondary growth less than 100 years old". Yet, for 100 years, residents and visitors to the Catskill Park have come to know and enjoy the views of the mountaintops – in an undeveloped state. To call this impact a "short-term, local, adverse impact"[37] understates the peak/valley scenic and rural community character impacts the project will have on the two Towns and, in turn, the Catskill region. The visual experience of visitors to the Catskills, including those at the Belleayre Ski Center, would be significantly impacted. The development, as proposed, would result in a significant loss to forested views that are known to be important to the area and are an attraction to people from throughout the world. Even with tree replacement, the growth of new trees would take another 100 years to reach the maturity of the trees that are going to be cut from the project site.

---

[36] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xvi.
[37] Ibid. p. 3-85.

B) Scenic Drive along Route 28

Protection of the Catskill Mountains has been a priority of the State for many decades. In 1970, a Temporary State Commission to Study the Catskills was created at the prompting of concerned citizens. There were significant land use changes occurring and the economy was shifting. Tourism, resorts and recreational activity are economic mainstays of the region, although the character of this loosely defined industry has changed.[38] The Commission recognized the need for NYS DEC and OPRHP to officially designate certain roads as "scenic roads".

In 1976, the NYS DEC completed a study on developing a Scenic Roads Program in the Catskills. The study shows that as long ago as 1969, the county legislature in Ulster County nominated Route 28 to the State's system of scenic roads, then under development by the State Natural Beauty Commission.[39] The study recognizes that scenic roads are concerned with the visual qualities of the landscape, both natural and cultural (man-made) features and the spatial relationships of these features as they are seen from the highway.[40]

In 1990, a study was completed by the Catskill Center for Conservation and Development, Inc. for Route 28 in Ulster County (The Catskill Gateway Conservation Study: A Design Strategy for Land Protection). A similar study was completed in 1991: Route 28: Scenic Road Study. Both studies assess the potential of the Route 28 Corridor being designated as a scenic road in New York State. The studies illustrate that Route 28 is considered a scenic corridor because of the hills and valleys, woodland and seasonal effect of vegetation, historic rural villages and panoramic views to name a few characteristics. The impacts of the Belleayre Resort at Catskill Park would be visible from Route 28 and impact the quality of this scenic drive. The DEIS does not address these impacts, and in fact, its visual assessment does not include any points along Route 28 in the evaluation.

The Route 28 Corridor study also recognizes the potential for the "Central Adirondack Trail" which is also Route 28, to be extended into a "Catskill Parkway". The experience of Route 28 in the Catskills lends itself to many of the criteria for becoming a scenic byway: "transportation corridors that are of particular statewide interest. They are representative of a region's scenic, recreational, cultural, natural, historic or archaeological significance."[41]

[38] The Future of the Catskills. The Temporary State Commission to Study the Catskills. 1975. p. 9.
[39] Towards a Scenic Roads Program for the Catskill. September 1976. p. 2.
[40] Ibid. p. 4.
[41] http://www.dot.state.ny.us/scenic/descript.html.

The Catskill Forest Preserve Public Access Plan recognizes that a significant element of the visitor experience to the Catskill Park and Catskill Forest Preserve is the scenic and rural character of the highway corridors of the region. "A significant element of the visitor experiences to the Catskill Park and the Catskill Forest Preserve is the character of the highway corridors of the region."[42] The views of and to the mountains along Route 28 are part of the experience and character of the Catskill Region. The visual assessment in DEIS does not include any points along Route 28 in assessing the potential impacts of the development on the scenic character. The development of the Belleayre Resort at Catskill Park would impact the potential for Route 28 to become a scenic byway and, potentially, negatively impact tourism in the Towns. Development on the mountaintop – and the loss of the scenic views and vistas – as well as increased traffic along Route 28, would impact the tourist that is seeking a refuge in the Catskill region.

[42] A Vision for the Catskill Preserve. p. 5.

4.3 Impacts on Quantity or Quality of Existing or Future Open Spaces or Recreational Opportunities

4.3.1 A major reduction of an open space important to the community

A) Potential Loss of Additional 1,387 Acres – No Details on Protection

The DEIS states that "approximately 1,387 acres, or 71% of land, are not proposed for development. The...acres of land left undeveloped will be protected from future development by restrictions that could take the form of deed-restricted lands or conservation easements."[43] The DEIS fails to outline specifically how these lands would be protected and there are no guarantees that the remaining land would not be developed in future phases. Without the details on how the land is being "forever protected", the development could be expanded and additional peak/valley, scenic and rural community character impacts realized. There is also no information on future ownership of these lands; this could impact the future taxes generated from the preserved acreage. The specific measures for protection of the 1,387 acres must be included as part of the DEIS as they are in Appendix 4A, which includes the draft covenants for Highmount Estates.

The Catskill Forest Preserve Public Access Plan recognizes that the Catskill Forest Preserve is an invaluable asset to the quality of life and economic vitality of the Catskill region. Management of the region is imperative, yet the DEIS does not adequately address protection and management as a viable alternative. The Access Plan recognizes that "deterioration of trails, natural resources or infrastructure, as well as overcrowding or user conflicts, would be undesirable consequences to be avoided whenever possible."[44] The Plan notes that the "primary justification" for establishing the preserve was to protect the water resources. The proposed project initially impacts over 500 acres, yet the entire project site encompasses almost 2000 acres.

The project applicant has stated, in public meetings, that they intend to sell the proposed Belleayre Resort at Catskill Park once the approvals are received. This would leave little, if any, responsibility with the current applicant over the future development that could occur on the remaining portion of the project. Without guarantees on how the undeveloped land outlined in this proposal is to be protected in perpetuity, there is little assurance that the project would not be expanded in the future, which would have even greater community impacts.

[43] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. 1-22.
[44] Catskill Forest Preserve Public Access Plan. August 1999. p.20.

4.4 Impacts on the Character of the Existing Community

4.4.1 The permanent population of the city, town or village in which the project is located is likely to grow by more than 5%

"The Resort is intended to be the catalyst that will drive the revitalization of year-round tourism and provide improvements to the quality of life for those who live in, as well as those who visit, the Catskill Park."[45] The DEIS overstates many of the economic benefits of the project in an effort to downplay the negative impacts of the Resort. In 1990, the Town of Shandaken population was 3,053. Following a decline in population in the middle of the century, the Town now has a population of 3,299. The Town of Middletown's population is 4,051. A project of this size would have an immediate impact on the Catskill region that has evolved over time.

A) DEIS Economic Benefits and Growth Inducing Effects Analysis

The socioeconomic analysis presented in the DEIS does not present an accurate picture or assessment of the community character impacts of the proposed Belleayre Resort at Catskill Park. The data is outdated and, in many cases, contradicts itself. The analysis contains numerous mistakes including typographical errors, data errors, unsubstantiated assumptions and inconsistent sources/geographic areas. There are also many misrepresentations that make the area seem depressed and not economically viable. The following highlights some of these errors.

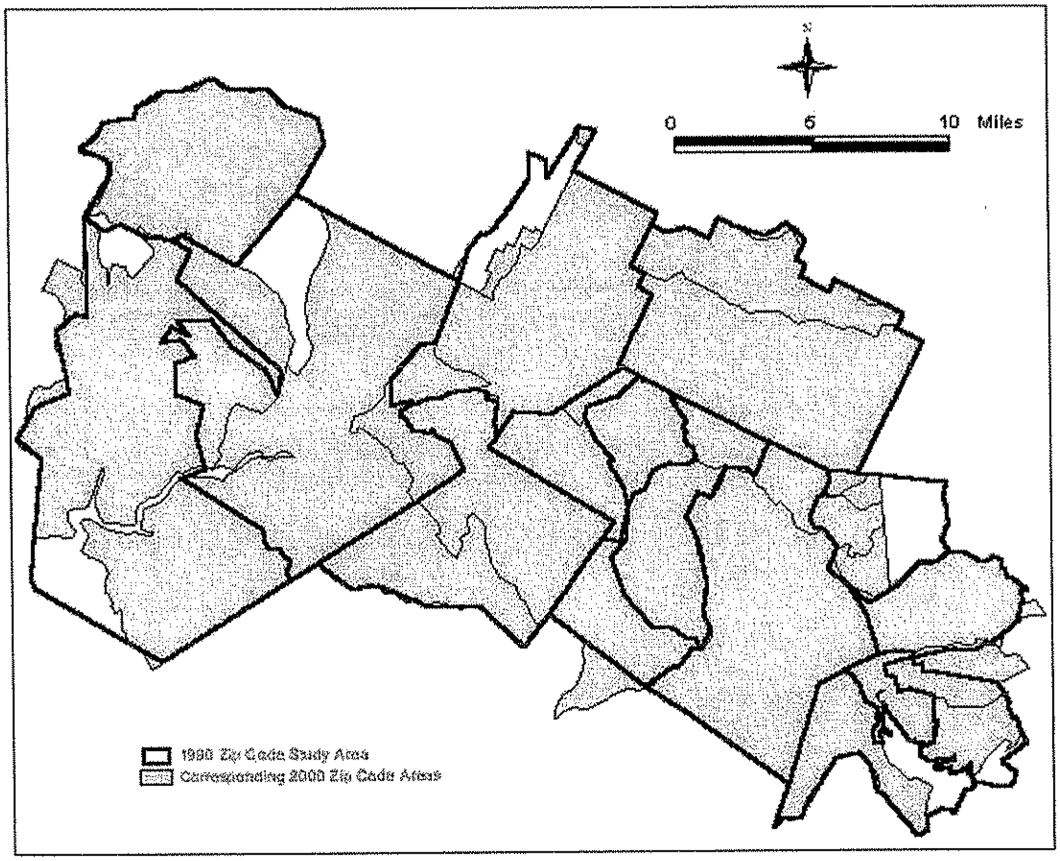
The Study Area Boundaries

The specified study area presents many data issues in the DEIS analysis. The DEIS chooses an area made up of fifteen 1990 zip code areas. While geographically, this study area makes sense, it creates several issues with data collection. One major problem is that the zip code boundaries changed between 1990 and 2000 so comparisons between the two Census data sets is difficult. Zip code 12465 has been completely eliminated.

[45] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. iii.

The following illustrates shows the difference between the 2000 Census zip code boundaries in the vicinity and the zip code boundary created by 1990 Census.

Figure 4-2 Comparison of 1990 and 2000 Zip Code Areas
Catskill Region



Socioeconomic data from the Census Summary File 3 (SF3) is available at the zip code level for 2000. This same summary file data is also available for 1990 at the zip code level. However, since the geographic areas do not correspond, trend analysis between 1990 and 2000 cannot be accurately displayed because the boundaries have changed. As a result, the DEIS relies on data obtained from a secondary data provider to provide consumer information and market segmentation. The DEIS uses this provider to present data that would otherwise be available through the US Census or Department of Labor had they defined their study area in a more conventional method – Block Groups, Towns and Counties. In all of these cases, SF3 Census data can be easily obtained for 1990 and 2000 to allow for a true analysis of trends; all parties interested would then be able to verify the trends based on this data.

For the purposes of this analysis of the DEIS, the actual 2000 Census figures were obtained at the block group level from ESRI. The data for the block groups were then correlated to the 1990 zip code levels to ensure that the study area assessed was the same for both time frames.

The data presented in Table 2-1 of Appendix 26 in the DEIS is inaccurate for several reasons. These include:

- Typographical errors in the percent growth statistics from 2000 to 2005
- A negative symbol is missing in three cases where there was shown to be a decline in the population
- The decline of the population forecasted for 2005 in Counties that demonstrated substantial growth from 1990 to 2000 goes unexplained by the DEIS

The discrepancy in the data is the result of using two different data sources. The "study area", as defined in the DEIS, data is provided from a secondary data provider while the county data is based on the US Census. The same data source should be used for all comparisons or the analysis is inherently inaccurate – the 2000 Census are true figures while the secondary data provider data is estimated or projected. The use of two data sources was necessary because of the choice to use zip code data, where the boundaries changed between 1990 and 2000.

The data from the DEIS suggests that the population of the study area increased only 0.8% from 10,472 in 1990 to 10,552 in 2000. Actual census figures reveal that the population of the study area increased from 12,434 to 13,634 between 1990 and 2000 for a 9.7% population increase. Similar data inaccuracies are present for household data. Actual census figures show that the number of household in the study area increased from 5,159 in 1990 to 5,865 in 2000 for an increase of 12%. The numbers presented by the DEIS are 4,339 (1990) and 4,454 (2000) for an increase of only 3%.

The DEIS analysis has confused households with housing units, and in fact, suggest that "household figures…include a large proportion of second homes in the area"[46]; this is a description of housing units, not households. The comparison made in this way suggests that there are less than 2,500 occupied houses in the study area. In 2000, there were, in fact, 10,437 housing units in the study area of which 43.8% were vacant mainly due to seasonal use.

The accuracy of the data supplied by the secondary data does not appear to be accurate and this leads to questioning the findings of the entire economic analysis. There was a significant difference between the figures given in the DEIS and actual Census figures in both 1990 and 2000. Not only are projections for 2000 incorrect, but many of the projections are based on incorrect estimates from 1990.

[46] Draft Environmental Impact Statement for Belleayre Resort at Catskill Park. Appendix 26. p. 2-2.

Definition of Economic Benefits

The DEIS analysis is inconsistent in using a base-year dollar in the economic analysis to adjust data for inflation. In many cases, the tables included in the DEIS do not have any base-year indicated; it is unclear whether the base-year dollar was used, but accidentally left out or if the dollar values reflect the future conditions. For example, the DEIS uses numbers with no base-year to determine an average annual salary. This information, with no base-year, is then compared to the average annual wages of the three counties, which is based on 1999 dollars. This inconsistency does not allow for a true evaluation of the data and the economic benefits.

B) Labor Force and Employment Characteristics

The DEIS presented a summary of the labor force available in Chapter 2 of Appendix 26. In this section, the "Tri-County Area" becomes the labor pool. There are a number of inconsistencies raised by this analysis. In Table 2-7 of Appendix 26, the 2000 Census was used as the source and no information is offered for the study area that had been established in the DEIS; the study area and the areas being compared continue to change throughout the DEIS.

In Table 2-8 and 2-9, 1990 data is used, while 2000 Census data is not included, to assess the location of County resident's workplace. The US Bureau of Census asks if you work in the county in which you reside, although this chart implies that the Census is asking what county residents work in; these are completely different questions. The DEIS should accurately reflect the information. Other data problems or inaccuracies include:

- The commuter destinations in 2-9 cannot be attributed to Census data; after careful analysis of STF 3A, this information is not part of the data set.
- The DEIS states that "the most current county-level data available on occupations from 1990"; in fact, the 2000 Census information is available and should be made part of the DEIS to give a more accurate portrayal of the region.

According to the DEIS, the project is expected to create 747 full-time equivalent jobs. The DEIS states that, generally, unemployment rates underestimate the true number of unemployed and that residents commute long distances; these claims are unsubstantiated given the data and explanations in the DEIS and anecdotal data should not be used. For example, the DEIS sites Kingston, Delhi and Oneonta as job destinations and states that "these commuting workers represent a volatile segment of the labor pool likely to change jobs in favor of a closer to home job."[47] There is no analysis as to why these jobs would be favorable to local residents.

The following table illustrates the number of residents by occupation in Shandaken and Middletown:

Table 4-2 Occupation
Towns of Shandaken and Middletown

	Shandaken	Middletown
Total:	1,581	1,703
Management, professional, and related occupations:	443	502
Service occupations:	289	309
Sales and office occupations:	378	442
Farming, fishing, and forestry occupations	20	41
Construction, extraction, and maintenance occupations:	244	198
Production, transportation, and material moving occupations:	207	211

Source: US Census, 2000

In the Town of Shandaken, approximately 289 residents are in the service industry while in Middletown 309 are in this industry. Most people in the service occupations do not travel 30-45 minutes for their jobs; the costs of commuting are prohibitive. People commuting to Kingston, Oneonta and Delhi are more likely to be professional, sales or construction workers that will tend to travel longer distances for work. These workers will not be likely to change jobs for one at the proposed Resort. While those in the construction industry would benefit during the projects' development, there is little evidence to support the assumption that they would leave their construction jobs to take one closer to home; the same can be said about those in professional or sales occupations. The DEIS is also unrealistic to believe that the all unemployed persons would seek employment at the new Resort. Some unemployment always exists in a community to allow for job market fluidity. The DEIS should include a clear analysis of where potential workers will come from, what the salaries would be and where they will live; this type of analysis is essential to determine the impacts of the proposed project.

[47] Draft Environmental Impact Statement Belleayre Resort at Catskill Park. p. 3-200.

C) Job Creation and Salaries

The DEIS states that "the small number of mid- and upper management jobs would probably be filled by non-resident personnel who relocate to the Resort Area."[48] The DEIS states that Approximately 16-20 positions would have salaries approximately $28,000 to $150,000. With a total of 747 "full time equivalent" jobs being created, this is less than 3% of all positions that would be mid and upper range management jobs, most of which, the DEIS states, would probably be filled with "non-resident personnel". The other full-time positions would include hotel housekeepers, wait staff at the restaurants, retail workers and other service positions that can be expected to make less than the mid- and upper management jobs. The DEIS states that the annual salaries for full-time employees would be "expected to range from $16,390 for guest services to $150,000 for hotel executives and golf management."[49] The lower paying jobs are expected to be well below the average household income for the region and the impacts are not addressed in the DEIS; these could include the need for affordable housing and other services.

In assessing the DEIS, the annual wages and salaries for each aspect of the project is outlined in Table 4-2 of Appendix 26. The number of jobs generated in each aspect is summarized in Table 4-1 of the same appendix. The DEIS does not separate the mid- and upper management jobs from those that are expected to be paid less. The DEIS groups all annual wages and salaries by project component and does not provide a breakdown by job description (housekeeper, wait staff, grounds keeper, front desk clerk, golf pro, etc.). This breakdown is important to give a full and clear picture of the types of jobs that would be created and what the expected salaries would be. The lump sum approach results in a skewed picture of the true economic benefits of this project on the Catskill region, and in particular, the Towns of Shandaken and Middletown. The salaries stated in the DEIS do not reflect the potential for additional services, affordable housing and other development and community character impacts on the community. The DEIS states that the median income level would be $27,272. Again, this median is inflated because of the mid- and upper management job salaries that are included in the calculation and does not offer a true economic picture of the proposed project.

Many of the jobs created by the proposed project would be lower paying and, clearly, the work force to fill these positions is not available in the two Towns; only 200 people are unemployed in the two communities. The DEIS expects that people will commute to the Resort, yet, if jobs are lower paying, the cost of commuting would prohibit this.

The income projections in the DEIS should be separated by occupation for each project component to clearly indicate potential economic impacts of the jobs created. The impacts on housing demand, the potential need for affordable housing and other services needed for the new population, is not addressed in the DEIS.

[48] Ibid. p. 2-69.
[49] Ibid. p. 3-201.

D) Unemployment Rates

High unemployment rates do not appear to be an issue in this area of the Catskills, and in particular, the two Towns and three Counties where the proposed project would have the greatest impact and where the DEIS states most of the work force would come from and live. The unemployment rates in the Town of Shandaken and Middletown are low when compared to New York State as a whole. The New York State unemployment rate is 7.1% compared with the Town of Shandaken with an unemployment rate of 5.4% and Middletown unemployment rate of 6.1%. The unemployment rate in Upstate New York (that area outside the New York City Metropolitan Area) is 6.3%, which is comparable to that of the three counties and higher than that of the two Towns:

Table 4-3 Unemployment Rate
Towns of Shandaken, Middletown, Ulster County and New York State

	Shandaken	Middletown	Ulster County	Delaware County	Greene County	Upstate New York	New York
Total Population Over 16:	2,711	3,296	141,015	38,528	38,448	6,908,309	14,805,912
In labor force:	1672	1814	89555	22230	21769	3,388,553	9,046,805
Unemployed	91	111	5623	1376	1330	214,434	640,108
Unemployment Rate	5.4%	6.1%	6.3%	6.2%	6.1%	6.3%	7.1%

Source: Data Set: Census 2000 Summary File 3 (SF 3)

This table illustrates that in Shandaken and Middletown, there are approximately 200 people that are unemployed and approximately 750 jobs to fill at the Resort. The proposed project is expected to draw on this local work force, as indicated in the DEIS. However, there is not a large number of unemployed people from which to draw employees in the two Towns. This would indicate that employees would have to move to one of the two Towns or commute to the project.

The DEIS states that the project will create approximately 750 full time equivalent jobs. Many of these new jobs will be lower paying where employees will not be able to afford high commuting expenses. The chart above illustrates that only 200 unemployed people in the two Towns where the project is proposed. This would indicate that, employees will, in all likelihood, currently be a resident or become residents of Shandaken or Middletown. As will be illustrated later in this report, there are few vacant housing units in these two communities; this would indicate that additional housing would be needed to accommodate new families. Additional services would also be needed to accommodate the population growth (schools, fire, police, recreation) and the DEIS does not consider these impacts.

E) Average Household Income

The average household income statistic used throughout the DEIS is an unconventional statistic because it has a tendency to distort figures of an area in which a few people have an extraordinarily large income. For this reason, the median household income is more commonly used in demographic analysis. The US Census Bureau does not directly calculate the average household income, although this information can be obtained by dividing the aggregate income by the number of households.

The numbers in table 2-2 of Appendix 26 as presented in the DEIS, are inconsistent with actual 2000 Census figures. Although aggregate income data is not available at the block level, average household income for the study area can be compiled using data from the nine towns that lie within the study area boundaries. The following compares the actual 2000 figures given in the DEIS with the actual Census numbers.

Table 4-4 Average Household Incomes
As presented in the DEIS and US Census

	DEIS	Census 2000
Delaware County	$40,341	$42,611
Greene County	$44,733	$46,969
Ulster County	$49,583	$52,982
Study Area (as Defined in DEIS)	$39,524	$46,580
New York State	$66,124	$61,889

Source: DEIS and U.S. Census (SF3)

The DEIS underestimates the average income of the Counties, Study area (as they have defined it) and overestimates the average income for New York State. This results in a greater discrepancy of average income between the Catskill region and New York State, to make the Catskill region appear economically depressed. While the average income of the three Counties and study area is less than that for New York State, the difference is less significant that that presented in the DEIS. In addition, looking at New York State as a whole, which includes the New York City Metropolitan area, inflates the average household income; the cost of living in New York City is much higher than other parts of the State and this, in turn, skews the numbers.

The DEIS also states that the real average household income (in base-year dollars) has declined in the study area from 1990 to 2000. Based on the 1990 Census, the average household income of the study area was $31,270. This figure, converted to 2000 dollars, is $40,149. The real average household income of the study area has actually increased by 16.0% over the ten-year period.

The DEIS states that the $39,534 average household income in the area is $26,000 less than the New York State overall average.[50] Again, the DEIS includes New York City in its evaluation and this skews the results; the cost of living in the New York City Metropolitan Area drives up salaries for those that live in the area and a more realistic analysis of the Catskill region, as it relates to the rest of the State, should be prepared. A more accurate comparison is to compare the study area with Upstate New York, which reflects a truer picture of the economy outside the City. The following reflects the household income of the residents in Shandaken, Middletown, Ulster County, Delaware County, Greene County and Upstate New York. The aggregate household income was divided by the average household size for each community to determine the average household income. These results are summarized below:

Table 4-5 Average Household Income
Towns of Shandaken, Middletown, Ulster County and Upstate New York State

	Shandaken	Middletown	Ulster County	Delaware County	Greene County	Upstate New York	New York
Aggregate household income in 1999:	68,280,600	68,325,600	3,576,371,700	820,043,100	858,411,000	135,799,600,200	436,742,533,400
Total population in occupied housing units:	3,244	3,829	166,412	46,034	44,218	6,593,595	18,395,693
Households	1,460	1,666	67,501	19,245	18,276	2,656,066	7,056,860
Average HH Size	2.22	2.30	2.47	2.39	2.42	2.48	2.61
Average HH Income	$46,768	$41,012	$52,982	$42,611	$46,969	$51,128	$61,889

Source: Data Set: Census 2000 Summary File 3 (SF 3)

When New York City is eliminated from the New York figures, as presented in the chart above, the Upstate New York Average Household Income figure reflects conditions throughout most of the rest of the State. The Upstate Average Household Income is $51,128. This chart shows that the average household income figures, based on 2000 Census information, are clearly in contrast to the analysis included in the DEIS; the DEIS that states the average household income in the area is under $40,000 while this chart shows that two Towns and all three Counties are above $40,000.

The average household income computed using this method, and using Upstate New York as the base rather than the entire State that includes the New York Metropolitan Area, shows that the economic conditions in the Catskill region are comparable to the rest of the State. The condition of the economy, as portrayed in the DEIS, is not a true picture of the Counties and two Towns.

[50] Ibid. p. iii.

F) Per Capita Income

As another indicator of the communities' economic conditions, the per capita rates should be considered; unemployment rates and average household income alone do not show the quality of jobs in the county. The per capita income statistic better reflects the earning power of the people. The Census Bureau defines per capita income as the average income computed for every man, woman, and child in a particular group. This figure is derived by dividing the total income of a particular group by the total population in that group (excluding patients or inmates in institutional quarters).

Table 4-6 Per Capita Income
Towns of Shandaken, Middletown, Ulster County and New York State

	Shandaken	Middletown	Ulster County	Delaware County	Greene County	Upstate New York	New York State
Per capita income in 1999	21,121	17,635	20,846	17,357	18,931	19,657	23,389

Source: Data Set: Census 2000 Summary File 3 (SF 3)

In this table, the New York State per capita income figure includes New York City where the cost of living is higher and, in turn, the wages are higher. A more realistic analysis would be to compare Upstate New York with the two Towns and three Counties. This table illustrates that the Towns of Shandaken and Ulster County have a higher per capita income than Upstate New York and their per capita income is comparable to all of New York State. The Town of Middletown, Delaware County and Greene County have income levels that are comparable to Upstate New York, although they are lower than all of New York State. The DEIS understates the economic health of the two Towns and Counties and the viability of the economy in the entire Catskill region. The analysis fails to recognize the improvements to the economy in recent years, and the influence that the revitalized hamlets have had on these changes. These figures clearly reflect a comparable economy to the rest of Upstate that offers a healthy living environment.

G) Housing

Current Housing Stock

The current housing stock in Shandaken and Middletown is primarily single-family detached units. Over 82% of housing in Shandaken and over 78% of Middletown is single-family detached homes; another 8% in Shandaken and 11% in Middletown are manufactured housing. The proposed project, in developing the residential units as attached units (88 units in 22 quad buildings, 60 units in 20 triplex buildings, 168 units in 21 octoplex buildings) will add over 300 units of attached housing. The majority of this housing is not year-round housing and is in direct contrast to the existing single-family, rural character.

These buildings are not being developed near population centers where “smart growth” policies, as outlined in both the APA Smart Growth Policy Guide and New York State Quality Communities Policies, would recommend they be located. The existing land use patterns in the two communities, and throughout most of the Catskill area, is being ignored with this proposal; that is valley, hamlet centered development. The DEIS does not address the scenic, rural or hamlet character impacts of adding attached housing, in an undeveloped area of the municipality and to a community of almost exclusively single-family homes.

Need for Additional Housing

The time-shares in the proposed development are not anticipated to be year-round housing and are not considered to be housing for the Resort employees. The DEIS states that the workforce can be expected to seek housing in the Towns of Shandaken and Middletown in order to be proximate to their jobs and to reduce commuting costs.

The US Census defines vacant housing as **vacant** if no one is living in it at the time of enumeration, unless its occupants are only temporarily absent. Units temporarily occupied at the time of enumeration entirely by people who have a usual residence elsewhere are also classified as vacant. A housing unit is classified as **occupied** if it is the usual place of residence of the person or group of people living in it at the time of enumeration. This information is important to evaluate in the DEIS, which states that no new housing would be needed to accommodate the new employees expected at the Resort.

The following illustrates the number of vacant units in the two Towns, three Counties, Upstate New York and New York State.

Table 4-7 Housing Occupancy and Vacancy
Towns of Shandaken, Middletown, Ulster County and New York State

	Shandaken	Middletown	Ulster County	Delaware County	Greene County	Upstate New York	New York State
Occupied	1,460	1,672	77,656	28,952	26,544	2,424,309	7,056,860
Owner occupied	1,059	1,292	67,499	19,270	18,256	1,636,894	3,739,247
Renter occupied	401	380	45,916	14,597	13,178	787,415	3,317,613
Vacant	1,208	1,341	21,583	4,673	5,078	330,626	622,447
For rent	66	78	10,157	9,682	8,288	74,373	164,623
For sale only	55	33	1,225	591	683	33,418	69,772
Rented or sold, not occupied	45	11	1,025	447	486	17,262	43,729
For seasonal, recreational, or occasional use	930	1,136	605	114	282	140,967	250,199
Other vacant	112	83	6,077	7,836	6,250	64,160	94,124

Source: US Bureau of the Census, 2000

According to the US Census, there are approximately 144 vacant homes for rent and 88 vacant homes for sale in the Towns of Shandaken and Middletown, which are the two communities most likely to be impacted with population growth. Other vacant units account for approximately 200 vacant housing units and would include housing for caretakers/janitors, units held for personal reasons of the owner and similar types of housing; these would probably not be available for new workers moving in as a result of the proposed project. These figures would indicate that adequate housing for the new families that can be expected to move into the area, based on approximately 750 new jobs, is not available. does not appear to be adequate housing for the number of employees the project is expected to generate; the DEIS states that 750 jobs would be created.

There is no analysis in the DEIS as to how these new families would be accommodated, except to say that they would move in to existing vacant housing. The vacant housing is insufficient to house the new families that would, in all likelihood move in to the region and could result in a shortfall of hundreds of housing units. Additional affordable housing is likely to be needed as the number of low-paying jobs, and lack of available housing, will only increase housing demand facing the Towns of Shandaken and Middletown and, in turn, change the existing land use patterns of communities that surround and house the proposed Resort. The DEIS needs to address the rental housing market for the region, and specifically for the Towns of Shandaken and Middletown. The DEIS fails to address the current rental housing market and lower end priced housing market to determine the availability for lower paid employees.

Cost of Housing

In the Towns of Shandaken and Middletown, the median gross rents are $573 and $450, respectively. This is comparable to the median rents in Delaware County, but lower than those in Ulster County. The following summarizes the gross rents:

Table 4-8 Gross Rent
Towns of Shandaken and Middletown

	Shandaken	Middletown	Ulster County	Delaware County
Less than $300	6.3%	5.0%	5.8%	12.3%
$300 to $399	12.1%	20.9%	6.6%	19.9%
$400 to $499	16.0%	22.3%	12.1%	24.6%
$500 to $599	11.0%	12.5%	17.7%	17.6%
$600 to $699	19.7%	10.0%	18.6%	6.7%
$700 to $799	3.9%	7.5%	13.8%	4.4%
$800 to $899	11.3%	1.1%	8.5%	1.2%
$900 to $999	4.7%	0.6%	4.5%	1.2%
$1,000 or more	2.9%	3.3%	6.9%	1.0%
No cash rent	12.1%	16.7%	5.6%	11.2%
Median gross rent	573	450	626	451

Source: US Bureau of the Census, 2000

The employees at the proposed Resort would likely live in one of the two Counties; this is especially true of those that are lower-paid employees where commuting costs would prohibit long travel times. These rents would represent a large percentage of the gross rent for lower paid employees.

H) Secondary Growth Impacts

The DEIS does not adequately address secondary growth impacts that could result from the proposed project, and in fact, puts the onus on the two Towns to restrict such growth[51]. The socio-economic analysis contains voluminous information, but a more detailed assessment of secondary growth impacts should be completed; this would include using up-to-date data and information as 2000 Census data is not used for any of the socio-economic analysis. The discussion on secondary growth inducement must consider potential impacts well in to the future as growth impacts evolve over time and will not be felt within a short time frame.

[51] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. 7-8.

The secondary growth impacts that must be considered in the DEIS would include:

- Potential for Secondary/Vacation Homes - As more people utilize the Resort facilities and Belleayre Ski Center, the potential for second home construction will increase; this will impact the need for services that will be required. Second home ownership trends have not been evaluated as part of the DEIS. The undeveloped areas that surround the proposed project, on both public and private roads, should be considered as potential growth areas and evaluated.
- Year Round Housing – The DEIS ignores the potential for population increases as people will likely move into Shandaken and Middletown to fill the jobs being created at the proposed Resort. This will impact the current housing stock, which could mean the need for affordable housing and other services.
- Economic Impacts on the Villages and Hamlets – The DEIS does not evaluate the impacts of creating a "self-contained" development that competes "head-on" with the businesses in the hamlets and villages. This evaluation is essential to determine the potential business losses and the associated community character impacts such as empty storefronts and the impact on the urban fabric of these commercial centers.
- Additional Commercial Development – The DEIS offers little more detail on the details of the anticipated commercial development. Where the 76,000+ square feet of commercial space is likely to be located and what type of development can be expected will greatly impact the region. If developed along the Route 28 corridor, the community character impacts could be tremendous and this should be considered. The type of commercial space is also not addressed in the DEIS as 76,000 square feet of service stations and fast food restaurants will have a different impact on the two communities than the development of five-star restaurant and high-end boutiques.
- Cumulative Impacts of Expansion at Belleayre Ski Center and the Proposed Resort – The DEIS fails to address the overall impacts of the planned improvements and expansion of Belleayre Ski Center and the proposed project. Combined, these projects will impact the levels of traffic, noise, lighting, housing demand and community services. The "do nothing" alternative in the DEIS fails to address the impacts of the improvements at the Ski Center separate from the proposed Resort.
- Overall Fiscal Impacts - The fiscal impacts on the two Towns are not considered in the DEIS in a detailed cost/benefit analysis. These impacts include the cost of servicing for the new development and the residents that can be expected to move in to the Region.

4.4.2 Proposed Action will conflict with officially adopted plans or goals

A) 2002 NYS Open Space Conservation Plan

The NYS Open Space Conservation Plan[52] is prepared to identify and protect open space resources throughout the State. The plan recognizes many benefits of open space on the economy, quality of life of residents and overall character of the state. The following benefits of open space, as identified in the Plan, are important in considering the appropriateness of the proposed project in the Catskill Region:

- **Open land, scenic** and historic sites and the availability of recreation are important to the **state's quality of life** and thus are a primary factor in attracting and retaining **economic investment**.
- The Parks, beaches, **scenic landscapes**, historic sites, lakes, streams and coastal areas are central to New York's State tourism and travel industry.
- Retaining **open land** can be the **least costly approach** to **environmental protection**. For example, New York City can **buffer its watershed** from intensive development through the historic watershed agreement, avoiding much of the estimated $8 billion cost to construct treatment facilities for the Delaware and Catskill sources of its drinking water. In fact, the NYC Department of Environmental Protection has stated that "**forests are a preferred land use,**" and is supporting extensive forest land retention, stewardship and sustainable forest management efforts in the watershed by the Watershed Agricultural Council's Forestry Program.
- **Forests are a primary source of clean water**; the Adirondacks and Catskills are the sources of several of the state's major river systems. The **Catskills also contain much of New York City's reservoirs** critical to the needs of millions of New Yorkers. Similarly, undeveloped land protects the quality of underground water supplies.
- **Parks and preserves** can provide the opportunity for **escape and relaxation** for every New Yorker. Outdoor experiences provide important social values and are an important and inexpensive form of relaxation.

The Plan also lists Priority Projects in the region that could be impacted with the development of the proposed Resort. The Catskill Unfragmented Forest is the top priority within Region 3 and 4. This project recognizes that the high peaks area of the Catskills should be protected and the Preserve expanded by giving priority to large parcels that border the State land and to areas that are highly visible from Route 28; the proposed project site fits both criteria and its importance to the region is downplayed in the DEIS. The proposed project would not help to further the goals of the Plan and may, in fact, hinder the goal of unfragmented forests. The DEIS does not address how the proposed project fits within the context of this Plan or the impacts on open space conservation as a result of its development.

---

[52] 2002 NYS Open Space Conservation Plan. Chapter 2. p. 11-18.

B) Land Use Plan for Ulster County

The Ulster County Planning Board has developed a Land Use Plan for Ulster County (1977) that includes policies for development within the County. The Plan was prepared to provide guidance for future decisions made within the County that address the changing economic and social characteristics of the region. While the Plan is over 20 years old, this is the County Comprehensive Plan that is considered as the County completes reviews of projects. Several areas of the Plan address key issues as they relate to the proposed project. The following statements on slope development are included in the Plan:[53]

- Removal of vegetation deprives the soil of the stabilizing function of roots as well as the moderating effects on wind and water erosion
- Development on hillsides increases runoff, not only by creating impermeable surfaces but by altering natural drainage patterns
- Degradation of hillsides also destroys a community's character. The surrounding hills are an aesthetic resource which gives the community its distinctive setting

These statements illustrate the commitment of the County to protecting the community character within the entire region. The proposed project, located on a mountaintop and hillside, are in contrast to the policies set out by the County. The Plan concludes in the Land Use Section[54] that "this plan…capitalize[s] on previous public investment by strengthening and improving the existing centers rather than duplicating facilities and services in rural undeveloped areas." The County Plan also encourages smaller scale facilities that do not infringe on environmentally sensitive areas; the proposed project is in direct conflict to this Plan in this way.

C) Zoning Codes

The Town of Shandaken implemented zoning changes in 1999 to allow, by special permit, golf courses in the R-5 District. At that time, the Ulster County Planning Board, wrote " The Board is concerned about the lack of the required planning board report as well as an apparent connection between the land use changes and as of yet defined project. It is these land use changes, namely the addition of golf courses and an increase in density, being sought for some for some of the most environmentally sensitive districts in the community that causes our great concern."[55] The zoning amendments passed and today, golf courses are allowed, by special permit, in the R-5 District.

[53] Land Use Plan for Ulster County. p. 14.
[54] Ibid. p. 42.
[55] Referral No. 99-115. Recommendation Re: Town of Shandaken – Amend Zoning Ordinance. p. 1.

The DEIS states"[t]he proposed uses are allowed by both Town's zoning ordinances and are consistent with the other provisions and requirements of such ordinances."[56] Both communities require a special use permit for the vacation resort. Town Law states that "the term "special use permit" shall mean an authorization of a particular land use which is permitted in a zoning ordinance or local law, subject to requirements imposed by such zoning ordinance or local law to assure that the proposed use is in harmony with such zoning ordinance or local law and will not adversely affect the neighborhood if such requirements are met."[57] A vacation resort is not allowed UNLESS the general standards outlined in §116-39 of the Town of Shandaken and §601-D of the Town of Middletown are met. These standards are somewhat generic in nature, yet the statement on development being in "harmony" with the peak/valley, scenic, rural or hamlet character of surrounding land uses cannot be ignored.

§116-39G in the Town of Shandaken Zoning Code states: "The character and appearance of the proposed use, building, structures and/or outdoor signs shall be in general harmony with the character and appearance of the surrounding neighborhood."[58] §601-D1 in the Town of Middletown Code standard indicates the "[l]ocation, use and size of structure, nature and intensity of operations involved, size of site in relation to it, and location of site with respect to existing or future streets giving access are such that it will be in harmony with orderly development of the district."[59] The undeveloped character of the proposed project site is currently wooded or forest land and would be changed dramatically.

The proposed development will include clear-cutting approximately 500+ acres of this forestland and is not in harmony with the existing surrounding land uses. The DEIS fails to address the lack of harmony with the surrounding neighborhood as development moves from the valleys to the mountaintops. "Most of the developed land uses serving tourism are concentrated in the hamlets along the NY Route 28 corridor including Phoenicia, Pine Hill, the Village of Fleischmanns, Arkville and Margaretville."[60] Historically, development has been located in hamlets and in villages located in the valleys, and mountaintops have remained undeveloped. Changing this trend will forever alter the scenic and rural character of the Catskill region and the two Towns.

[56] Ibid. p. xvi.
[57] § 274-b Town Law. Approval of special use permits.
[58] Town of Shandaken Zoning Code. §116-39.
[59] Town of Middletown Zoning Code. p. 73.
[60] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xvi.

D) Route 28 Corridor Study

In 1994, a concerned group of citizens began meeting to discuss these and other challenges confronting communities along the Route 28 corridor. After a period of 8 months, the group, calling themselves the "Route 28 Corridor Committee" and chaired by Dean Gitter, produced *The Route 28 Corridor Study*. This study laid out a vision for the corridor's future economic growth with attention to protecting natural resources. In general, the study suggested a maximization of facilities at Belleayre Mountain (site of the state-run Belleayre Ski Center) and the revitalization of the two villages at its base, Pine Hill and Fleischmanns. The study states "The various hamlets along the corridor provide services to the visitor and should serve as the hubs for future concentrated development." The study went further stating "...four or five 100 room hotels, built over a 5-10 year period, would be far more viable than either a multiplicity of smaller units or dependence on a mammoth new resort."

The Route 28 Corridor study recognizes the value of the Catskills environment in the opening statement of the report: "The Catskill Forest Preserve in Upstate New York is an underutilized resource of significant potential. A metropolitan market of 21 million people lies within 100 miles of its eastern gateway. An additional 18 million people visit the metropolitan area annually (6 million of them from abroad, many from countries where a preserve as pristine as the Catskills Forest has not existed for decades)."[61]

This study recognizes the uniqueness and unspoiled wilderness area of the Catskills. In the mid-19th century, the Catskills were "devastated" by the tanning and logging industries and today, "represent one of the world's few and most obvious success stories."[62] The proposed development would once again devastate the mountaintops that have taken 100 years to regenerate themselves. The DEIS downplays the significance of the Catskill's environmental restoration and the impact that one large-scale development could have on the region.

[61] Route 28 Corridor Study. p. 1.
[62] Ibid. p. 1.

The Route 28 Corridor Plan was developed to guide land uses along Route 28 with a specific strategy. The first recommendation in the Plan is that the preparation of a land use/economic development strategy be developed to "capitalize on the existing pattern of small hamlets connected by the strong transportation corridor."[63] The Corridor Plan outlined in the study states that intensive year-round activity would " spark the construction of lodging and entertainment facilities at appropriate spots along the Route 28 Corridor through the two Towns, particularly at the two Gateway development areas: Phoenicia through Mt. Tremper in the east and Margaretville to Arkville/Halcottsville in the west." The proposed development is in direct conflict with these goals. The historic patterns of development are ignored with the proposed development that would result in numerous land use changes on top of the mountains, as opposed to capitalizing on the existing pattern of small hamlet development. Likewise, the two Gateway areas identified in the plan are not being targeted for development as the study stated.

Finally, the Route 28 study offers recommendations on land use controls and guidelines and states "the natural features of the Corridor should be the **dominant visual element**. Man made development should recede to the background or enhance a common theme."[64] Clear-cutting 500+ acres of land on top of the mountain would detract from the natural features, and the dominant visual elements of the proposed project, the hotels, golf courses and other man made improvements, would overshadow the natural beauty at this location on the mountaintop and must be addressed in the DEIS as it relates to community character.

E) West of Hudson Economic Development Study for the Catskill Watershed Corporation

In 1999, the Catskill Watershed Corporation conducted a study to assess the economy of the Catskill watershed. The study states that "despite the challenges, the watershed region also has several substantial economic strengths on which to build. These include...a tourism destination sector that has remained stable despite a shakeout of the hotel industry as large noncompetitive resorts give way to smaller niche players."[65] The results of the HR&A Study were not unlike that of the Route 28 Corridor Study but went further. The study emphasized focusing development within existing hamlets. The study said, "The hamlets and villages are among the watershed's most important assets from an environmental protection standpoint. New economic activity within these centers can make use of existing infrastructure and buildings, thereby limiting the amount of land that would be cleared to accommodate new development."

[63] Ibid. p. 11.
[64] Ibid. p. 51.
[65] West of Hudson Economic Development Study. p. 12.

The study states, "Active recreation in the watershed can create conditions that are detrimental to water quality. In particular, skiing and golf can have greater impacts due to water-use for snowmaking or irrigation from clearing large sections of land. Also, the use of herbicides and fertilizers on cleared land such as golf courses present possible water quality impacts." It continued "communities felt strongly that they desire and strive for a sense of place for their residents. There was a sense of pride when people spoke of their community and a willingness to preserve the existing character." Finally, the study said "...there is a shakedown in the hotel industry as large noncompetitive resorts give way to smaller niche players."

Additionally, the objectives[66] of the plan include:

- Respect the natural environment as an asset and maintain the clean and pristine character of the Watershed communities
- Encourage growth of industries and businesses that are compatible with clean water standards
- Strengthen the economies of hamlets, towns and villages while supporting and promoting a protected working landscape
- Provide incentives for environmentally sound businesses practices
- Support entrepreneurial endeavors which provide job opportunities
- Maximize available resources
- Utilize funds as a catalyst for stimulating public and private investment and economic activity

Additionally, the study states "the watershed's economic development plan needs to encourage many small businesses within an area as opposed to one large one."[67] The proposed project would not meet the objectives outlined in this study. The first three objectives would be compromised with a project that proposes clear cutting over 500 acres, developing two golf courses that will require pesticides and fertilizers and cuts off the top of a mountain that is not proximate to the existing hamlets and Villages.

The study also recognizes the shift in the tourism industry as it relates to the Catskill region. The industry has remained stable despite a decline in the hotel industry. The study suggests that tourism accounted for approximately $670 million of the five-county economy in 1997; the hotel industry lost a substantial number of jobs due, in part, to "accommodations industry...shifting from full-service "borscht-belt" style resorts to facilities focused on niche opportunities."[68] Large, non-competitive resorts are not viable in the Catskill Region. This would suggest that tourists are not interested in large-scale resort style lodging, but rather smaller facilities. The proposed Resort and the DEIS analysis of its impacts, do not address this tourism trend.

[66] Ibid. p. 16.
[67] Ibid. p. 56.
[68] Ibid. p. 13.

F) Public Input Results – Survey in Shandaken

In the Summer and Fall 2000, the Comprehensive Plan Committee for the Town of Shandaken undertook a community survey to identify issues and determine the overall opinions of residents on various community aspects. The survey was mailed to all 3,040 households in June. A total of 769 surveys were returned for a response rate of 25%. The results of the survey have been tabulated and several of the questions and answers directly relate to the residents "vision" for their community and future development. The average length of property ownership in the Town is almost 22 years, so there is a definitive "history" that has been established by many residents.

The following outlines the mean scores, and survey responses, received for various questions related to community character and resident's vision for the Town of Shandaken. The scale on the survey included a rating from 1 to 5 with 5 being very important. Many of the survey responses are in direct conflict with the probable impacts of the proposed development, and have not been addressed or considered by the DEIS:

- Character
  - 4.5 – Protecting Rural Character
  - 4.4 - Protecting Existing Hamlets
  - 4.7 – Protecting Scenic Views
- Development Pattern
  - 3.4 – Encourage Development in the Hamlets
  - 2.8 – Encourage Development in other Areas
- Type of Economic Development
  - 4.2 – Arts/Theater
  - 4.1 – Small Inns/Bed & Breakfasts
  - 3.9 – Tourism
- Housing
  - 4.2 – Single Family Dwellings
  - 2.2 – Townhouses/Condos/Cluster
  - 2.2 – Apartments/4 or more units
- Reasons for Living in Shandaken
  - 4.8 – Natural Surroundings
  - 4.6 – Rural Lifestyle
  - 4.3 – Low Crime Rate

Over 72% of respondents indicated that the community rural character is very important to them and 63% indicated the existing hamlets were very important. 82% indicated that the forests and woodlands are very important. Over 92% indicated that the scenic views were very important or important to them; this is over 90% of residents answering the survey. 67% believe that maintaining the rural character is very important while another 17% believe it is important. Almost 60% believe that controlling the rate of development is very important. 43% believe that enhancing economic opportunities is very important.

Almost 28% of the survey respondents indicated that development along Route 28 should be encouraged, while 34% thought it should be discouraged. Development in the hamlets should be encouraged according to 53% of respondents.

When asked what type of economic development should be encouraged, the proposed uses ranked lower than many other uses. The following percentage of respondents agreed the following should be encouraged:

- 76% - Arts/Theater
- 73% - Small Inns/B&B
- 70% - Crafts
- 66% - Tourism
- 64% - Home Business
- 62% - Visitor/Interpretive Center
- 61% - Restaurants
- 61% - Tele-commuting/Internet
- 54% - Retail Businesses
- 40% - Spas
- 33% - Hotels
- 31% - Light Manufacturing
- 13% - Gambling

87% of survey respondents indicated that the natural surroundings were very important in their reason for choosing Shandaken as their home. Additionally, 74% indicated the rural lifestyle was very important for their reason for choosing this community as their home.

When asked what type of recreational activities they are interested in having in Shandaken, Golf Courses ranked low as a priority for residents. The following percentages of respondents were in agreement that the following should be encouraged:

- 82% - Hiking Trails
- 73% - Arts/Theater
- 72% - Hunting/Fishing
- 69% - Theater
- 64% - Cross Country Ski Trails
- 63% - Bike Paths
- 62% - Crafts
- 61% - Ice Skating
- 60% - Eco-Tourism
- 60% - Horseback Riding
- 59% - Whitewater Recreation
- 59% - Cultural/Heritage Tourism
- 59% - Bird Watching
- 57% - Community Center
- 54% - Downhill Skiing
- 53% - Town Pool
- 52% - Museums
- 41% - Tennis Courts
- 32% - Golf Courses
- 22% - Snow Mobile Trails

The proposed project appears to be in direct conflict with the vision of residents in Shandaken as they have responded to the survey completed as part of the Comprehensive Planning process. The residents have indicated that small-scale development that complements the hamlets and maintains the natural beauty is the type of development they envision for their community in the future.

G) Community Workshops

The Town of Shandaken workshops were completed as part of the Comprehensive Planning process. The workshops identified preserving and promoting the hamlets as important, encouraging low-impact small businesses and encouraging hamlet revitalization as important. These are the people that live and work in the community where the development is proposed. The most important goals outlined in the workshops held in Shandaken include[69]:

- Encouraging hamlet revitalization for businesses and homes
- Need for a comprehensive Catskill Park zoning plan to reflect the special nature of the Park, Route 28 and other areas
- Preserve and promote cultural, historic and economic character of the hamlets
- Encourage clean, low-impact small businesses that pay above minimum wage
- Provide a community center for all ages
- Provide improved internet access and other communication capabilities without impacting the natural setting
- Promote Route 28 as a scenic highway
- Enhance the aesthetics of Route 28
- Encourage oversight of development (lighting, materials, landscaping, setbacks)
- Place a cap on the scale of development to preserve the rural character
- Preserve and enhance the beauty of the area though the development of "riverwalks" that link hamlets
- Provide improved and affordable public services (trash removal, water quality"

Their vision is clearly different from the proposed project outlined in the DEIS that includes a large-scale development with no relationship to the hamlets, the history or the region or the scenic character of the Catskills. There has been no consideration for the drastic impacts that the proposed Resort would have on the vision identified by those that have supported the communities as residents and business owners. The proposed Resort, given its large-scale and location, would be in conflict with the goals outlined by those living in the Town of Shandaken.

The Catskill Center conducted visioning workshops for the major hamlets in the two communities; this includes Fleischmanns, Pine Hill and Phoenicia. The visioning workshops in Fleischmanns were held between May and July 2002 to identify what residents identified as their future. The aspects of their community that residents "love about Fleischmanns" and its community assets include:

- Nature (scenery, mountains, water, serene view)
- Town and its Amenities (architecture, library)
- Proximity to Belleayre Mountain
- Local History
- Quaint Environment

[69] Town of Shandaken Community Workshops. December 2000. p. 9 and 14.

Similar results came from the Pine Hill workshop held in January 2002. Residents "love" the following aspects of Pine Hill:

- Strong Sense of Community
- Friendly People
- Small Town Feel
- Natural Beauty
- Mountains
- Activities such as skiing, fishing and hiking

The Phoenicia workshop identified the beautiful setting of the mountains, small town look and feel, small and quaint community and making changes that benefit all – not just tourists, as important to their vision during a workshop held in February 1999. The aspects of Phoenicia that residents "love" included:

- Beautiful setting in the Mountains
- Small town look and feel
- Small and quaint community
- Community spirit and cooperation

4.4.3 Proposed Action will cause a change in the density of land use

A) Increases in Land Use Intensity

"The existing community character reflects a mix of land uses associated with historical land uses within the Central Catskill Region including agriculture, forestry, tourist related land uses and residential uses."[70] The density of land uses in the Towns of Shandaken and Middletown will increase dramatically and irrevocably with the development of the proposed project. As stated in the DEIS, the existing land uses on the eastern project site include two hunting camps, a house and barn, State hiking trails, the Brisbane (Turner) Mansion, carriage barn and caretakers house, lands formerly known as White Horse Lodge. The western portion of the project site includes the Highmount Post Office, the Marlowe Mansion/Wildacres Hotel, a residence and barn, house and outbuildings from former Leach farm and the former Highmount Ski Resort.[71] This area, for the most part, has been historically undeveloped, as stated in the DEIS.

The concentration of the land uses proposed for the mountaintops will cause a tremendous change in the overall density of land uses. The project site to be impacted includes 573 acres that will be clear-cut and covered with over 100 buildings. These include two hotels, residential buildings, maintenance buildings and restaurants. The two golf courses will result in grassing almost 400 acres of an area that, today, is heavily forested. This change in land use not only increases density, but changes the peak/valley and scenic character of the mountains forever.

B) Scale and Design of Hotel Complexes

The Wildacres Resort Hotel complex is reflective of the diverse collection of architectural styles that defines Catskill resort architecture since the mid 18th Century, as stated in the DEIS. However, the placement of the Wildacres Resort Hotel, at the peak of a picturesque mountaintop, is in direct contrast to the previous trends in resort development in the Catskills. Historically, large-scale, multi-function resorts, have been nestled in the valleys or constructed on pre-existing plateaus. This was done to preserve and maintain the character of the mountain and prevent any negative impacts to the natural integrity of the mountain ranges. Wildacres Resort Hotel is, as designed, a significant alteration to the mountain on which it is to be constructed, as it is located in a prominent location at the peak. This location will forever alter the existing natural landscape of the Catskills.

[70] Draft Environmental Impact Statement For Belleayre Resort at Catskill Park. September 2003. p. xvi.
[71] Ibid. p. 2-5.

The design of the Big Indian Resort and Spa has no cultural, historical or natural connection to the Catskill Mountains. The architectural details call for the roof and terrace areas of the main structure to be " planted with a mix of indigenous plants". The DEIS states that this approach to the design of the building will result in, "essentially making it invisible", with the building "virtually hidden within the landscape. In fact, there is no way to hide a building of this size and magnitude on the side of a mountain that is currently heavily forested.

Plans to vegetate numerous parts of the Big Indian Resort Hotel, while helping to visually mitigate the structure, will not make it blend into the indigenous vegetation. This is due to the fact that the existing maple-beech forest will not be replicated in the roof top gardens. Only shrubs, small trees under six-feet in height and grasses will be used due to the technical constraints of "rooftop planting".

In the DEIS it states that there will be approximately five-acres of planted roof. There will be an engineered soil profile with soil depths ranging from 12-inches for small shrubs, 18-inches for larger shrubs and 24-inches for small trees under six feet in height. Larger trees will not be used due to blow down concerns. The soil will be placed over filter fabric and a drainage layer to prevent water retention. The plantings will then be irrigated to maintain a soil moisture content suitable for plantings. In spite of the irrigation, the designer wisely is proposing to use a xeriscape planting method where plants with various water requirements are separated into irrigation zones with most of the plantings requiring little supplemental water. Finally, the ground will be covered with three inches of mulch to further conserve water.

The result of the rooftop-planting scheme is that while the plantings will eventually establish themselves, the end result will not blend into the surrounding forest. From the air, the building could be somewhat masked, but in elevation, the reflection from glass and the building itself will be visible. The xeriscape plantings will not resemble the indigenous maple-beech forest. The initial plantings will need to be somewhat sparse to allow room for the plants to grow. Until they are established in several years, with proper maintenance, five-acres of mulch will be the most visible element.

The square footage of both proposed Resorts, with main buildings that fall in the range of 390,000 - 410,000 square feet, are each equivalent in size to four (4) big box structures, such as a Wal-Mart. The impacts from a building of this magnitude on the natural topography will be irretrievable, in terms of the amount of natural vegetation and foliage that will be lost and changes to the visual aesthetics of the mountain range.

4.4.4 Development will create a demand for additional community services (e.g. schools, police and fire, etc.)

A) Impacts of Population Growth

The DEIS dismisses the impacts on schools, fire and police by concluding that there would be no adverse impacts from the proposed project. This conclusion ignores the impacts of potentially hundreds of new families moving in to the Region and specifically, how many can be expected to move in to the Towns of Shandaken and Middletown.

There will likely be population growth in the Towns of Shandaken and Middletown, and probably in Olive and Andes, yet the DEIS ignores this potential population growth and the need for additional services. The DEIS includes a letter from the Margaretville Central School District that they would "have capacity to serve the proposed project with the understanding that probably only the privately-owned homes in Highmount Estates might house school-aged children". As many workers, and their families, can be expected to move into the Region, and specifically Shandaken and Middletown, there will be an increase in population and school age children that goes beyond those in the Highmount Estates.

The impacts on fire and police protection could also be impacted by the population growth. Because the DEIS assumes no population growth, there are no considerations for additional fire and police protection that would be needed as a result of the project. The National Fire Protection Agency and the Commission on Fire Accreditation International both recommend a total response time (i.e., the time from the notification element to the on-scene time) of 6 minutes[72] for fire protection. The DEIS does not illustrate that this response time will continue to be met, even in remote areas of the development. There could also be a need for additional police protection. Yet mitigation measures for the potential impacts have not been included in the DEIS; the conclusion that "no mitigation measures are necessary" is made because there is no recognition of possible population growth. The DEIS should examine the costs of services with and without the proposed project as they relate to schools, fire, police and other community services.

[72] http://www.sparksfire.org/response_times.htm#_ftn8.

B) Traffic Impacts from Belleayre Ski Center and the Proposed Development

In the Catskill region, the rural, winding roads lend to their overall charm and scenic and rural character as they tend to follow the natural topography – roads are generally located in the valleys and the mountains have remained undeveloped. The DEIS states that the "three largest ski area: Belleayre, Hunter and Windham have the potential capacity to complete head-on with other ski regions and even to transition from primarily serving a weekend and vacation market to serving a more steady stream of skier volumes seven days a week."[73]

The expansion of the Ski Center would result in additional traffic volume – especially on Route 28, as this is the primary access road to Belleayre from the NYS Thruway. The traffic increase impacts stemming from improvements and expansion at the Ski Center have not been included in the overall analysis of the proposed development. By ignoring the potential traffic impacts of the Ski Center, the cumulative impacts on Route 28 cannot be fully assessed. The increases, in recent years, in attendance have also been ignored.

The proposed Belleayre Resort at Catskill Park would only exacerbate the traffic issues that would result if Belleayre Ski Center were "serving a more steady stream of skier volumes seven days a week." Increased traffic leads to increases in noise levels, the potential for accidents and vehicle emissions. What is now a rural, winding country road (Route 28) would see an influx of traffic, which could later require the widening of Route 28, which would transform the entire rural character of this scenic corridor. Costs for improvements to County Road 49A and Friendship Road (only 18-20 feet wide) are not included as part of the DEIS and the expenses born by the applicant.

The DEIS does not adequately address this possibility, and general traffic impacts, on the rural character of the Town of Shandaken and other Route 28 corridor communities. The DEIS understates the traffic impacts of the proposed project because it does not evaluate the full-build out of the project, uses days of the year that are not peak usage (Martin Luther King, Jr. weekend), does not use current usage numbers for Belleayre Ski Center and other issues identified in the summary report.[74] The full impacts of traffic on the two communities must be identified to full build-out.

[73] Ibid. p. 1-16.
[74] Summary of Traffic Impacts of the Belleayre Resort at Catskill Park. Community Consulting Services. January 10, 2004.

COMMENTS ON GROUNDWATER ISSUES OF DEIS FOR BELLEAYRE RESORT

Andrew Michalski, Ph.D., CGWP
Michalski & Associates, Inc.
1301 Jankowski Court
South Plainfield, NJ 07089

I have reviewed major portions of the September 2003 Draft Environmental Impact Statement (DEIS) for the proposed Belleayre Resort at Catskill Park. My comments focus on evaluation of hydrogeologic issues, including surface and groundwater interactions, and adverse impacts of proposed groundwater pumping to meet potable and irrigation needs of the proposed Belleayre Resort. These issues and impacts have either been inadequately evaluated or not addressed in the DEIS. They are detailed under the specific headings of my comments below. A summary of my major comments follows.

(1) The proposed groundwater withdrawal rates from Rosenthal wells R2 and R1, required to meet potable and irrigation water demands for the eastern portion of the project (Big Indian Plateau), cannot be sustained over dry weather periods. The Silo A Spring cannot be used as a backup supply source during such periods because the flow in Crystal Spring Brook would fall below the criterion of 30% of average flow ("the Tennant threshold").

(2) Even at sustainable reduced rates, groundwater pumping at the two portions of the project (the eastern Big Indian Plateau and western Wildacres Resort) would significantly reduce the baseflows in Crystal Spring Brook, Birch Creek, and Emory Brook. Existing streamflow measurements for dry weather months show that Crystal Spring Brook is already losing much of its baseflow along the segment above the confluence with Birch Creek, and Birch Creek is barely gaining any water within its two-mile segment below the confluence with Crystal Spring Brook. The amount of further reduction in the Birch Creek baseflow attributable to the proposed pumping would approach withdrawal rates from the Rosenthal wells, as the wells would subtract water from the creek. The lower segment of Crystal Spring Brook might completely lose its baseflow due to the combined effects of increased pumping rates at the two portions of the proposed resort and at the existing Belleayre Ski Area, and through flow short-circuiting along open holes of numerous deep bedrock wells installed within and adjacent to the project area.

(3) Extensive lowering of bedrock water levels due to pumping at the Rosenthal supply wells, estimated to exceed 45 to 50 feet within a half-mile radius of the wells, can adversely impact a number of residential wells located outside the Pine Hill Water Company service area. Cumulative impacts of concentrated bedrock pumping at the two portions of the project and at the Belleayre Ski Center include well interference effects and the potential for inducing an upward migration of saline water.

(4) Re-evaluation of bedrock hydrogeology and spring capture areas, with due accounting for structural effects of a stacked multi-aquifer bedrock and the role of open holes, should be conducted by the Applicant in order to assess and quantify groundwater-related impacts and to develop a reliable monitoring of such impacts.

1.0 Overview of Hydrogeology, Groundwater Resources and Streamflow Issues

1.1 Bedrock Hydrogeology and Aquifer Productivity

The DEIS is deficient in describing the hydrogeology of the region and of the two large areas of the proposed resort adjacent to the existing Belleayre Ski Area. A description of regional hydrogeology provided in DEIS Section 3.3 is based on old groundwater-supply reports for Delaware County (Soren, 1963) and Ulster County (Frimpter, 1972). It is limited to a brief listing of hydrostratigraphic units, typical ranges of yields for wells and springs, and some water quality problems. No geologic or hydrogeologic maps or cross-sections of the mountainous study area have been included in the DEIS. No attempt was made at conceptualization of groundwater flow in bedrock and unconsolidated deposits and at establishing relationships between groundwater and surface water, including hydrogeologic characterization of springs within the study area, even though these issues are critical for proper interpretations of results of environmental measurements and testing. Flow contribution areas to springs were determined based on surface drainage area while ignoring any structural and vertical heterogeneity influences on spring catchment areas.

Specifically, the DEIS failed to consider results of more recent hydrogeologic studies conducted by the USGS in the Catskills at the Beaver Kill basin (Reynolds, 2000) and in the Batavia Kill valley (Heisig 2002). These two study sites, located south and north of the project area in similar geologic and geomorphologic settings, provide good analogs for conceptualizing groundwater flow in the bedrock.

Reynolds (2000) conceptualizes bedrock in the Catskill Formation as a series of stacked aquifers separated by (semi)confining units of varying thickness (Attachment 1). Groundwater within each of the permeable units can be locally perched near the mountainsides. Permeable bedding-plane fractures typically form at the contact between lithologically dissimilar units as contact springs. The deeper flow system is recharged by leakage across the semi-confining units.

Results of the Heisig (2002; Attachment 2) study in the Batavia Kill valley provide further refinement of the above generic conceptual model and its response to pumping. The predominant water-bearing units of the fractured bedrock are formed by few hydraulically separate, low-angle bedding-plane fractures. Pumping test results indicate that the bedrock aquifer has very little storage, and pumping effects can extend one mile up-valley and down-valley. Vertical flow measurements indicate that up to 25% of the pumped discharge comes from flow along open holes of observation wells that short-circuited previously naturally isolated water-producing bedding fractures. The most productive short circuits interconnect deeper fractures with fractures that can "steal" water from saturated valley fill deposits and surface water bodies.

These findings from the Batavia Kill valley are consistent with studies conducted in other sedimentary basins where productive/transmissive units are formed by only a few bedding fractures that are often non-uniformly distributed within a stratigraphic column (e.g. Novakowski and Lapcevic, 1988; Williams and Conger, 1990; Michalski and Britton, 1997).

There is strong evidence that the same hydrogeologic paradigm applies to this study area. For example, a boring log for the proposed potable supply well Rosenthal #2 (R2) near Pine Hill Lake (Exhibit E) indicates that the first water-producing fractures in this 274-foot deep well were encountered below a depth of 180 feet. This first producing unit was most productive in well R2. In the Village of Fleischmanns Well #2, an audible cascading of water from a fracture at a depth of 37 ft was noted during the recovery phase of a pumping test (Exhibit D, p. 9), attesting to the discrete occurrence of water-producing units. The use of borehole geophysical logging (fluid conductivity, flowmeter logs) is essential for identification and characterization of such transmissive/productive bedrock fractures for water-supply studies, well interference analyses, and impact monitoring in an environmentally sensitive area. However, no such diagnostic logs were obtained from any of the bedrock wells in the study area.

An anomalous depth to water of 280 feet under non-pumping conditions is reported at the 410-foot deep Fleischmanns Well #3 (Exhibit 4, page 2 of letter to Mr. Dean Glitter). As such a deep water level in a long open hole represents a composite of potentiometric levels from all transmissive fractures penetrated by this deep well, one must conclude that the most productive/transmissive bedding fracture intersects Well #3 below that depth of 280 feet. Based on my preliminary geometric projection, this transmissive bedding fracture likely extends updip (i.e., eastward) to connect the Fleischmanns wells hydraulically with some of the six supply wells at the Belleayre Mountain Ski Resort (mentioned on page 3-63 of DEIS), with the Pine Hill Water Company supply wells (PH-1, PH-2, PH -3), and with Crystal Spring Brook itself. In addition to these wells, the Pine Hill Water Company owns a series of three springs known as the Bonnie View Springs, and Depot Station Road Spring (DEIS, page 3-60).

A documented loss of flow within a lower segment of Crystal Spring Brook during dry season months (see Comment 3.2) is likely a surface manifestation of the effectiveness of that hydraulic connection and the short-circuiting of transmissive bedding fractures by the open-hole well conduits. The proposed increased pumpage at the Fleischmanns wells for water supply at Wildacres Resort may substantially exacerbate this type of water transfer from the Crystal Spring Brook drainage area, resulting in drying-up of the lower segment of Crystal Spring Brook and diminished baseflow in Birch Creek. The DEIS does not consider combined impacts of the Fleischmanns wells and the Belleayre Mountain Ski Resort well pumping on the baseflow of Crystal Spring Brook and Birch Creek. In the DEIS, a groundwater divide is implicitly and incorrectly assumed to coincide with the topographic drainage divide.

In order to evaluate structural impacts of individual transmissive bedding fractures in a stacked multi-unit bedrock aquifer, reliable measurements of strike and dip of bedrock layers are required. The DEIS only states in general terms, on page 3-1, that the layers dip slightly toward south and west but a different dip direction (slightly to the northwest) is reported from the Beaver Kill basin (Reynolds, 2000). Published geologic maps (Fisher et al., 1961; 1972) are too coarse to be used for a dip determination for the study area.

The Applicant should accurately determine dip angle and direction within the project area through taking several elevation measurements of a marker bed contact exposed on slopes of Crystal Spring Brook and Birch Creek. Only then can a reliable hydrogeologic cross-section be prepared, which would show positions of open-hole well segments in various supply wells, major springs, and surface water bodies projected against traces of major productive units (transmissive bedding fractures). The latter would be identified through observation in borehole geophysical logging, as mentioned earlier. This would provide a proper hydrogeologic basis for realistic assessments of the impacts that the proposed two large resort developments east and west of the Belleayre Ski Center would have on the streams, groundwater, and wetlands, as well as for setting up reliable monitoring of such impacts.

1.2 Overburden Deposits

The thickness of unconsolidated deposits over bedrock ranges from one foot in upland areas to more than 80 feet in portions of the valley along Route 28. Low-permeability till is the dominant type of unconsolidated deposits. No major outwash deposits of permeable sand and gravel are found in the Birch Creek valley within the project area. Outwash deposits are typically absent in small tributary valleys within the upper reaches of drainage basins in the region (Reynolds, 2000, page 11). The overburden is not a significant source of water supply or groundwater storage within the project area.

1.3 Surface Runoff and Flow in Birch Creek

Because of the steep topography, the low-permeability glacial overburden, and the small size of the Birch Creek watershed, the flow in the creek shows a very "flashy" or rapid response to precipitation events. Daily discharge can increase by three orders of magnitude in one day, then decrease by two orders of magnitude within 10 days, as measured at the Esopus Creek gauging station (DEIS, Page 3-21).

The discharge that is exceeded 90% of the time is a commonly used measure of baseflow, or contribution of groundwater flow to streamflow. For 23 small Catskill mountain streams, the summer baseflow represented from 0.5 inch to 1.3 inches of the mean annual discharge expressed in inches (Reynolds, 2000). At the easternmost high-elevation portion of the nearby Beaver Creek watershed, which is very similar to the high-elevation portions of the project site, mean annual precipitation is 55 inches/year, with runoff of 40 inches/year (Ibidem). The calculated summer baseflow of 1 inch for that watershed constitutes merely 2.5 % of the total runoff or 1.8% of the total rainfall. These figures are provided here to illustrate how small the summer baseflow, or groundwater contribution to streamflow, is in relation to the total rainfall, which makes the summer baseflow susceptible to adverse impacts by groundwater pumping from bedrock wells adjacent to the stream.

In this site-specific context, the use by the DEIS of annualized water budget analysis (Exhibit A within Exhibit G) as a sole basis for evaluating aquifer recharge and impacts of the proposed development on groundwater recharge is misleading. At best, such annualized analysis would only apply to generic soil types of the generally thin soil cover but not to the bedrock.

2.0 Availability and Impacts of Proposed Water Supply Sources - Big Indian Country Club and Belleayre Highland

2.1 Evaluation of Pumping Test Data

It is proposed that potable water supply for this portion of the project will be obtained from the bedrock Rosenthal well #2 (R2) as a primary source, with the Silo A Spring serving as a backup source. A combined average daily flow required for the eastern portion of the project is projected at 114,817 gpd (or 82 gpm; Appendix 7, page 6). Upon accounting for all water saving devices, the daily average demand would be reduced to 64 gpm. Another bedrock well, Rosenthal well #1 (R1) will be used to meet seasonal irrigation needs for the golf course. Well R1 would be pumped at 57 gpm. The bedrock wells R1 and R2 are located in the Pine Hill Snowmaking Pond (Lake) area and are170 feet apart.

The greatest demand on the well water supply will be during dry season months, when both R1 and R2 would need to be pumped, whereas the use of Silo A Spring as a backup source would no longer be permitted because of the Applicant-invoked Tennant threshold: The use of Silo A Spring to meet the potable demand for extended periods of time during drought conditions could cause the flow in Crystal Spring Brook to fall further below the Tennant threshold. Demand should continue to be met by the primary water supply well, Rosenthal #2, during drought conditions"(Exhibit G, page 14). The DEIS sets the Tennant threshold for Crystal Spring Brook above its confluence with Birch Creek at 797 gpm, which amounts to 30% of an estimated average flow in the brook of 2,657 gpm (Exhibit G, page 13).

Note that baseflow in Crystal Spring Brook would further be reduced owing to the proposed pumping from two of the Fleischmanns wells to supply water for the western portion of the project, as discussed in Comment 3.0 below.

The Applicant claims that R1 is capable of sustaining a long-term irrigation pond replenishment rate of 57 gpm and well R2 is capable of sustaining a long-term, average daily, potable demand of 64 gpm without adversely impacting neighboring water supplies and surface water bodies" (Exhibit F, pages I and 13). Specifically, the DEIS claims that the proposed pumping will not affect flows in Birch Creek or any other surface water because the wells tap a confined aquifer with no connection to the surficial aquifer"(DEIS, page 3-63).

These claims on the long-term performance and impacts of the proposed pumping of R1 and R2 are based on Alphas interpretations of pumping tests and a projection (or rather extrapolation) of drawdowns obtained from a three-day (72-hour) pumping test into a 180-day period. Inherent in the projection are assumptions of 1) an unlimited extent of the bedrock aquifer and 2) bedrock aquifer storage as the sole source of water withdrawn from the pumping wells. These assumptions are equivalent to Alpha□s wording □without the positive effects of recharge or negative effects of a limited aquifer" (Exhibit F, page 13), which is necessary for the projection to be valid. However, proper evaluations of the pumping test data provided in Exhibits F, E, I, and H show that these assumption cannot satisfied, so Alpha□s projections of the long-term well performance and impacts are misleading for the following reasons:

First, the presence of negative effects is indicated by a change of slope on the drawdown versus logarithm of pumping time graphs after 200 to 300 minutes of pumping during all three tests conducted, including the simultaneous pumping tests at supply wells R1 and R2 (Exhibit F) and separate pumping tests at well R1 (Exhibit I) and at well R2 (Exhibit E).

Second, a 50-foot deep Residential Well #1 (Exhibit F, page 3), which is installed within unconsolidated deposits 675 ft north of pumping well R1, did show a drawdown response of 1.61 feet (Exhibit E, page 10) and 1.75 ft (Exhibit I, page 7) during pumping tests at R2 and R1, respectively, and during the simultaneous pumping at R1 and R2 (Exhibit F, page 4 and Table 8). The lowering of the water table in this overburden well indicates some recharge from the unconsolidated surficial deposits, thus contradicting the Applicant claim that □the wells tap a confined aquifer with no connection to the surficial aquifer (DEIS, page 3-63).□ However, the rate of such recharge was small in relation to the large pumping rates applied at the Rosenthal wells, as glacial deposits in the Pine Hill Lake area make poor aquifers.

Third, a poor recovery of water levels in the Rosenthal wells after cessation of the three-day test pumping indicates an overpumping condition that likely resulted in a partial dewatering of bedrock fractures and loss of the originally confined character of the aquifer due to unsustainable pumping rates. The water levels did not return to pretest levels in three days of recovery monitoring in any of the three pumping tests.

Fourth, drawdown-distance graphs provide another method of analyzing pumping test results (Driscoll, 1989) independently from the drawdown-time graphs provided by the DEIS. The drawdown versus distance graphs show how unrealistic the extent of the cone of depression would become if the Applicant-projected drawdown holds (as both types of graphs utilize the same assumptions regarding an unlimited aquifer extent and the absence of recharge). I have prepared drawdown-radial distance graphs (Attachment 3) for two of the 72-hour pumping tests for which drawdown data were available for Residential Well #4, which was used as an observation well. This 145-foot deep bedrock well, located 1,500 feet from pumping well R1, intersects the same transmissive/productive bedding fracture that was encountered during drilling of well R2 just below a depth of 180 feet. A direct hydraulic connection between the proposed supply wells and Residential Well #4 is confirmed by a large drawdown response of 9.91 feet measured in Residential Well #4 at the end of the 72-hour pumping in well R1 (Exhibit I, page 8, Table 11), and of 18.95 feet at the end of the 72-hour simultaneous pumping at R1 and R2 (Exhibit F, page 8, Table 13).

My drawdown-distance plots (Attachment 3) indicate that drawdown effects in the transmissive bedrock fracture were felt as far as 3,300 feet after three days of pumping at R1, and as far as 4,200 feet after three days of simultaneous pumping at R1 and R2. I also used the drawdown-distance plot for the R1 constant-rate pumping test to calculate values for aquifer transmissivity (1,360 gpd/ft) and storage coefficient (0.0001) based on standard hydraulic calculations (Driscoll, p.237-239). The low storage coefficient value obtained, which is already inflated by incorporating effects of a limited vertical leakage/recharge rate from the glacial deposits in the Birch Creek valley, is the principal reason for the propagation of drawdown effects over a large distance from the Rosenthal wells.

The lowest line, actually a logarithmic curve, in Attachment 3 represents a projected drawdown (or the cone of depression) after 180 days of simultaneous pumping at R1 and R2 with the same rates as during the three-day pumping test (represented by the middle line in Attachment 3). The projected drawdown curve was obtained by calculating drawdown after 180 days of pumping at a distance of 1,500 feet (i.e., at Residential Well #4) and then drawing a line parallel to the middle line in Attachment 3. The projected drawdown after 180 days would extend for a distance of more than 30,000 feet (or approximately 6 miles) from the Rosenthal wells.

However, the propagation of a cone of depression within such a large distance from the pumping wells will be disrupted by negative boundaries owing to a limited extent of the productive bedrock units. Specifically, the transmissive bedding fracture, which intersects the Rosenthal wells just below a depth of 180 feet, terminates some distance downstream of Birch Creek owing to combined effects of the eastward sloping streambed and the westerly dip of the fracture. The termination of this bedding fracture (due to its cropping out under unconsolidated deposits) is expected to occur within an approximate distance of one to two miles from the Rosenthal Wells, depending on the dip angle of the fracture, the thickness of unconsolidated deposits, and the streambed grade. This negative boundary was not encountered during the pumping tests conducted because projected drawdown effects during the 72-hour tests had not reached the one-mile radius (Attachment 3). A longer duration test is required to ascertain the effects of this boundary on drawdown and pumping rates. A longer duration test is also needed to assess pumping impacts of wells R1 and R2 on Pine Hill Water Company□s Station Road well and well PH-1, which are located approximately 6,000 feet and 7,400 feet, respectively, from well R1.

Contrary to DEIS claims, the above analysis of the pumping test data in the context of site-specific bedrock hydrogeologic framework indicates that the proposed withdrawal rates from wells R2 and R1 for potable and irrigation uses cannot be sustained over the 180-day period. A claim that available drawdown at well R2 exceeds, by 71 feet, the Applicant-projected drawdown of 163 feet after 180 days of simultaneous pumping (Exhibit F, page 13) disregards the fact that available drawdown in this bedrock well is determined by the elevation of the most productive fracture rather than the position of the pump intake. Once the water level drops below that elevation, the productivity of the fracture would decline. By adding a pre-pumping depth to water of approximately 25 feet (Exhibit E, Well Completion Log for R2) to the projected drawdown of 163 feet, one obtains a depth to the projected pumping water level of nearly 188 feet. This depth is already below the most productive fracture found in R2 at a depth of 186 feet (Exhibit E).

2.2 Pumping Impacts on Baseflow in Birch Creek

The proposed pumping at wells R1 and R2 will result in a reduced baseflow in Birch Creek through the combined effects of the following three mechanisms: 1) interception by the pumping wells of groundwater flow from the sides of the bedrock valley, which is the flow that would otherwise reach Birch Creek; 2) indirect downward leakage from the stream across the unconsolidated valley-fill deposits; and 3) direct leakage from Birch Creek into bedrock fractures at locations where such leakage is feasible. During dry weather months, the reduction in the Birch Creek baseflow would approach the pumping rates at wells R1 and R2.

The proposed pumping at R1 and R2 may also reduce baseflow in Lost Clove Brook, as the pumping influence would encompass large portions of the Lost Clove Brook drainage area.

2.3 Other Adverse Impacts of Pumping Not Addressed in the DEIS

Several substantial adverse impacts of the proposed use of wells R2 and R1 for potable and irrigation water supply have not been addressed, or even identified, in the DEIS.

1) Significant lowering of potentiometric water levels in the bedrock aquifer would occur over a large area, as demonstrated by pumping test data for Residential Well #4 and the drawdown-distance graphs. The proposed pumping is projected to lower water levels by as much as 45 to 50 feet within a half-mile radius from the Rosenthal wells, with lesser lowering throughout the entire study area (Attachment 3).

2) A number of residential or other bedrock supply wells operate within the area impacted by this lowering of potentiometric levels. Preliminary data indicate several private wells are located outside the Pine Hill Water Company supply area but within a 1.5-mile radius of the Rosenthal wells. These private wells will be most impacted by the proposed pumping.

3) The cumulative effects of water withdrawal at nearby pumping centers on well yield and drawdown interference should be evaluated, given the very large distance of pumping influence established for the Rosenthal wells (Attachment 3). The pumping centers of concern include the Rosenthal Wells; the Belleayre Mountain Ski Center wells, the Village of Fleischmanns wells #2 and #3; the Pine Hill Water Company wells; the Sewer Plant wells; and existing supply wells on the project sites (the □mid-road,□ Brisbane Mansion, the □pool□ and the □Janius East□)to be utilized to meet landscape irrigation and other needs. Any well interference analysis will show the bedrock aquifer in the study area would be overpumped as more and more supply wells compete for a limited bedrock groundwater resource during critical supply periods.

4) The proposed pumping may induce upward movement of saline water contaminating the fresh water aquifer. Saline water is known to occur in deeper fractures in valley-bottom and hillside areas of the Catskills (Heisig, 2002). There are some indications that more saline water occurs in

deeper fractures at the Emory Creek valley (see Comment 3.0), so the potential for exacerbating the salinity problems by the proposed pumping needs to be evaluated.

3.0 Availability and Impacts of Proposed Water Supply Sources - Wildacres Resort and Highmount Golf Club/Highmount Estates

The average potable water demand for the proposed Wildacres Resort is estimated at 76 gpm, after accounting for water saving devices. A peak water demand of 174 gpm is projected, including irrigation water demand (Exhibit D). The demand would be met by an excess capacity of the Village of Fleischmanns bedrock supply wells. Installation of a new supply well near existing well #3 is considered.

Results of limited short-term pumping tests conducted in wells #1 and #2, together with the measured physical parameter data for these wells, well #3, and surface water bodies, indicate that infiltration from Emory Brook is the principal source of water pumped from well #2 and a major source of discharge for well #3. As stated in Comments 1.1 and 3.2, the latter well is likely connected via bedding fractures with the Pine Hill Water Company wells in the Crystal Brook valley. Evidence of the induced water infiltration from Emory Brook includes the strong recharge effects apparent on the drawdown-time plots of pumping test data, the relatively rapid recovery after pumping, a cascading observed in well #2 at a depth of 37 feet, and the measured low electrical conductivity data in wells #2 and #3 (Exhibit D). Alpha's claims that wells #1 and #2 show "no indication of any surface water influence from Emory Brook"(Exhibit D, page 2 of letter to Mr. Dean Gitter), and that pumping from well #3 "does not affect Emory Brook discharge"(Ibidem) are not supported by the presented data.

It should be noted that electrical conductivity values for well #1 appears to indicate that more saline water is intercepted by deeper fractures in this well.

4.0 Stream and Spring Flow Measurement Data

4.1 Birch Creek

My analysis of spring and stream flow measurements provided in DEIS (Table 1A of Exhibit G) indicates that nearly all flow in Birch Creek during dry season months is sustained by groundwater entering the creek above the confluence of Birch Creek and Crystal Spring Brook. Alpha's streamflow measuring station "W" is located just below this confluence (Figure 2 in Exhibit G), and a USGS stream gauging station at Big Indian is located approximately two miles downstream from location W.

Comparison of flows reported for these two locations for five consecutive dry month measurements (July 28 through November 28, 2000) indicates that Birch Creek lost some of its flow within the two-mile segment in three measurements (Jul 28, Oct 26 and Nov 28), and gained some flow in two instances (Aug 28 and Sep 28). The largest loss of flow within this brook segment of 1,960 gpm (or 41%)on Nov 28 may be related to drawing water from the lake for snow making, but this explanation may not necessarily apply to the Oct 26, 2000 and Jul 28 dates, for which the loss of flow was 660 gpm and 78 gpm, respectively. The largest dry season gain of 510 gpm for the Aug 28 measurement represents only 13% of the flow measured below the confluence (location W), while a gain of 237 gpm on Sep 28, 2000 represents merely 11% of the flow at location W.

Even after accounting for the water diversion from Birch Creek into the snowmaking pond, the lower two-mile segment of the creek barely gains any flow during dry season months. The size of the drainage area associated with that creek segment (in relation to surface drainage area above location W) does not appear to explain the disproportionally low inflow from groundwater discharges into that segment. Poorer groundwater resources of the segment provide an alternative explanation. The proposed irrigation and potable supply wells R1 and R2 are located approximately halfway up that stretch of Birch Creek. As detailed in Comment 3.0, the results of pumping tests conducted in R1 and R2 reveal a limited rate of recharge, thus validating the alternative explanation. The proposed pumping in R1 and R2 during dry weather months at a combined rate of 128 gpm would worsen the loss of baseflow in that segment of Birch Creek by an amount approaching the combined pumping rate.

4.2 Crystal Spring Brook

Streamflow measurement data provided in Table 1A of Exhibit G indicate that the lower segment of Crystal Spring Brook was losing some of its flow during dry summer months of years 2000 and 2001. The loss occurred between measurement locations S (Crystal Spring Brook - below Station Rd. Spring; see Figure 2 in Exhibit G) and location U (Crystal Spring Brook - above Birch Creek), upon accounting for flow contribution from Balley Brook measured at location T. A negative value of the measured flow difference [U - (S + T)] indicates a loss of flow in the brook between locations S and U.

Based on the data in Table 1A, the largest summer loss of 224 gpm (or 21% of flow measured at location S) occurred on September 28, 2000. In percentage of streamflow, the largest loss of 33% occurred during the August 30, 2001, measurement. In absolute terms, the largest flow losses of 363 gpm and 278 gpm were recorded, respectively, for the December 2000 and January 2001 measurement dates.

The large flow losses in the brook during non-summer months appear to be caused by groundwater withdrawal at the Belleayre Mountain Ski Area and by installation of the Wildacres pool well in 1999 and the Janis East well in November 2000 (DEIS, page 3-63). These deep bedrock wells are located downdip of the losing stream segment and thus are likely to be hydraulically connected via transmissive bedding fractures with the Pine Hill Water Company wells. The loss of flow along the 0.5-mile long lower Crystal Brook segment likely represents an interbasin water transfer through a man-made combination of pumping from the new bedrock wells and flow short-circuiting along the long open-hole well conduits.

5.0 Recharge Areas to Springs - Relation to Headwater Streams and Wetlands

Springs present in the project area range from minor ephemeral springs to major high-yield springs that are used, or can be used, as water-supply sources. Such major springs in the Crystal Spring Brook area include the Railroad Spring, Bonnie View Springs, Silos A and B, and Depot Spring. Adequate mapping of actual recharge areas for these springs is a prerequisite for any reliable impact assessment related to the proposed development.
The DEIS arbitrarily assigned recharge areas for these major springs based on topographic features (Exhibit G, page 14 and Figure 7). Ridge crests and nearest ravines were assumed to define spring recharge (capture) area, as if groundwater flow pathways mimicked the rugged local topography. Such a crude methodology ignores the structural effects of the westward-dipping bedrock layers, including the role of a few transmissive bedding-plane fractures that function as thin aquifer units recharging the major contact-type springs.

In order to determine an actual recharge area for each major spring in the Crystal Spring Brook valley, the position (elevations) of each transmissive contact bed needs first to be traced on a topographic map, at least updip and sideways (along strike) of a given spring location. It will then become apparent that (1) the recharge areas for individual major springs are different than claimed and extend farther eastward than assumed on Figure 7 in Exhibit G;(2); these areas partially overlap, producing some vertical leakage; and (3) the DEIS assumption that ridge crests and headwater stream valleys define the recharge areas for the major springs is not valid.

Headwater streams that lose much of their base flow to groundwater, or even all of their flow at specific locations, function not as boundaries (as assumed on Figure 7 in Exhibit G) but rather as significant sources of additional recharge to groundwater and the springs at lower elevations. This is apparent from the descriptions of some tributary streams, unmapped drainages, and high-elevation wetlands provided in another section of the DEIS (pages 3-12 through 3-15). For example, during the Summer1999 Giggle Hollow lost its flow at some locations near the existing railroad trestle to reoccur at other locations (page 3-12). Some of the unmapped drainages never re-emerge, however, and are simply discharging to the groundwater"(page 3-14). A few of the drainages are associated with the mapped wetlands areas.

To assess the impacts of these types of interconnections between surface water and springs, and to monitor such impacts, the Applicant should be required to locate and define subsurface flow pathways between the contributing headwater streams, unmapped drainage with wetlands, and individual major springs used for water supply. This is relevant because the entire area to be developed within the eastern project portion is above an approximate elevation of 2,000 feet msl, while the major springs in the Crystal Spring Brook valley discharge below an approximate elevation of 1,700 feet msl. Thus, water quality in those springs can potentially be impacted by the proposed development.

6.0 Proposed Groundwater Quality Testing Program

The proposed monitoring program for nitrates and pesticides includes an existing supply well located just downhill of hole 11 of the Big Indian Country Club and known as the mid-road well (page 3-75 of DEIS). This bedrock well is 698 ft deep, with 40 feet of casing extending through 29 ft of hardpan (till). Given the long case-off overburden section, the very large depth of this bedrock well, and the dominant hydraulic role of bedding fractures and flow short-circuiting in long bedrock holes (discussed under Comment 1.1), the mid-road well is an extremely poor candidate for a monitoring well. Instead, a shallow overburden monitoring well or the nearest contact spring that captures flow from the uppermost transmissive bedrock fracture should be used.

The same critical comment applies to another bedrock well, 475-feet deep, known as the Rashid Well and proposed for monitoring of water quality at the Highmount Golf Course (p. 3-75).

7.0 References

Driscoll, F.G., 1989, Groundwater and Wells, Second edition. Published by Johnson Filtration Systems Inc., St. Paul, Minnesota.

Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970. Geologic map of New York: New York Museum and Science Service Map and Chart Series No.15, Hudson-Mohawk Sheet, 1:250,000 scale.

Fisher, D.W. et al., 1961. Geologic map of New York, Hudson-Mohawk Sheet, 1:250,000 scale.

Frimpter, M.H., 1972, Ground-water resources of Orange and Ulster Counties, New York: U.S. Geological Survey, Water-Supply Paper 1985.

Heisig, P.M., 2002, Wellbore short-circuits in a fractured-rock aquifer, Catskill Mountains, New York - management considerations [abs]: in Fractured-Rock Aquifers 2002, Denver, Colorado, 2002, Proceedings: National Ground Water Association, p. 177-178.

Michalski, A., and Britton, R., 1997. The role of bedding fractures in the hydrogeology of sedimentary bedrock - Evidence from the Newark Basin, New Jersey, Ground Water, vol. 35, no.2, March-April 1997.

Novakowski, K.S. and Lapcevic, P.A., 1988. Regional hydrogeology of the Silurian and Ordovician sedimentary rocks underlying Niagara Falls, Ontario, Canada: J. Hydrol., v.104, p. 212-236.

Reynolds, R.J., 2000, Hydrogeology of the Beaver Kill Basin in Sullivan, Delaware, and Ulster counties, New York. U.S. Geol. Survey Water-Resources Investigation Report 00-4034, Troy, New York.

Soren, J., 1963. The ground-water resources of Delaware County, New York: New York State Department of Conservation Bulletin GW-50.

Williams, J.H., and Conger, R.W., 1990, Preliminary delineation of water-bearing fractures intersected by open-hole bedrock wells: Ground Water Monitoring Review, Vol. 10, no. 4, p. 118-126.

HUDSON
VALLEY
CLIMATE
SERVICE

"Great Hudson Valley Weather Days"

1720 MORNINGVIEW DRIVE
YORKTOWN HEIGHTS, N.Y. 10598

DR. JEROME S. THALER: Climate Historian

January 29, 2004

To whom it may concern:

I have reviewed the reports on the precipitation regime in the Belleayre ski area section of the Catskills.

The six page report comparing precipitation for three rain gauges at Slide Mountain, Highmount and Belleayre gives a true picture of the varied character and effects of precipitation in the Catskills. Other local stations only confirm the conclusion that the Slide Mountain rain gauge amount is highly atypical of the region. An average annual precipitation of 60 inches, 150% greater than any other local gauges does not represent the region where about 40 inches is the rule. Any analysis based on this one gauge would be severely in error.

For additional supporting data, refer to *Catskill Weather*

Very truly,

Jerome S. Thaler

Trout Unlimited

Precipitation Data As A Basis For Calculating Water Budgets,
With Implications For Irrigation And Storm Water Management

Tables one through three show data from the National Weather Service Slide Mountain station, the National Weather Service Highmount station and the DEC Bureau of Air Quality Surveillance Belleayre Mountain station. Table four compares storms of six inches precipitation or more at Slide Mountain and Highmount. Also included are National Weather Service narrative accounts of five major storms. The two chapters' research on comparative precipitation is validated in a letter from Jerome S. Thaler, author of Catskill Weather [see enclosure 1].

The periods of record for the three weather stations are:

Slide Mountain daily records: 05/02/1948-01/14/2004
Belleayre Mountain annual totals: 1987-2003
Highmount daily records: 05/01/1948-12/31/1976

- The Slide Mountain record covers 53 years after the incomplete records for 1948 and 2004 are deducted. Slide Mountain is the highest peak in the Catskills at 4,180 feet, and of all weather stations in the Catskills the one on Slide records the highest annual precipitation (Thaler, 1996). The Slide Mountain station is 8.76 miles from the Highmount station and is at elevation 2,649.

- The Highmount record covers 28 years after the incomplete record for 1948 is deducted, and it stops in 1976. Highmount is – or was - at the base of Belleayre Mountain, on the divide between the Esopus and East Branch Delaware drainages, at elevation 1,841.

- Daily values for Belleayre Mountain commence on 1991 06 07. A communication from the DEC informs the two chapters that from 1987 until that date values were taken at irregular intervals of days or weeks. This means the 1987-1991 record is unreliable. Those years have been disregarded. The station is on the Mountain at elevation 2,000.

- The range of elevation for the proposed Belleayre Resort at Catskill Park is 2,000 – 2,700 feet.

- There was a National Weather Service volunteer station at Arkville, 6.93 miles from Highmount, at elevation 1,309.7. The period of record is from 1948 to1967. The station was then moved to a location 8.54 miles from Highmount, and data continue from this location to the present. Arkville data cover 53 years but were not included in this analysis. The DEIS mentions that, "Average annual precipitation measured at . . . Arkville is 38.47 inches" [Vol. 1, 3.4.1, p. 76.]

- As Slide Mountain and Highmount are volunteer stations, their records are incomplete. Two examples: A full month, 04.01.1959 – 04.30.1959 inclusive, is missing from the Highmount data; and three consecutive days, 08.06.1991 – 08.08.1991 inclusive, are missing from the Slide Mountain data. With only fourteen days missing over the entire 53-year period of record, Slide Mountain data are the more complete of the two sets.

- Missing data are entered in the Slide Mountain and Highmount records as –999. In setting up a spreadsheet for the Highmount data the two chapters substituted 0 for –999 so the computer could accurately total.

- As daily readings are taken at the same time each day, while the 24-hour storm used for storm water management calculations includes the most intense rainfall over any 24-hour period, the two kinds of measurement aren't side-by-side comparable. This caveat applies to table four, in which daily records are sifted to highlight large storms.

Discussion

Despite the limitations of the Highmount and Belleayre data, the two sets together suggest that data from Slide Mountain are a poor fit for Belleayre Mountain. In justifying the use of Slide Mountain data, the DEIS asserts that this station is "at a comparable elevation," to the project site, that "it is the closest" and that it is "in a similar physiographic location."[1] In fact, the Highmount and Belleayre stations are much closer, and the Belleayre station is not only at a comparable elevation but on the mountain. As to physiography, Belleayre Mountain is 750 feet lower than Slide Mountain and is surrounded by similar peak elevations, while Slide is the Catskills tallest and has five other high peaks of over 3,500 feet in a semicircle to its southeast and northeast. One would expect Slide Mountain weather to exhibit a pronounced orographic effect even for the region, and that expectation is verified by the data. Yearly totals for precipitation at the Slide Mountain station are considerably higher than at the two stations on or near Belleayre Mountain (in fact they higher than anywhere else in the Catskills), and Slide Mountain weather is more extreme. The thirty-year average of yearly totals for Slide Mountain, shown in the first table (copied and pasted from the DEIS), is 60.24 inches. The average of yearly totals for Belleayre is 42.59 inches, for Highmount 42.98 inches. Averaging these two yields 42.78 inches, fully 17.26 inches, or 28.62 percent, less than Slide Mountain.

Use of Slide Mountain data as a basis for calculating water budgets in Appendices 19 and 19A is suspect. By making more precipitation available for replenishment of groundwater sources than is the case in fact, these data skew the result, and in the developer's favor. With 28 percent less water available for percolation, the question is whether predicted groundwater withdrawals for the two resort complexes will lower the water table, contrary to what the DEIS asserts. As lowered base flows would irreparably harm the aquatic biota of Birch Creek, Lost Clove Brook, Emory Brook and their tributaries, over-estimating precipitation by so large an amount is a significant failing of the DEIS.

Elsewhere the DEIS discusses replenishment of the irrigation ponds for the golf courses. Again the 60.24 inch Slide Mountain number is cited and defended, in terms identical to that of the water budgets,[2] and the claim is made that, "direct precipitation input to the 3.5 acre irrigation ponds, less the expected evaporation losses, will be approximately 3.8 million gallons per year, on average." The further – and critical – claim is that this contribution from runoff will reduce demands on proposed irrigation well Rosenthal no.1, adjacent to Birch Creek. As annual average precipitation for Belleayre Mountain is roughly 28% less than for Slide Mountain, 3.8 million gallons is perhaps optimistic. If so, Rosenthal well no.1 will have to be pumped harder to make up the shortfall, to keep the Big Indian golf course green in dry weather. The two reasons why this is important are indicated below, in part 4, under Hydrogeology. They are, (1) there isn't enough water in the aquifer, and (2) pumping the Rosenthal wells will take water from Birch Creek.

Turning to the implications for storm water management, the construction and operation phase storm water management plans in Appendices 9, 9A, 10 and 10A reference the design ten-year storm of six inches of precipitation in 24 hours. Proposed control structures will be sized to successfully moderate runoff during such an event. But Slide Mountain numbers, applied to Belleayre Mountain, predict substantial detention basin overflows, both during and after construction. Slide Mountain data show 12 storms of 6 inches of precipitation or more, including the massive 15.11 inch rainfall of 10.15.55 – 10.17.55. And Slide Mountain data register large storms at intervals of less than eight years, the projected time needed to complete the development. The 6.62-inch rainfall of 07.10.52 was followed less than four months later, between 11.20.52 and 11.23.52, by a rainfall of 8.33 inches, and the double hurricane of 10.15.55 – 10.17.55 was preceded only two months earlier by an impressive rainfall of 10.59 inches.

If Slide Mountain numbers apply to the water budgets, they apply to storm water management – with an unacceptable risk of overflow or failure of detention basins containing thousands of cubic feet of silty water and situated upslope from trout spawning streams. If Slide Mountain numbers don't apply to storm water management, then a lower number for annual rainfall must be adopted in the water budgets, reducing rates of percolation to groundwater sources, which suggests dry-condition reductions of base flow, harmful to aquatic life. The DEIS contains a major discrepancy between two methodologies referencing two different sets of numbers.

One more weather-related comment: Accounts from the National Weather Service included below attest to the severe weather and aftermath of same experienced in eastern New York State, including the Catskill Mountains. The DEIS describes the geology and geography of Belleayre Mountain in terms generally applicable to the Catskills: Exposed bedrock or shallow soils over bedrock and hardpan at higher elevations, outcrops at sudden changes in elevation, glacial till at lower elevations, and steep slopes of 10 - 30% percent or more dropping abruptly to deeply incised water courses and streams. This topography and this geology do not bode well should a major storm strike Belleayre Mountain during or at any time after construction.

Conclusions

It is the position of the two chapters that the SEQRE process won't be complete until:

- Belleayre Mountain precipitation is more scrupulously defined.
- Precipitation data for the water budgets are consistent with those for the storm water management plans.
- Extreme conditions are modeled in the water budgets, especially in respect to droughts.
- The water budgets are peer-reviewed
- Irrigation demands and sources are re-done with more realistic numbers

It is further the position of the two chapters that the potential for violent runoff from higher elevations to valley floors during extreme storms makes Catskill Mountaintops fundamentally unsuited to large-scale development of any kind.

Precipitation Table
One

TABLE 3
Slide Mountain Precipitation: January 2000 through December 2000

Belleayre Resort
Alpha Project No. 00109

STATION: SLIDE MOUNTAIN STATE: NY ID: 307799
LATITUDE: 42.02 deg LONGITUDE: -74.42 deg ELEVATION: 2649 ft

Day of Month	2000											
	January-00	February-00	March-00	April-00	May-00	June-00	July-00	August-00	September-00	October-00	November-00	December-00
1	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.01
2	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.06	0.52	0.00	0.00	0.00
3	0.01	0.00	0.09	0.00	0.00	0.50	0.00	0.07	0.06	0.00	0.00	0.01
4	0.02	0.10	0.00	1.18	0.00	0.00	0.50	0.06	0.05	0.02	0.00	0.00
5	0.41	0.00	0.00	0.28	0.04	0.10	0.00	0.00	0.03	0.18	0.01	0.00
6	0.00	0.01	0.00	0.00	0.06	0.42	0.00	0.00	0.00	1.18	0.01	0.01
7	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.54	0.00	0.00	0.00	0.00
8	0.03	0.02	0.02	ND	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.07
9	0.00	0.00	0.00	0.87	0.02	0.00	0.00	0.16	0.00	0.03	0.00	0.04
10	0.03	0.00	0.60	0.09	0.29	0.00	0.05	0.02	0.60	0.00	0.64	0.00
11	0.76	0.12	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.02	0.22	0.02
12	0.04	0.01	1.59	0.13	0.28	1.28	0.00	1.76	0.03	0.00	0.05	0.20
13	0.27	0.00	0.04	0.00	0.38	ND	0.00	0.13	2.05	0.00	0.00	0.00
14	0.18	1.06	0.00	0.00	0.53	0.33	0.00	0.01	0.00	0.00	0.02	0.65
15	0.00	0.33	0.03	0.00	0.00	0.02	2.06	0.59	0.17	0.00	0.69	0.01
16	0.00	0.07	0.00	0.00	0.00	0.00	3.85	0.40	0.01	0.00	0.01	0.00
17	0.05	0.02	0.76	0.00	0.00	0.03	0.04	0.00	0.00	0.19	0.00	3.42
18	0.00	0.00	0.03	0.66	0.17	ND	0.00	0.00	0.00	0.44	0.00	1.98
19	0.00	0.75	0.00	0.02	0.47	0.42	0.00	0.01	0.00	0.63	0.00	0.00
20	0.06	0.01	0.00	0.00	0.70	0.00	0.00	0.00	0.16	0.00	0.00	0.20
21	0.15	0.06	0.00	0.28	0.21	0.00	0.00	0.00	0.00	0.00	0.14	0.00
22	0.00	0.00	0.00	0.97	0.05	0.70	0.12	0.00	0.01	0.00	0.00	0.00
23	0.00	0.00	0.00	0.43	0.29	ND	0.00	0.00	0.00	0.00	0.00	0.04
24	0.00	0.00	0.00	0.10	0.97	0.02	0.00	0.98	0.12	0.00	0.00	0.00
25	0.00	0.04	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.01
26	1.04	0.60	0.07	0.00	0.26	0.66	0.00	0.00	0.10	0.00	0.24	0.00
27	0.02	0.00	0.00	0.05	0.00	0.07	0.77	0.00	0.32	0.00	0.40	0.01
28	0.00	0.48	1.50	0.00	0.00	0.07	0.09	0.00	0.00	0.00	0.00	0.01
29	0.00	0.02	0.01	0.00	0.01	0.01	0.10	0.21	0.01	0.00	0.01	0.02
30	0.00		0.11	0.06	0.00	0.17	0.64	0.02	0.00	0.00	0.21	0.08
31	0.93		0.01		0.00		0.22	0.01		0.00		1.25
Monthly Total	4.01	3.62	4.87	5.12	5.75	8.23	8.42	5.11	4.24	2.69	2.65	8.04
30-yr Avg	4.61	4.36	5.07	5.29	5.75	5.1	4.7	4.91	4.72	4.72	5	5.11

Total Precipitation Year 2000 = 62.75"
30-yr Avg. Total Yearly Precip. = 60.24"

ND = No Data
All measurements recorded in inches

Precipitation Table Two: Belleayre Annual Total Inches

~~Belleayre Mt. 87~~	~~39.89~~	Belleayre Mt. 96	50.72
~~Belleayre Mt. 88~~	~~33.06~~	Belleayre Mt. 97	34.02
~~Belleayre Mt. 89~~	~~40.47~~	Belleayre Mt. 98	39.7
~~Belleayre Mt. 90~~	~~43.65~~	Belleayre Mt. 99	44.02
~~Belleayre Mt. 91~~	~~32.46~~	Belleayre Mt. 00	51.68
		Belleayre Mt. 01	32.95
Belleayre Mt. 92	41.57	Belleayre Mt. 02	48.23
Belleayre Mt. 93	38.94	Belleayre Mt. 03	49.83
Belleayre Mt. 94	39.9		
Belleayre Mt. 95	39.56	Belleayre averaged	42.59

Precipitation Table Three: Highmount Annual Total Inches

1949	40.79
1950	49.42
1951	51.4
1952	48.13
1953	45.42
1954	49.23
1955	50.62
1956	41.9
1957	34.89
1958	48.41
1959	40.02
1060	49.21
1961	36.76
1962	38.04
1963	39.37
1964	32.59
1065	31.89
1966	35.83
1967	38.55
1968	42.32
1969	44.42
1970	37.24
1971	39.77
1972	45.45
1973	58.3
1974	46.65
1975	43.39
1976	43.57
Highmount averaged	42.98

Precipitation Table Four

Slide Mountain 6"+Storms		Highmount 6"+Storms	
date	inches	date	inches
1948 12 30-1949 01 01	8.92	1955 10 15 - 1955 10 17	8.42
1952 07 10	6.62	1973 06 29 - 1973 07 01	7.06
1952 11 20-1952 11 23	8.33		
1955 08 13-1955 08 14	10.59		
1955 10 15-1955 10 17	15.11		
1960 09 12-1960 09 14	7.07		
1963 11 06-1963 11 08	9.01		
1972 06 22-1972 06 24	10.42		
1979 09 06 -1979 09 07	6.40		
1985 09 27-1985 09 28	6.84		
1987 04 05	6.64		
1998 05 10-1998 05 12	7.94		

Extreme Weather In The Catskills: National Weather Service narratives.[iii]

August 1955 - Back-to-back hurricanes Connie and Diane struck the region following a rather severe drought so their effects were greatly reduced by the existing extremely dry conditions. On August 12, 15 inches of rain at Slide Mountain brought the Esopus Creek only up to 12 feet. Five days later, on August 17, hurricane Diane came right into the Hudson valley, which resulted in the worst flood disaster in the Lower Hudson Valley of New York and in the State of Connecticut. The village of Ellenville was nearly washed off the map, while the riverfront in Kingston was under nearly four feet of water.

October 1955 - Severe Flood on the Schoharie Creek, caused by a slow-moving coastal storm with 16 to 18 inches of rain over the Tannersville area and devastation in the Schoharie Valley.

September 1975 - Hurricane Eloise, caused significant (not record breaking) flooding on the Susquehanna and parts of Catskills.

March 1980 - "The Great Catskill Toilet Flush" with around 10 inches of rain on nearly bare and frozen ground which led to rapidly developing and severe floods on Schoharie, Catskill, and Esopus creeks.

January 1996 - Major flood event throughout the region as a result of rapid meltdown of snowpack along with two to four inches of rain. Record flooding on Schoharie Creek and significant floods on Mohawk River at Schenectady, and on the Hudson at Albany (15.5 ft - greatest since New Years 1949).

[1] "Climatological data indicate that the Crystal Spring Brook drainage basin receives more annual precipitation on average than the rest of the upper Esopus Creek drainage basin. Significant variations in the amount of total precipitation occur throughout the Catskills due to orographic effects. Precipitation at the Slide Mountain Station (NOAA Station ID 307799) is likely to be more similar to the project area than any other station since it is the closest, is at a comparable elevation and is in a similar physiographic setting." (Vol. 7, Appendix 19, 2.2.2, p. 8)

[2] "In the preceding analysis natural pond replenishment by precipitation and also replenishment by stormwater control contribution have not been considered. These two factors will serve to further reduce the demands placed on the proposed irrigation well. Local meteorological data collected at Slide Mountain and summarized for the project area indicates that on average there are 60.24 inches of precipitation for the year. Average annual pan evaporation for the area is 20.5 inches. Based on these data there is a net difference of 39.74 inches of precipitation. Direct precipitation input to the 3.5 acre ponds, less the expected evaporation losses, will be approximately 3.8 million gallons per year, on average. Climatological data indicate that the Crystal Spring Brook drainage basin receives more annual precipitation on average than the rest of the upper Esopus Creek drainage basin. Significant variations in the amount of total precipitation occur throughout the Catskills due to orographic effects caused by the mountainous nature of the geography. Daily precipitation measured at Slide Mountain (NOAA Station ID 307799) is likely to be more similar to the project area than any other station since it is the closest, is at a comparable elevation and is in a similar physiographic setting." (Vol. 1, 3.3.2B, pp. 3.65 - 3.66) (NOTE: The claim that the Crystal Spring Brook drainage receives more precipitation is not supported by any data in the DEIS.)

[iii] Webpage, National Weather Service Albany Office, Past Storms, "Greatest Floods Of The Past 150 Years in New York and Western New England."

HydroQuest

Paul A. Rubin
P.O. Box 387
Stone Ridge, N.Y. 12484
845-255-5203
hydroquest@yahoo.com

October 3, 2003

Mr. Alexander F. Ciesluk, Jr.
NYS DEC Region 3
21 South Putt Corners Rd.
New Paltz, New York 12561-1696

RE: Pine Hill Water Supply; Town of Shandaken

Dear Mr. Ciesluk,

This letter is submitted on behalf of the Catskill Heritage Alliance in the matter of Crossroads Ventures LLC's proposal to use the Silo A Spring in Pine Hill as a backup water supply for their Belleayre Resort at Catskill Park. I have 22 years of specialized expertise in both surface water and groundwater hydrology. My curriculum vitae is attached.

Respectfully, we wish to recommend that the Department of Environmental Conservation request Crossroads Ventures to remove the Silo A Spring from consideration as a backup water supply for the Big Indian Plateau component of their proposed resort. Historically, this spring has been integral in providing sufficient water for Pine Hill during times of drought. The Silo A Spring was integrated into the Pine Hill water supply system to provide additional water supply during periods of drought, including those more severe than the one the Applicant refers to that occurred in 2001. The proposed removal of the Silo A Spring from the Pine Hill water supply system will jeopardize the integrity of the water supply system, is likely to limit future growth in Pine Hill, and simply does not make sense hydrologically from a water supply perspective.

The attached November 11, 2002 affidavit was prepared, but not submitted, in anticipation of an adjudicatory hearing requested by the Pine Hill Water District Coalition and others in reference to a permit application (WSA 10,181; DEC Permit Number 3-515-00365/00001) submitted on September 12, 2002, by the Pine Hill Water Company under the ownership of Dean Gitter. This affidavit addresses the serious hydrologic issues associated with any reduction in water availability to the hamlet of Pine Hill. The Department of Environmental Conservation declined to conduct that hearing, and that decision was upheld during litigation, with the court ruling that consideration of these issues was more appropriately raised in the context of the SEQRA review and the permitting process associated with the proposed Belleayre Resort Project submitted by Crossroads Ventures for review by the DEC.

The Applicant has identified and tested a primary water supply in their Rosenthal #2 well. Rather than jeopardize the water supply of Pine Hill homeowners and commercial businesses both now and in the future, we would like you to request the Applicant to locate a different backup water supply. The Applicant succeeded in locating the Rosenthal #2 well and is fully capable of locating a different backup water supply than the Silo A Spring.

Review of the Applicant's December 2, 2002 *Surface Water and Groundwater Assessment* report (pp. 1-19) reveals that 1) the Silo A Spring is not capable of continuously meeting the requirements of the Ten States Standards during periods of drought, and 2) the Applicant's comparison of flow between Crystal Spring Brook and the Allaben USGS gauging station is inappropriate.

The Applicant's assumption (p. 13) that the Crystal Spring Brook drainage basin is typical of the Esopus Creek at Allaben is in error. In an effort to show that the Silo A Spring will continue to flow during drought conditions, the Applicant compares the drought flow of Crystal Spring Brook to that of the Esopus Creek at Allaben. The Applicant reports that the Crystal Spring Brook drainage basin, which includes Silo A Spring, is approximately 2.54 mi^2 in extent. The Applicant's Figure 7 reveals that the Silo A Spring sub-basin is a substantial percentage of this 2.54 mi^2 basin that Pine Hill has historically relied upon for their water supply. The watershed tributary to the Allaben gauging station is 63.7 mi^2 in extent. Having conducted geologic mapping and stream flow measurements throughout the Esopus basin for many years, I can state with confidence that geologic and hydrologic factors associated with the Allaben valley bottom setting vs. the headwater reaches of Birch Creek are significantly different (e.g., basin size, soil/sediment thickness, hydraulic gradient).

In the absence of long-term stream flow data for Crystal Spring Brook, the Applicant's basin-to-basin comparison method of assessing likely low flow conditions and potential water availability is reasonable. However, a comparison of this nature is best conducted for similar headwater tributaries with small catchment basins. Ideally, basin-to-basin comparisons should be conducted for basins of similar size. Reference to the USGS's web site readily provides such information for both basins of similar size (i.e., Panther Mountain, Hollow Tree Brook, Beaver Kill) and somewhat larger (and less geologically similar) basins in the Esopus drainage (see Table 1). These records, even though some are of limited duration, clearly show record low flows far below that required to use the Silo A Spring as a backup water supply when compared to an Applicant-determined minimum required Silo A Spring discharge of 0.14 cfs for a basin size of less 2.54 mi^2. It should be noted that other stream discharge values are present in the USGS data that are also far below the Applicant's 10.19 cfs Allaben equivalent discharge for their respective basin sizes, and that they often remained low or dry for extended periods of time (e.g., see attached Panther Mtn. tributary data - 2 pages). Further basin-to-basin comparisons with NYC Department of Environmental Protection stream gauging records specific to Esopus basin headwater tributaries are also likely to show that headwater tributary stream flows decrease markedly during dry periods.

Table 1: Esopus Tributary USGS Discharge Data:

Esopus Tributary	USGS Station #	Period of Record	Basin Size (mi^2)	Lowest Recorded Q (cfs)
Beaver Kill	01362465	7/27/00-9/30/02	0.98	0.00
Panther Mtn	01362192	10/01/01-9/30/02	1.54	0.00
Hollow Tree Bk.	01362342	10/01/97-9/30/02	1.95	0.17
Birch Ck.	013621955	10/01/98-9/30/02	12.5	1.9
Bush Kill	01363382	8/11/00-9/30/02	16.2	2.2
Little Beaver Kill	01362497	10/01/97-9/30/02	16.5	0.15

Stony Clove	01362380	2/01/07-9/30/02	31.5	4.0

The danger of relying on the Silo A Spring as a backup water supply for the Crossroads Ventures resort project (vs. as an important and integral add-on component of Pine Hill's water supply) is further accented even when using the Applicant's Allaben USGS gauging station data. The Applicant reviewed the USGS's Esopus Creek historical discharge data through November, 2001 and found that the data *"indicates that monthly, mean, daily discharge dropped below the threshold flow rate indicator of 10.19 cfs (4571 gpm) for 12 months out of the 458 months since measurements began in 1963."* The Applicant determined that the average potable daily water demand for Big Indian Plateau is 64 gpm (0.14 cfs), which correlates to an Esopus Creek flow at Allaben of 4,571 gpm (10.19 cfs). This value of 10.19 cfs was determined by the Applicant to be a threshold indicator discharge value below which there may not be enough discharge from Silo A Spring to meet the potable demand for Big Indian Plateau.

Importantly, mean daily discharge values at the Allaben USGS gauging station often fall below the Applicant-determined low discharge threshold value of 12.19 cfs (i.e., for portions of 28 years of the 39 years of record from 1963-2002). The lowest recorded mean daily discharge value for the Allaben gauging station is 3.3. cfs. The Applicant's means of assessing periods of potential water supply deficit based on monthly, mean, daily discharge data for the Allaben gaging station vs. mean daily discharge data does not provide a representative picture of the duration and actual number of times daily water needs historically dropped below 10.19 cfs. The Applicant's monthly, mean, daily discharge approach minimizes the number of months with below Applicant determined cut-off discharge values (i.e., below their 12.19 cfs value). This approach minimizes the measured low daily discharge values and occurs as a result of averaging both high and low mean daily discharge values together to achieve a monthly, mean, daily discharge value above the Applicant's threshold discharge value of 12.19 cfs. Looked at from a different vantage, the total number of months (not individual days) with one or more days with discharge values less than 12.19 cfs at Allaben are 73 vs. the Applicant's 12. This 73 number equates to about 15.6 percent of all the months of record that have one or more days with less than the required discharge recommended for backup water supply purposes (based on USGS records from 10/01/63 to 9/30/02). Thus, the Silo A Spring does not continuously meet the Ten States Standards as a backup water supply for the proposed Crossroads Ventures project, as it does <u>not</u> *"equal or exceed the average day demand with the largest producing well out of service."* During those times when the backup water supply may be most needed, sufficient quantity is not likely to be available. An alternate backup water supply should be required.

The use of the Silo A Spring by the Applicant during times of drought conditions, when it may be needed by the hamlet of Pine Hill, may have a significant adverse impact on the Pine Hill water supply. We are submitting these materials now because the issues raised are relevant to the current application. Essentially the question is whether Silo A (the Crystal Spring), which was used historically to supply the hamlet of Pine Hill with water during periods of drought, can be permitted to another entity (Crossroads Ventures) for use outside the hamlet of Pine Hill. The Applicant documents (p. 13-14) that the discharge from the Silo A Spring during the recent study (not during a drought emergency situation) comprised up to 37 percent of the total stream flow measured in Crystal Spring Brook. The materials contained in the attached affidavit demonstrate that the record established in regard to Water Supply Permit Number 3-515-00365/000 (to remove Silo A Spring) from the Water Supply Permit of the Pine Hill Water Company) and submitted on January 15, 2002 (to use Silo A as a water supply for the proposed Belleayre Resort) is insufficient to demonstrate compliance with governing law and regulations. As detailed in the affidavit, the adequacy of water sources now owned by the Town of Shandaken for the Pine Hill Water District has not been demonstrated under drought emergency and disaster conditions, nor has it been demonstrated under sustained groundwater pumping conditions. Other materials submitted to the DEC by the Catskill Heritage Alliance question the accuracy of the data used to calculate expected current and future water needs.

We request that the DEC not issue a determination of completeness until data necessary to evaluate these substantive issues has been provided. We strongly recommend that the Department of Environmental Conservation require the Applicant to seek an alternate backup water supply other than the Silo A Spring for the reasons addressed in this letter and the attached affidavit. The Applicant's hydrologic consultants are fully capable of locating an alternate backup water supply. Thank you for your attention to this matter.

Sincerely,

Paul A. Rubin
HydroQuest

STATE OF NEW YORK

SUPREME COURT: COUNTY OF ULSTER

In the Matter of the Application of THE PINE HILL WATER DISTRICT COALITION (PHWDC), RICHARD SCHAEDLE, ADAM NAGY, for himself and as Chairman of the CATSKILL HERITAGE ALLIANCE,

AND THE NATIONAL RESOURCES DEFENSE COUNCIL, INC.

Plaintiffs/Petitioners,

For Judgment pursuant to Article 78 of the Civil Practice Law and Rules

-against- **Affidavit**

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, ERIN M. CROTTY, as Commissioner of the New York State Department of Environmental Conservation, MARC MORAN, as Regional Director, Region 3, New York State Department of Environmental Conservation, ALEXANDER F. CIESLUK, JR., as Deputy Permit Administrator, Region 3, New York State Department of Environmental Conservation,

AND PINE HILL WATER COMPANY,

AND SILK ROAD ORGANIZATION NY, INC.,

AND CROSSROADS VENTURES, LLC,

AND THE TOWN OF SHANDAKEN

Defendants/Respondents

STATE OF NEW YORK)
)
COUNTY OF ULSTER)

Paul A. Rubin, being duly sworn, deposes and says:

1) I am a hydrogeologist with twenty-one years of professional experience. I make this affidavit on

behalf of the Petitioners, Pine Hill Water District Coalition and Richard Schaedle, Chair of the Pine Hill Water District Coalition, in support of previous submissions by the Pine Hill Water District Coalition, documenting that substantive and significant comments were provided in the public comment process that may have resulted in denial of the permit application or the imposition of significant conditions on the hamlet of Pine Hill's water supply system. A public hearing on the application should have been held relative to the Pine Hill Water Company's water supply permit modification. Concerns raised by the Plaintiffs clearly indicate that partial disassembly of the historic water district is likely to A) adversely impact the growth potential of Pine Hill because the application fails to demonstrate that the proposed water supply is adequate, and B) potentially result in insufficient water availability for existing water users during dry conditions. Hydrologically, in terms of water resource availability and future land use, it is not scientifically sound to remove portions of Pine Hill's water supply system. This affidavit accents some of the key issues previously raised. In addition, this affidavit documents that the Defendant did not adequately evaluate material submitted by the Pine Hill Water Company in support of their proposed water supply permit modification.

2) I received a B.A. degree from the State University of New York at Albany in 1977 and a M.A. degree in geology with a specialty in hydrogeology from the State University of New York at New Paltz, New York in May, 1983. My educational background and professional experience are more fully set forth in my curriculum vitae, which is attached hereto.

3) Within the broad field of hydrology, I have specialized expertise in both surface water and

groundwater hydrology. I have conducted detailed assessments of groundwater flow systems, springs, streams, and watersheds. This work has been conducted for both professional characterizations and as part of my own personal research. I have published papers and led all day field trips relating to this work at professional conferences (see curriculum vitae).

4) In evaluating the issues related to the proposed water supply permit modification, I reviewed material prepared by the Pine Hill Water Company and the Plaintiffs. I visited the water supply area on November 3, 2002 to observe the physical relationship between the various components of the water supply system. These components include the physical topographic and geologic setting, bedrock exposures, springs, wells, and reservoirs. One obvious conclusion based on this site visit and material submitted by the Plaintiffs is that, through time, Pine Hill water demands required the addition and integration of a series springs and reservoirs to meet existing water needs. If this were not the case, there would only be one spring area connected to a single reservoir. There are three main spring and reservoir areas that have historically been connected. It is highly unusual to remove a significant portion of any Town's water supply system, as is called for in this permit modification.

5) Newkirk, Marx, and Goldstein of the National Resources Defense Council, on behalf of the Pine Hill Water District Coalition, in their letter of June 26, 2002, raise the substantive and significant issue of future water needs (e.g., p. 2 and 4). A key, and unreasonable, premise underlying the Pine Hill Water Company's water supply permit modification is the assumption that Pine Hill's water needs will always be what they are today. Pine Hill should retain the potential to, at a minimum, revitalize the hamlet's infrastructure to previous maximum water usage. The Defendant should have required the Applicant to fully address both present and future water needs. Accordingly, historic maximum water usage figures should be increased in keeping with water demands of modern plumbing systems and societal water use. At this time, revitalization within Pine Hill is occurring. Similarly, regular upgrades, expansions, and new

programs at nearby Belleayre Ski Center are likely to increase ecotourism and Pine Hill water demands.

6) The Defendant's acceptance of the proposed water supply permit modification without a public hearing will irreparably harm Pine Hill's ability to expand to or exceed its historic residential and commercial capacity because a significant portion of the historic water supply is targeted for private ownership and usage. The removal of any portion of Pine Hill's water supply system will almost certainly limit the hamlet of Pine Hill's future growth. The Plaintiffs have provided written comments addressing this issue. Similarly, the Pine Hill Water District Coalition has raised substantive and significant issues relative to the reliability, accuracy, and omissions of Applicant provided flow measurements that may alter the quantity of available groundwater (e.g., PHWDC letter of 6/18/02).

7) The Defendant, in their review of the proposed water supply permit modification, has examined and considered the Applicant's determination that there will be sufficient water for continued Pine Hill water usage after the Applicant removes the Silo A and Crystal Spring water sources from the hamlet's water supply system for private commercial use. Silo A was constructed to behead Crystal Spring and is the second most productive spring within the hamlet of Pine Hill's water district. The term "modification" does not adequately reflect the intent of the permit application - that is to remove a significant portion of the hamlet's water supply system for private usage and personal gain.

8) Newkirk, Marx, and Goldstein, in their letter of June 26, 2002, raise the substantive and significant issue of water availability under "dry" conditions (e.g., p. 3). The Defendant, in determining that a permit hearing was not necessary, relied on the project Applicant's statement that:

> *"Alpha Geoscience continued to monitor Bonnie View Springs throughout the calendar year 2001. During that time, a drought watch and later warning was issued by DEC ... Throughout the monitoring period, Bonnie View Springs continued to be the water source for the PHWC and continued to produce more than adequate quantity of water."*

As pointed out in material submitted with the application, a drought warning is only the second of four sequentially more severe drought levels that may be issued. The drought advisory rating system goes from watch, warning, emergency, to disaster. The Defendant, in reviewing the Applicant's material, should have recognized that it was not prudent to accept the adequacy of Bonnie View Springs based on a stated one-year, second level, drought condition. Statements such as that provided by the Applicant above required rigorous assessment of historic drought conditions by the Applicant and by DEC. It is scientifically unsound to remove a significant component of the hamlet of Pine Hill's water supply from use based on limited assessment.

9) As noted in 8) above, Newkirk, Marx, and Goldstein, in their letter of June 26, 2002, raise the substantive and significant issue of water availability under "dry" conditions. The Defendant should have recognized that reference to one-year of water data during a second level drought advisory was not sufficient to demonstrate the adequacy of the Bonnie View Springs during level three or level four drought conditions. In the absence of nearby long-term aquifer data, precipitation records can be used to provide a reasonable approximation of likely groundwater/spring conditions since precipitation recharges the groundwater flow system. Instead of relying on a limited, non-rigorous, statement of spring water adequacy, the Defendant should have reviewed readily available historic precipitation data or required the Applicant to do so. Figure 1, for example, examines fifty-four years of precipitation data collected at the Arkville weather station, situated some seven miles west of Pine Hill. This weather station is at an elevation of 1310 feet vs. the similar elevation of Bonnie View Springs at about 1550 ft. msl. This plot shows the accumulated monthly precipitation for the years 2000 and 2001 compared to the monthly median precipitation from 1948 to present and the year 1965, the lowest precipitation year since 1948.

10) Figure 1 shows that the accumulated precipitation in 2001 for the Pine Hill vicinity was not appreciably less than the amount that is constructed from the historical median. In fact, at the end of September 2001 the accumulation was nearly identical to the median (28.87 inches vs. the accumulated median of 28.45). Furthermore, the year 2001 started with a significant moisture surplus since the year 2000 experienced the second highest total precipitation in the fifty-four year record. Both 1999 and 1998 were also above normal for the period starting in 1948. Thus the actual measurements do not support significant drought conditions for 2001. For perspective, the plot for 1965 illustrates how a truly low precipitation period appears on the graph. It is entirely possible that level three or level four drought conditions (such as probably occurred in 1965) may significantly reduce the water availability from Bonnie View Springs. In this likely event, Pine Hill may wish to supplement Bonnie View Spring water with Silo A water. Conditions such as this are undoubtedly why the hamlet of Pine Hill has multiple water sources. They may not always be needed, but when they are - they're critical. Clearly, substantiative and significant issues were not taken into account by the Defendant which, if ignored, will result in the imposition of significant conditions on the Pine Hill water supply.

11) The Defendant has raised the issue of potentially insufficient water resources should any alteration of the historic Pine Hill water supply system occur. Newkirk, Marx, and Goldstein, in their letter of June 26, 2002, comment on this substantive and significant issue. The Defendant, in reviewing the Applicant's data, relied on the Applicant's data analysis and conclusions. One such area includes the assessment of the aquifer tapped by the Station Road Well. This well is proposed in lieu of the Silo A/Crystal Spring water source as Mr. Gitter plans to use the Silo A water for his Crossroads Ventures project. The Station Road Well was pumped with a discharge of 39 gallons per minute for 79.25 hours (3.3 days). During this test, the aquifer was drawn down some 112.9 feet and had only 80 feet of remaining aquifer left before the aquifer would have been largely dewatered. At the termination of the test, the aquifer's specific capacity (i.e., yield per unit of drawdown) was steadily decreasing and the aquifer was being exploited further and further outward from the pumping well in an effort to deliver water to the Station Road Well at a rate equal to the discharge/pumping rate. Equilibrium conditions (i.e., when recharge within the zone of influence of the pumping well equals the rate of discharge of the well) were not achieved, thus this proposed water source is not capable of sustaining a discharge of 39 gpm. This should have been evident to the Defendant from the Applicant's report, from the steeply plummeting semi-log time drawdown graphs of the pumping well, and from the drawdown data collected in observation wells (e.g., PH-1 and PH-2) during the pumping test. The Applicant's observation well drawdown data, collected from wells PH-1 and PH-2 at a distance of some 1,800 feet from the pumping well, (as illustrated in Figure 2) graphically shows the data the Defendant evaluated. If the aquifer could provide adequate recharge water to maintain the Station Road Well's discharge of 39 gpm, the latter part of the two plots, through which lines of best fit are drawn, would be horizontal, not steeply sloping. In the absence of additional aquifer test data and aquifer testing during severe drought conditions, these steep slopes throw any long-term yield projections into question. The Applicant's data indicates that the aquifer tapped by the Station Road Well will not be able to continuously provide groundwater at 39 gpm. The aquifer never achieved a hydrogeologically stable equilibrium condition.

12) The Defendant should also have noted that the aquifer was slow to recover to its initial static water level (approximately 6 days), thus it may not be capable of providing a reliable, long-term, continuous water source - especially when it will be needed most. This already questionable hydrogeologic situation may be further compounded when considering that the higher yielding portions of fractures that provide groundwater typically anneal or become narrower with depth. Thus, reduced water availability commonly associated with increasingly deeper aquifer recharge may result in aquifer dewatering in a much shorter time than projected by the Applicant. The Defendant's evaluation of this data should have signaled the need for further hydrogeologic analysis, particularly in light of the Applicant's plan to remove a key water source from the Pine Hill water supply system. The Station Road Well may not be a reasonable substitute backup water source for the Silo A/Crystal Spring water source that the hamlet of Pine Hill has historically relied upon. The recharge area tributary to Silo A may be significantly larger than the recharge area tributary to the Station Road Well. There is no hydrologically or economically sound reason to

remove Silo A water from the hamlet of Pine Hill's water distribution system. There is no benefit to the hamlet in doing this, only the risk of jeopardizing the viability of the present and future water supply system. *I recommend against any significant water withdrawal from wells and springs within the limits of the historic Pine Hill water supply system by outside users (other than private homeowner wells) because potentially overlapping aquifer recharge areas may result in the loss of control of much needed groundwater resources.* These substantive and significant issues were raised during the comment process and should be addressed in a public hearing.

13) In reviewing the Pine Hill Water Company's permit modification, the Defendant was aware that aquifer testing had documented that the Station Road Well, Pine Hill well # 1, Pine Hill well # 2, and a private well were hydraulically connected. These hydraulically connected water sources that share a common recharge area have not been fully evaluated relative to their combined yield. Drawing from one may significantly impact the other's yield potential. While this situation was discussed, it is incomplete and requires further hydrogeologic assessment. I recommend that a public adjudicatory hearing format be used to fully assess the potential groundwater availability and related impacts from wells simultaneously tapping the same aquifer. This substantive and significant issue was addressed by Newkirk, Marx, and Goldstein in their letter of June 26, 2002 (p. 3).

Conclusions

14) Substantive and significant issues were raised during the comment process. The Defendant's decision to not grant a public hearing has placed the hamlet of Pine Hill's current and future water needs (and growth potential) in jeopardy. In approving the Pine Hill Water Company's proposed water supply permit modification without the benefit of a public hearing, the Defendant effectively and unilaterally determined that 1) removal of the hamlet's Silo B and Crystal Spring water source would still allow for a sufficient water supply for the present-day Pine Hill hamlet in times of drought, 2) that it is a sound hydrogeologic practice to subdivide a Town's water resources for private commercial gain, and 3) that little or no future growth should occur in the hamlet of Pine Hill (as a key water source would be removed from the hamlet's control). Yet, clearly, Pine Hill's historic water demands required the addition and integration of a series springs and reservoirs to meet drought and high demand water needs. The Defendant is not in a position to certify that, once granted, the requested permit modification will leave the hamlet of Pine Hill with an adequate water supply capable of meeting present and future water demands during periods of drought.

15) In my professional judgment, the Defendant failed to adequately address substantive and significant issues relating to the application as raised by members of the public. Resolution of the issues raised may have resulted in denial of the permit. Furthermore, the application is much further reaching than simply a permit modification. If approved, this "modification" has a high likelihood of thwarting future residential, commercial, and economic growth in Pine Hill. Permit approval will result in Pine Hill relinquishing control of a key component of the hamlet's water supply system. A hearing should have been held. It is not advisable to separate out any portion of a hamlet's water supply system, especially when considering that a second private party will then have control for private, commercial, gain. I recommend that the court require the Defendant to A) either hold an adjudicatory public hearing on the permit application, or B) review all material submitted by all parties to date and deny the application based on its being hydrologically unsound.

PAUL A. RUBIN
Hydrogeologist
HydroQuest

Sworn to before me this

11th day of November, 2002.

Notary Public

COMMUNITY
CONSULTING
SERVICES INC.

March 31, 2004

Mr. Alexander Ciesluk, Jr.
Permit Administration
New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, NY 12561-1696

Re Crossroads Ventures, LLP
The Belleayre Resort at Catskill Park
NYSDEC No. 3-9903-00059/0001
Comments on Traffic Impact

Dear Mr. Ciesluk:

I am submitting these comments as a licensed professional engineer who has prepared traffic impact statements of far greater complexity than that prepared for the above referenced project. These comments were prepared as a pro bono service of Community Consulting Services for organizations representing communities along Route 28. CCS is a not for profit organization that provides technical assistance to community leaders so that they may be more informed participants in the environmental decision-making process. Although I have a home in Margaretville and will be affected by whatever is built for the Belleayre Resort, my analysis was undertaken not in opposition to the project; rather to ascertain whether in my field of expertise, the draft EIS presents the adequate and accurate disclosure of impacts required by the State Environmental Quality Review Act. It does not.

I am enclosing several documents which summarize my findings regarding the traffic impact of the Belleayre Resort at Catskill Park.

1. Traffic Impacts of the Belleayre Resort at Catskill Park Preliminary Comments on Belleayre Resort at Catskill Park DEIS, January 10, 2004: The finding is that the DEIS for the project both understates the magnitude of existing traffic conditions as well as the background traffic growth which is likely to occur by approximately 40%, or by approximately 400 p.m. peak hour trips than reported. In addition, it ignores the effects of expanding the Belleayre Ski Resort, which would add an additional estimated 229 p.m. peak hour trips, and under reports the impact of the project itself by more than half, adding approximately 600 additional p.m. peak hour vehicle trips not accounted for in the DEIS (see Table 5, attached).

2. Addendum re Shuttle Bus Operations. A supplemental analysis of the realistic operations of a shuttle service demonstrates that were shuttle trips fully accounted for, the trips from Big Indian would add at least 100 more trips in the p.m. peak hour to the 600 resort-generated trips estimated above, and that if the shuttle is not successful in competing with the much shorter drive time, there would be many more trips than projected, resulting in a virtual doubling of p.m. peak hour traffic on Route 28 east of County Road 49 (see Table 5, attached).

3. Transit Use in Resort Villages in North America and Europe (attached) summarizes research undertaken by Konheim & Ketcham as part of a 1998 Lake Placid Transportation Study for the NYS Department of Transportation for Creighton Manning Associates and The LA Group, the preparers of the

175 Pacific Street
Brooklyn, NY 11201
phone 718.330.0550
fax 718.330.0582
www.communityconsulting.org

DEIS. It is a mystery why the proposed traffic management program for the Belleayre Resort, which relies on an effective shuttle bus system, did not draw on this information to provide more confidence in assertions of the DEIS that the systems would serve 80% of the ski trips and 60% of the golf trips.

All of these findings are supported by the more extensive analyses, attached.

We would be happy to discuss any of the enclosed with DEC staff should any questions arise. I can be reached in Margaretville at 845-586-1506 or in Brooklyn at 719-330-0550.

Very truly yours,

Brian T. Ketcham, P.E.
Executive Director

Attachments

cc:
Governor George E. Pataki
Commissioner Erin M. Crotty
Commissioner Christopher O. Ward
Senator Charles E. Schumer
Senator Hillary Rodham Clinton
Attorney General Eliot Spitzer

COMMUNITY CONSULTING SERVICES INC.

175 Pacific Street
Brooklyn, NY 11201
phone 718.330.0550
fax 718.330.0582
www.communityconsulting.org

Traffic Impacts of the Belleayre Resort at Catskill Park
Preliminary Comments on Belleayre Resort at Catskill Park DEIS
January 10, 2004
Brian T. Ketcham, P.E., Executive Director

The traffic analysis for the Belleayre Resort at Catskill Park reports that, under what it asserts are worst case conditions, that is, during a Martin Luther King, Jr. weekend, the project would produce no more than 3 or 4 more auto trips per minute along Route 28, that the only impacted area is the entrance to the Belleayre Mountain Ski Center at County Road 49A and that any impact can be mitigated with simple geometric changes and a new signal operating only during the afternoon of the ski season at the Rt. 28/CR 49A intersection. While I concur that a traffic signal could accommodate significant increases of traffic at the entry to the ski area, the underlying analysis fails to accurately consider many factors that increase vehicle volumes along the corridor, slowing the travel of all traffic. Altogether, the addition of another 600 to 800 vehicles in the peak hour to volumes that are much higher than assumed when construction is completed will increase travel time for westbound vehicles in the morning peak period and eastbound vehicles in the eastbound direction on Route 28 by between 5 and 10 minutes. The bottom line is that traffic along Route 28 will grow by about 50% by 2014 without the project and by 80% with Resort traffic during Saturday peak hour conditions from current volumes.

The underreporting of future conditions is due to selection of 2008 as the year of the traffic analysis in the DEIS; 2008 is only two years into the 8-year construction schedule reported throughout the DEIS. If 2014, the year of completion were used for the traffic analysis, even though full occupancy will not be achieved for some years thereafter, the growth in background traffic on Route 28 would be twice as great as assumed. This is due to 14 rather than 8 years of 2% annual growth of traffic on Route 28 and a 40% increase of peak hour trips due to the planned expansion of the skier capacity of Belleayre Mountain from 5,000 skiers to 8,000 skiers a day by 2010 (assuming 30% of new skiers stay at the Belleayre Resort). The Resort DEIS assumes a growth rate of just 8% for the ski area from 2000 to 2008.

Although the DEIS follows standard procedure to examine the worst-case impact, it significantly underestimates factors that result in understating future conditions. Since these conditions are more attributable to the traffic generated by the ski center than by the Resort, there needs to be a much better depiction of travel patterns attributable to the Resort. The DEIS contains no information about Resort trips that occur at any other time than the peak hours of ski arrivals and departures. What, for example, is the effect of Resort trips on Sunday late afternoon travel on Route 28, even on the Thruway? What is the effect of Resort trips on Saturday mornings in Margaretville? These real world concerns are never mentioned in the DEIS. Even though the incremental effect of the Resort on ski traffic may not be very large, the relative effects of the overall Resort activity when they are greatest must be assessed. The DEIS traffic analysis must be revised for 2014 to reflect more recent conditions, a reasonable assessment of growth at Belleayre Mountain and impacts of non-ski trips from the Resort. Details follow.

1. The effects of added activity at Belleayre will occur more often than once a year. The basis of the traffic analysis, Martin Luther King, Jr. weekend may not be the worst case as claimed. Table 1 reports the number of skiers at Belleayre Mountain during the 2002-2003 ski year for the 18 highest attendance days during this period. Martin Luther King, Jr.'s birthday, January 20th, is the lowest attendance shown for this period. Moreover, attendance over Martin Luther King, Jr. weekend is exceeded by five other days over the 2002-2003 period. In fact, the number of days on which skier attendance approaches 5,000 can easily exceed a dozen during a year with good snow conditions. And this number has been growing as Belleayre Mountain expands.

2. The major fallacy of the DEIS is that it does not account for the dramatic growth in skiers at Belleayre Mountain since traffic counts were taken. Figure 1 presents this growth in both tabular format and graphically and shows that for the 2002-2003 season, as of March 2, attendance was up 50% from that which occurred during the 1999-2000 ski season. This growth is not reflected in the DEIS traffic analysis nor is the growth accounted for that may occur as a result of the expansion program underway at Belleayre Mountain which would accommodate an increase in the peak day ski visits from approximately 5,000 to 8,000 (a 60% increase).

3. If the Resort were the source of approximately 900 ski visits (half the 1,800 visitors on a peak ski weekend) of this increase to the Resort (the DEIS does not report this number but it appears to assume about 600 ski visits from the Resort), that leaves another 2,100 trips, a further 42% increase from present levels, to be accounted for. The Belleayre Resort DEIS assumes a Belleayre Mountain growth rate of just 1% per year or 8% total by 2008, the year of their traffic analysis, from their 2000 baseline. And, this does not account for the current short term growth of 50% over three years mentioned above. Clearly, the DEIS does not account for future winter conditions estimated with the full build out of Belleayre Mountain

4. To assess the impact of the actual growth of Belleayre Mountain, CCS took turning movement counts at three of the intersections reported in the DEIS. The results are shown in Table 2. Overall, traffic volumes for both the morning and evening peak hours at Route 28 and County Road 49A were 20% above those reported on in the DEIS. Certain ski area turning movements were as much as 34% greater in 2003 than reported for the Martin Luther King, Jr. Saturday reported in the DEIS. Counts taken at Route 28 and County Road 47 were 12 to 16% higher than reported in the DEIS. We took counts on February 15, 2003. A comparison of ski visitor volumes in Table 1 for Feb. 15th shows that 3,970 skiers attended Belleayre Mountain on that date, more than 20% below the peak attendance that occurred during the 2002-2003 season. The conclusion is that traffic along Route 28 could be as much as 40% greater than reported in the DEIS for baseline conditions in 2000 and, by 2008, much greater than the 27% growth in volume reported in the DEIS for No Build conditions.

5. The consequence is that intersections along Route 28, especially that at County Road 49A, may have little available capacity for Belleayre Resort traffic in 2008 or worse, in 2014, when the Belleayre Resort is more likely to be completed and fully occupied.

6. Project generated trips are likely to higher than reported in the DEIS. While the DEIS asserts its trip forecasts per housing unit are conservative, it utilizes median ITE trip generation rates, not worst case or 90th percentile rates, which would be representative of a very successful project, one that would fill its time shares 310 days a year. Its predictions are based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, which presents average conditions as well as providing minimum and maximum rates observed in the field. Tables 3 and 4 compare the full range of rates for each category of land use assumed in the DEIS (except for the golf courses). Overall, the DEIS assumes trips are about 40% of the maximum rates reported by ITE. In fact, the number of trips for each land use type is closer to the lowest rates reported by ITE, not the much higher rates representative of a very successful resort project.

   For example, for the 168 lodging units proposed for the Belleayre Resort, ITE land use category 260 was selected for the analysis. This category is for recreational homes. However, the data is based on only two surveys, one of a 700 unit community and the other, a 1,500 unit community. The result is a huge range in peak hour travel, ranging, for example, from 44 trips to 286 trips for a Saturday peak hour. The DEIS reports 60 vehicle trips, very close to the low range reported by ITE. If the Resort is as successful as projected, surely the numbers of trips that can be expected are closer to the upper limits of what has been observed. The same is true for each land use category included in the DEIS: hotel rooms, club memberships and single family homes.

   The result is that it is very likely the DEIS under reports the total number of trips that could be made by occupants of the proposed Resort. According to ITE data, the number of trips could be as many as double what has been reported. Thus, instead of the reported 415 vehicular trips for a Saturday

PM peak hour during a typical ski season, 900 trips could be made for a busy ski season assuming 85% occupancy at the Belleayre Resort. This discrepancy must be addressed and corrected in the FEIS.

7. The assignment of trips to each direction along Route 28 in the DEIS show virtually all trips (97%) coming from and going to the east of County Route 49A. This is not documented in any way, e.g., a comparison to zip code data from ski ticket purchasers. Although the high proportion of trips to the east may be conservative in overstating the impacts of Resort trips, it overlooks any trips that will be made to Fleishmans or Margaretville for any purpose, shopping, sight seeing, etc., as assumed in the Economic Impact section of the DEIS. It is worth noting that the traffic counts early in 2003 show about a quarter of the skiers arriving at Belleayre Mountain come from the west in the morning. However, fully 40% leaving the Mountain in the evening peak hour turn left and return to the west. If significantly more than 3% of Resort generated trips will move to and from the west, even during ski season, there is no consideration of their impacts, e.g., on Bridge and Main Streets in Margaretville.

8. The DEIS asserts that 80% of all Resort trips to and from the Belleayre Mountain Ski Center will be by shuttle bus. However, the assignment of trips does not appear to reflect any shuttle trips. For example, few trips originating at Wildacres or Big Indian Plateau near Pine Ridge are evident in the trip assignments. While 15 additional (Resort) vehicles enter the upper driveway to the ski area from the east none exit. Moreover, none enter or leave the lower driveway where all shuttle buses are proposed to service (see response to Comment 16, page 12 of comment section). Presumably shuttle buses operating on 10 minute headways will return to Wildacres and Big Indian Plateau during the morning peak hour. Where is the shuttle in "shuttle bus"? Or do all shuttle buses simply layover at the ski area filling parking spaces? Something is screwed up here. And where are the 20% of trips not by shuttle bus?

9. Most important, the description of shuttle service is sketchy. There are allusions to five trips per hour, but no hours of service, routes, who could use it, if it is free and whether there are any parking constraints to lend confidence to the assumed usage. This is ironic since the two firms that prepared the DEIS have in their files an analysis of all elements of shuttle services in ski resorts, prepared for them by my consulting firm for a NYS Department of Transportation study of revitalizing the widely spread out resort area at Lake Placid. I suggest this information, which I append, be used to prescribe conditions for operational approvals.

10. Finally, what about Resort guests doing some exploration such as a trip to Windham or any of the other nearby ski areas to sample an alternative ski area, something frequent guests are likely to do with some regularity? Surely some small proportion of trips would make this journey. Nor is there any accounting of off-site non-ski trips.

Qualifications of the Preparer

Community Consulting Services is a not-for-profit organization that provides technical services to community leaders seeking sustainable development. CCS has no position on the proposed Belleayre Resort. These comments are submitted in keeping with the mission of CCS to promote informed decisions on environmental and transportation issues. Brian Ketcham is a Professional Engineer licensed by the State of New York, who as a New York City environmental official initiated comprehensive traffic management and vehicle emissions controls. Brian has more than 25 years experience in preparing and analyzing environmental and traffic impact assessments, primarily for State agencies, and developing innovative transportation strategies, as his consulting firm did for the principal preparers of the DEIS on a revitalization plan for Lake Placid, NY. He is a part-time resident of Margaretville, NY who uses Belleayre facilities year round and can be reached at 845-586-1506 or 718-330-0550 or at btk@communityconsulting.org. See www.communityconsulting.org.

TABLE 1

Peak Skier Attendance, 2002-2003 Season
Belleayre Mountain

Friday	12/27/2002	4,943
Saturday	12/28/2002	4,870
Sunday	12/29/2002	4,588
Monday	12/30/2002	4,620
Saturday	01/04/2003	3,359
Sunday	01/05/2003	4,309
Saturday	01/11/2003	4,910
Sunday	01/12/2003	3,629
Saturday	01/18/2003	4,687
Sunday	01/19/2003	4,552
Monday (1)	01/20/2003	2,928
Saturday	01/25/2003	3,691
Saturday	02/01/2003	3,866
Sunday	02/02/2003	3,408
Saturday	02/08/2003	4,925
Saturday	02/15/2003	3,970
Sunday	02/16/2003	3,986
Saturday	03/01/2003	5,188

(1) Martin Luther King, Jr.'s Birthday

Source: Belleayre Mountain Ski Center
Community Consulting Services (1/1/04)

FIGURE 1

Belleayre Mountain Attendance

Seasonal Totals as of March 2

Season	Total	Growth Yr-to-Yr	Growth Cummulative
02-03	149,621	24%	51%
01-02	120,852	1%	22%
00-01	119,718	20%	20%
99-00	99,370		

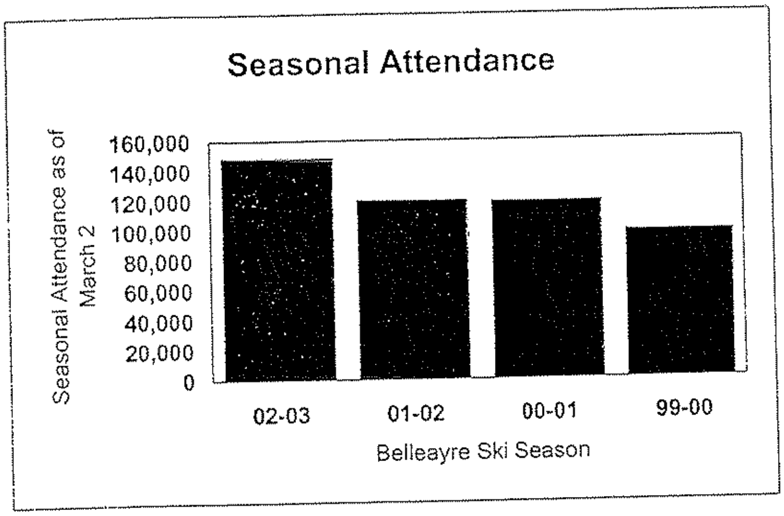


TABLE 2

COMPARISON OF TRAFFIC VOLUMES REPORTED BY CME FOR THE BELLEAYRE RESORT WITH COUNTS TAKEN FOR THE CATSKILL CENTER ON SAT. FEB. 15, 2003

COUNTY RD. 49A AT ROUTE 28 (Entrance to Bellearye Ski Resort)

	AM PEAK HOUR			PM PEAK HOUR		
	EIS 2000	Feb. 15 03 Ct.	% Diff.	EIS 2000	Feb. 15 03 Ct.	% Diff.
NB Rt. 28						
Left	270	355	31%	38	49	29%
Through	87	77	-11%	138	143	4%
Right	1	0		2	4	
SB Rt. 28						
Left	2	0		8	3	
Through	50	59	18%	113	131	16%
Right	85	99	16%	28	20	-29%
EB CR 49A						
Left	13	32	146%	243	278	14%
Through	1	1		4	6	
Right	27	27	0%	391	523	34%
WB CR 49A						
Left	1	1		5	3	
Through	7	1	-86%	0	1	
Right	0	0		3	4	
TOTALS	544	652	20%	973	1165	20%

COUNTY RD. 47 AT ROUTE 28

	AM PEAK HOUR			PM PEAK HOUR		
	EIS 2000	Feb. 15 03 Ct.	% Diff.	EIS 2000	Feb. 15 03 Ct.	% Diff.
NB Rt. 28						
Left	15	9	-40%	19	22	16%
Through	268	299	12%	162	174	7%
Right	0	1		0	2	
SB Rt. 28						
Left	0	2		4	11	
Through	62	64	3%	389	468	20%
Right	9	9		45	55	22%
EB Rt. 47						
Left	22	27	23%	17	7	
Through	0	1		3	1	
Right	9	13	44%	21	20	-5%
WB Rt. 47						
Left	0	1		0	1	
Through	2	3		0	5	
Right	3	8		3	4	
TOTALS	390	437	12%	663	770	16%

COMMUNITY CONSULTING SERVICES (2/23/03)

TABLE 3: TRIP GENERATION CHARACTERISTICS - WINTER SKI SEASON

ITE DATA BASE

ITE CODE	PROJECT TYPE		UNITS	WEEKDAY	SATURDAY	AM PK HR	PM PK HR	SAT PK HR
				VEHICLE TRIPS PER DWELLING UNIT				
TRIP GENERATION RATES								
DEIS	Lodging Units	Typical (1)	168	3.16	3.07	0.29	0.26	0.36
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
(1) Based on median day of operation								
260	Recreational Homes	Average	168	3.16	3.07	0.3	0.31	0.36
	(rates based on 2 studies,	Low	168	3	2.99	0.21	0.25	0.26
	700 to 1,500 du's surveyed)	High	168	3.24	3.23	1.33	1.33	1.7
		Dir. Split				49% in/51% out	44% in/56% out	48% in/52% out
NUMBER OF TRIPS POTENTIALLY GENERATED								
DEIS	Lodging Units	Typical (1)	168	531	516	49	44	60
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
260	Recreational Homes	Average	168	531	516	50	52	60
	(rates based on 2 studies,	Low	168	504	502	35	42	44
	700 to 1,500 du's surveyed)	High	168	544	543	223	223	286
		Directional Split				49% in/51% out	44% in/56% out	48% in/52% out
	WORST CASE				ENTER	109	98	137
					LEAVE	114	125	149

Source: Institute of Transportation Engineers, "Trip Generation", 6th Edition, Volume 1

Note that Land Use 233, LuxuryCondominium/Townhouse, has double the average trip generation rate at does Recreational Homes.

Community Consulting Services (1/10/04)

ITE CODE	PROJECT TYPE		UNITS	WEEKDAY	SATURDAY	AM PK HR	PM PK HR	SAT PK HR
				VEHICLE TRIPS PER DWELLING UNIT				
TRIP GENERATION RATES								
DEIS	Club Memberships	Typical (1)	183	3.16	3.07	0.3	0.26	0.365
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
(1) Based on median day of operation								
260	Recreational Homes	Average	183	3.16	3.07	0.3	0.31	0.36
	(rates based on 2 studies,	Low	183	3	2.99	0.21	0.25	0.26
	700 to 1,500 du's surveyed)	High	183	3.24	3.23	1.33	1.33	1.7
		Dir. Split				49% in/51% out	44% in/56% out	48% in/52% out
NUMBER OF TRIPS POTENTIALLY GENERATED								
DEIS	Club Memberships	Typical (1)	183	578	562	55	48	67
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
260	Recreational Homes	Average	183	578	562	55	57	66
	(rates based on 2 studies,	Low	183	549	547	38	46	48
	700 to 1,500 du's surveyed)	High	183	593	591	243	243	311
		Directional Split				49% in/51% out	44% in/56% out	48% in/52% out
	WORST CASE				ENTER	119	107	149
					LEAVE	124	136	162

Source: Institute of Transportation Engineers, "Trip Generation", 6th Edition, Volume 1

Community Consulting Services (1/10/04)

TABLE 4: TRIP GENERATION CHARACTERISTICS - WINTER SKI SEASON, CONTINUED
ITE DATA BASE

				VEHICLE TRIPS PER DWELLING UNIT				
ITE CODE	PROJECT TYPE		UNITS	WEEKDAY	SATURDAY	AM PK HR	PM PK HR	SAT PK HR
TRIP GENERATION RATES								
DEIS	Hotel Rooms	Typical (1)	400	8.92	10.8	0.72	0.53	0.56
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
(1) Based on median day of operation								
310	Hotel	Average	400	8.92	10.8	0.64	0.74	0.87
	(based on multiple studies)	Low	400	4.14	7.07	0.27	0.25	0.65
		High	400	17.44	13.86	1.51	1.23	1.05
	Rates are for occupied rooms.	Dir. Split				55% in/45% out	57% in/43% out	
NUMBER OF TRIPS POTENTIALLY GENERATED								
DEIS	Hotel Rooms	Typical (1)	400	3,568	4,320	288	212	224
	(DEIS Appendix 25, p. 20, 21)	Dir. Split						
310	Hotel	Average	400	3,568	4,320	256	296	348
	(based on multiple studies)	Low	400	1,656	2,828	108	100	260
		High	400	6,976	5,544	604	492	420
		Directional Split				55% in/45% out	57% in/43% out	57% in/43% out
	WORST CASE				ENTER	332	280	239
					LEAVE	272	212	181

Source: Institute of Transportation Engineers, "Trip Generation", 6th Edition, Volume 1
Community Consulting Services (1/10/04)

				VEHICLE TRIPS PER DWELLING UNIT				
ITE CODE	PROJECT TYPE		UNITS	WEEKDAY	SATURDAY	AM PK HR	PM PK HR	SAT PK HR
TRIP GENERATION RATES								
DEIS	Single Family Homes	Typical (1)	21	9.57	10.09	0.8	1.2	0.9
	(DEIS Appendix 25, p. 22)	Dir. Split						
(1) Based on median day of operation								
210	Single-Family Detached Housing	Average	21	9.57	10.09	0.77	1.02	0.94
	(rates based on 348 studies)	Low	21	4.31	5.32	0.33	0.42	0.5
		High	21	21.85	14.72	2.27	2.98	1.75
		Dir. Split				25% in/75% out	64% in/36% out	54% in/46% out
NUMBER OF TRIPS POTENTIALLY GENERATED								
DEIS	Single Family Homes	Typical (1)	21	201	212	17	25	19
	(DEIS Appendix 25, p. 22)	Dir. Split						
210	Single-Family Detached Housing	Average	21	201	212	16	21	20
	(rates based on 348 studies)	Low	21	91	112	7	9	11
		High	21	459	309	48	63	37
		Directional Split				25% in/75% out	64% in/36% out	54% in/46% out
	WORST CASE				ENTER	12	40	20
					LEAVE	36	23	17

Source: Institute of Transportation Engineers, "Trip Generation", 6th Edition, Volume 1
Assuming these homes will have many guests driving multiple vehicles, rates should likely be on the high side.
Community Consulting Services (1/10/04)

WORST CASE TOTALS FOR SKI SEASON vs DEIS ASSERTIONS FOR "TYPICAL" CONDITIONS

		VEHICLE TRIPS PER DWELLING UNIT					
ITE CODE	PROJECT TYPE	UNITS	WEEKDAY	SATURDAY	AM PK HR	PM PK HR	SAT PK HR
	TOTAL TRIPS REPORTED IN DEIS FOR TYPICAL CONDITIONS						
	(Table B-1 for peak hour trips)	ENTER	4,878	5,609	222	194	222
		LEAVE			193	208	193
			Possible number of people at Resort on busy ski weekend.				
	WORST CASE TOTALS (CCS ESTIMATE ASSUMING 85% OCCUPANCY)						
		ENTER	7,286	5,939	487	447	464
		LEAVE			464	421	432
			Ratio Total Trips		2.3	2.2	2.2

TABLE 5

ESTIMATE OF GROWTH IN TRAFFIC ALONG ROUTE 28
(Total, both directions, east of Belleayre Mountain)

	AM	% Increase from 2000	PM	% Increase from 2000
DEIS				
Baseline (1/15/00)	436		687	
Est. 2008 (+27%)	550		870	
Project Impact	202		192	
Total 2008	752	72%	1062	55%

	AM	% Increase from 2000	PM	% Increase from 2000
BKE Estimate				
Baseline (2/15/03)	519	19%	853	24%
Est. 2014 (+2%/yr)	126		208	
Impact of Belleayre Mountain Growth	153		229	
Project Impact (1)	404		384	
Total 2014 (% incr. from observed 2003)	1202	132%	1674	96%
Actual growth in traffic	450		612	
% Increase from DEIS	60%		58%	

(1) Assumed to be double that reported in DEIS based on CCS analysis of ITE Trip Generation Manual (see related tables).
Community Consulting Services (1/11/04)

KONHEIM & KETCHAM
175 Pacific Street, Brooklyn, New York 11201 (718) 330-0550 FAX (718) 330-0582

TRANSIT USE IN RESORT VILLAGES IN NORTH AMERICA AND EUROPE

Research by Konheim & Ketcham for
Creighton Manning Associates and The LA Group
Lake Placid Transportation Study, 1998
NYS Department of Transportation.

Successful resort villages in North America and Europe have been developed on the principal that an important element of creating a *carefree* atmosphere is a *car-free* environment, or one far less dependent on cars than the workaday world of most vacationers. To Americans, even New Yorkers outside the metropolitan area, using transit is a bit of a novelty, something they do in Paris, London, some airports, and even Disneyland--as part of being on vacation from their cars as well as their jobs.

Resorts around the world are learning that cars take up space that is much more valuable for shops, restaurants and people-gathering spaces; that traffic congestion wastes too much valuable recreational time; and that pollution and noise erode the natural setting that travelers, especially outdoor enthusiasts, seek. Many North American resort towns such as Vail, CO; Whistler, BC; and Mont Tremblant, Quebec have been designed in the tradition of an Alpine Village, concentrating lodging, shopping, eating and recreation within comfortable and pleasant walking distances. These resorts have been designed on a human scale, with heavy restrictions on cars.

In turn, many of these resorts have created public spaces that are quiet, pleasant and people oriented - something most Americans are not used to, but enjoy thoroughly. While Belleayre does not have its various destinations concentrated within walking distance, it has pockets of activity and trip generators that can be serviced by a transit system. A transit system that takes people where they want to go, easily and relatively quickly, coupled with traffic calming and provisions for cyclists and cross country skiers, can enhance the Alpine feel of Belleayre and its appeal to car-weary weekenders.

Characteristics of Successful Transit in Mountain Resort Villages

Successful transit systems have been implemented in many ski resort towns. In most of North America, however, dependence on the private automobile and low density development patterns put transit at a disadvantage when compared to the convenience, speed, cost, and flexibility of a private car. Many European resorts have successful transit systems, but most of these resorts are compact, near the ski slopes, and have a train station with fast, frequent service in or near the town. In North American resorts, people only use transit when using their cars is inconvenient, expensive, or impossible.

Some major destination resorts, such as Vail, Aspen, and Whistler, have extensive, well used transit systems. In most of these cases, the success of the transit system is dependent on severely curtailing the use and usefulness of automobiles through parking restrictions; pedestrian-only zones; and clean, frequent, and extensive transit service. Additionally, many western resorts are more compact because they were designed specifically as resorts, mimicking European villages.

Many successful transit systems have some of the following characteristics:

- Low out of pocket cost to users. Totally free service, free service within certain zones, or free service to those staying at certain hotels or those who have purchased lift tickets. It appears that people are more likely to take transit in a resort setting when they don't have to pay a direct fare. At virtually all resorts, direct fare collection is a relatively small proportion of the system's total revenue. Mount Snow has already eclipsed Stowe's ridership in less than one year, primarily because Mt. Snow does not charge a fare.
- Financing sources. Sources of funding vary from resort to resort. Some sources of funds include: federal and state grants (FHWA, Dept. of Agriculture, CMAQ), hotel, restaurant, sales, and lift ticket taxes; direct grants or contributions from hotels, condominium complexes, stores, or ski operators; fares; revenue from parking or parking violations; direct investment by large ski area developer (e.g. Intrawest, Vail Associates, etc.). The transit service near Mt. Snow was established as a non-profit corporation.
- Extensive service. At transit-friendly resorts such as Vail and Whistler, buses can take people almost anywhere they need to go, at almost any time. Service starts early--around 6:00am--for employees coming to the resort area for work. At larger systems, peak bus frequencies are 10 minutes or less. In smaller eastern US systems such as Stowe or Mount Snow, transit service connects important points such as the ski areas, downtown, and certain hotels and restaurants.
- Transit as a Novelty. Americans are generally so unaccustomed to using transit that when it is convenient, free, attractive, important to achieving the overall ambiance of the resort, and filled with other vacationers, they seem to enjoy the novelty of the experience.
- Clear signage, route maps and schedules, and other sources of travel information are essential to transit success.
- Removable ski and bicycle racks on buses.
- Clean buses. Most systems wash their buses at least once a day.
- Waiting areas. Comfortable, covered, and distinctive.

What service frequency is necessary?

Data gathered from other resort towns in North America indicate that optimal peak period headways are 10 minutes or less, resulting in an average wait of 5 minutes. At resorts with high ridership, service usually runs from before 6:00am until after midnight. Bus size may be a factor in determining headway.

Service frequency comes with a price: 10 minute headways will require twice the equipment and staffing of 20 minute headways. However, if Americans, with their short vacations, are forced to spend too much of it waiting for a bus, they will get back in their cars. If they are packed on to an overly crowded shuttle, they'll return to the private space of their cars. Short waits may be even more important in cold weather, even if ridership is initially low.

Service levels may differ for different routes. Out of town destinations which are a more scheduled part of people's activities could have longer waits than multiple, short, in-town, chained, and discretionary trips, as long as service is predictable and runs on schedule.

Visitor numbers fluctuate drastically and at varying intervals in resort villages: winter/summer, weekday/weekend, holiday/non-holiday, mild winter and other unpredictable weather conditions. For this reason special attention must be paid to demand fluctuations for a given transit system.

Questions to be answered: How accurately can fluctuations be predicted? How do employers deal with seasonal work layoffs? Does equipment lie dormant during slow periods? What is done with it? Answers to these questions of operating efficiency will require analysis of the operating strategies of other resort towns. The resorts we look to for guidance will have the following characteristics:

- four season mountain resorts
- various tourist destinations such as skiing, hiking, swimming, boating, restaurants and lodging are spread out over a large area
- town hosts large events drawing many people such as the Winter Olympics or other major winter sports competition

Fare or Free?

Mount Snow eclipsed Stowe in transit ridership in less than one year. Experts attribute the difference to its free system. Resorts use a variety of pricing mechanisms. Following are some examples:

- Mount Snow passengers pay no fares.
- Visitors to Stowe receive free bus tokens from participating lodges, while all others pay $1.
- Whistler's transit system is free within Whistler Village, $.50(C[1]) near the village, and $1.50(C) elsewhere.
- Vail's system is free in town, $2 to outlying areas.
- Crested Butte, Mammoth Mountain and Aspen have free shuttles to ski areas

How to Make Transit the "Thing to Do"

- Conduct interesting advertising campaigns to entertain passengers and bring in revenue for the system.
- Train drivers to give a tour as they go along the route pointing out places of interest.
- Design the system to look "old" or at least "old world," while keeping the same high tech conveniences -- or "old" in-town, high-tech out of town. Buses can also be exotically painted over their entire surface to convey the Catskill spirit. Provide excellent traveler information on routes, stops, schedules, fares.
- Promote transit use as taking a vacation from traffic, helping preserve the Catskill environment, being part of the fun and freedom of the Belleayre experience.
- Transit stops must be conveniently and safely located and easy to find. To the extent possible, they should protect riders from the elements, providing shelter if there is no nearby building where waiting passengers can take refuge. Remote locations could be equipped with a phone.
- Ideally, equip stops and hotel desks with monitors that tell waiting passengers when the next bus will arrive (achieved by installing a bus locating system which uses roadside beacons to track buses, calculate travel time, and send a digital signal).
- Use low boarding buses with wide front and rear doors. They provide a level of comfort to the rider, making it easier for several people to enter and exit the bus simultaneously

---

[1] Canadian Dollars.

(assuming no fare is collected); this is especially important when people are carrying hiking equipment, skis, or packages, or are pushing strollers, etc.

- Provide easy to use ski and bike racks.
- Charge no fare when boarding.
- Use cleanest diesel vehicles and best fuel available (cost and unreliability of non-diesel technologies in the Catskill climate not worth the P.R. benefit, and by 2007, diesels will be very clean).

Type of System

All the North American resort towns researched are using bus service. Buses are used in some of the European villages, but others are so compact that everything is within walking distance. One village, Serfaus in Austria, operates an underground air suspension funicular between ski areas and town. Buses appear to be the most cost-effective and flexible system given the constraints of providing transit to a resort town. The initial construction costs are low compared to light rail service. Roads and ROW's can remain the same. There is no disruption of bus routine because of construction, therefore a town dependent upon tourist dollars will not lose them. Bus routes can be easily changed to respond to demand.

How to pay for transit?

Transit can be financed in a myriad of ways, and systems at resorts around the country have used a variety of combinations to achieve their goal. The goal of resort planners is to achieve a modal shift from cars to transit, enhancing the pleasantness and old world charm of the resort. Within the financing discussion, one must make the distinction between initial capital costs and later operating and maintenance costs. While contractors and developers may realize a profit on the initial design and construction of the system, operation and maintenance is usually not a profit maker. Operations and maintenance will also likely be financed differently than initial construction costs. The following is a brief list of financing methods used by other resort towns:

- State and federal grants. Mount Snow (Two-year Federal Congestion Mitigation and Air Quality [CMAQ] funds); Stowe (FHWA grants); Whistler (BC provincial funds)
- Taxes: sales, hotel, restaurant, (3.5% in Vail, 1% county-wide in Aspen, 2% hotel in Whistler)
- Lift ticket (4% in Vail, $1/ticket in Aspen plus ski operator contributions, hotel tax in Whistler)
- fares (see discussion below)
- local government subsidies (Stowe, Whistler)
- contributions from local lodges (Stowe)
- private operator/developer
- automobile user fees: tolls, parking tickets, parking fees and meters (part of revenues in Vail)
- advertising revenues (Mt. Snow)
- gas tax
- payment for transit stops at lodges (Stowe)

The list of transit funding sources above is a general guide to the kinds of finances available. Achieving a sustainable funding mix varies from resort to resort. The following paragraphs highlight specific combinations of funds employed by selected resorts:

- MOUNT SNOW, VERMONT--The Deerfield Valley Transit Association is established as a non-profit corporation and operates under a mandate that no local property taxes or other local funds will ever be used to pay for the transit system. In its first year of operation, Deerfield Valley used the following funding sources: Federal CMAQ funds administered through Vermont Section 18 ($480,000); contributions from the ski area ($100,000), condominium associations, and hotels ($137,000); advertising revenue ($10,000); and other miscellaneous contributions ($2,500). Federal funds require a 20% local match. All service is contracted out, with little capital expenditures.

- STOWE, VERMONT--Stowe's system is paid for by Federal Highway Administration Section 18 operations grants ($70,000) and capital grants (87.5% federal match), town taxpayer subsidies ($20,000), contributions by local lodges ($30,000), ski area contribution ($25,000), and revenue from the $1.00 fare ($18,000). In past years the transit system received money from lodges by "selling" transit stops. Currently lodges that participate in the Stowe Area Association, a tourism group, are assessed a fee based on the number of rooms at the lodge in exchange for a shuttle stop. The Mount Mansfield ski area voluntarily contributes on a year-to-year basis. Three trolley buses were acquired for no charge as surplus from the City of Hartford, CT. Stowe recently purchased two new standard Bluebird buses with the assistance of federal capital grants.

- WHISTLER, BRITISH COLUMBIA--Transit service provided by BC Transit is a three-way partnership between BC Transit, the local government, and an operating company. The regulations of the BC Transit Act set out the formula for sharing costs of transit. The BC Transit share of funding is provided by the Provincial Government. The municipal share is made up of revenue from fares and property and hotel taxes. In addition to general sales and hotel taxes collected by the province, in British Columbia, the municipality can authorize the province to collect an additional two percent hotel tax. At Whistler, part of this hotel tax is used to maintain free in-town transit service. The municipality uses revenue collected from the transit system (fares, advertising, etc.) to reduce the property tax share of costs.

Specifications of an Effective Transit System: Experience of Vail, CO

Interview report with Mike Rose, Director, Vail Transportation, 970-476-4091, 2/4/98

Transit Costs

Equipment

Preferred bus equipment-

Orion Mach 6- 31 foot, 110 capacity (30 seated), 3-door, low floor, best craftsmanship, wheel chair lift simple to operate. List price: $275,000.

If ordering <30 buses, expect to be treated like a peon; best idea is to piggy back with larger transit property. Ask manufacturers if any agency has any unexercised options. (Vail has done other with Utica, NY for another Orion 2 door model, can use bids submitted to other property to meet FTA comparative bid requirements. The 2 door model, step-up is bus used for longer routes between towns, goes on expressway, costs $235,000. However, Orion is making its own Mack 6 just for Vail so right now no options. Vail may be asked to supply copy of telephone book size specs.

Source: Orion, Ariskanny, NY- Henry Betcker, Director of Technical Service, 905-403-1111

Other equipment:

Vail's current in-town bus is made by Neo plan, not as well built, lift difficult to operate.

Other bus manufacturers:

Nova -- low floor

Gillig-- 40' (no low floor)

Low floor = 8" over the road, no problem with snowy curbs.

Bus manufacturers operate on very tight cash flow conditions, will try to get payment up front. Don't give in!

Operating Costs

$.78/mile (no saving of 110 passenger bus over 20 passenger vans -$.72/mile)

Covers fuel, insurance, maintenance, depreciation:

Drivers range from $10.25 - $18.00/hour, but can pay $40/hour for peak periods

Maintenance cost (included in above) $.75/mile

Administrative Cost

$250,000 out of $2,200,000 operating budget

5 to 6 people plus $15,000/yr. to print schedules, no special marketing program.

Vail just provides information on service.

Vail has found that having lobbyist in Washington DC pays off in FTA funds, but now part of statewide transit association. Vail is getting $600,000 out of $11,000,000 statewide FTA grant. Pay only $1300/yr for lobbyist.

Capital Costs

Vail's maintenance facility was federally funded in 1970's – not likely available today. Vail's facility handles 250 vehicles that collectively operate 1,000,000 miles/yr, of which buses account for 700,000 miles, the rest are other public works agency vehicles.

Cost of facility is very influenced by land costs - if close to town, higher, if distant from town, low land costs, but have to pay cost of running empty buses. Typical cost of a bus maintenance/ storage facility today, $22-25 million. Bare bones ("cheap") facility would cost $12 million.

Vail Operations

In-town route 5.0 miles round trip, 17 stops, 5 buses operating and 3 buses as back up.

7-10 minutes headway, adding 2 more to reduce headways to 5-7 minutes.

Buses are alternated - one day in service, one day out, saves life of bus,

Vail gets 16-17 yrs of bus life cf. to FTA standard - 12 years.

Drivers maintain radio contacts with supervisor; Applying for FTA grant for GPS-AVL systems.

Peak service is NY's Eve- 24,000 day or ~1000 riders/hour.

Vail Financing

2.2 million/yr budget paid for by 4% tax on lift tickets, parking fees, guarantees from city sales tax if there is a shortfall. Out of $2.5 million parking revenue in past years, now expects to lose $500,000 in parking revenue due to new policy

VAIL PARKING POLICY

Basic rates: Under 1.5 hr., free
Various multiple-use parking passes are available: $1,100 season pass good at all times; $525 season pass, not valid for peak periods in Village garage; residents 10 passes @ $5. The main competition, Beaver Creek, offers parking around the clock at $2/hr at the slope and free parking with shuttle bus from the edge of town. Less glamorous areas usually have free parking in town. See parking rate schedule below:

Parking (hours)	Fee fee
0-1.5	Free
1.5-2	$2.00
2-3	5.00
3-4	6.00
4-5	7.00
5-6	8.00
6-7	9.00
7-8	10.00
8-9	11.00
9-11	12.00
11-15	13.00
15-24	14.00
All entrances and exits between 3 p.m. - 3 a.m. are free.	

Free Parking Experiment in Vail, CO; Interview with Susanne Silverthorn, Vail Information Officer, 970-479-2115, 2/5/98, 5/22/98.

Free parking after 3:00 PM in the garage of the Vail Transportation Center is an experiment instituted in November 1997 by the Town Council "under pressure from a small group of special interests who own commercial property." (Former typical rate was $5 for 2-3 hours.) The assumption was that for each $1 lost revenue in parking; town would get sales tax on $25 in added sales. Free parking was opposed by most merchants who felt that their own employees would abuse the free parking and take up spaces that customers would be willing to pay for. Others feel free parking is an important draw, and would support vouchers for paying customers.

According to Ms. Silverthorn, "the Council did not do its homework, or ask staff to do theirs and now regrets the move--in fact, could repeal it any day. Transit operator reports that policy competes with free bus service. Council objects to the Town being at risk to make up lost revenues. Council wants to see a greater sense of partnership from the business community." expectation that 4% sales taxes on $10,000,000 in sales would generate $400,000 didn't materialize. Sales tax collections were flat. Based on November-March parking and sales tax data, free parking will likely cost the town about $500,000 in subsidies to transit with no net return in sales tax dollars.

COMMUNITY
CONSULTING
SERVICES INC.

Addendum to Review of Traffic Analysis
Belleayre Resort at Catskill Park DEIS
March 30, 2004
Brian T. Ketcham, P.E., Executive Director

Since the preliminary review of the Belleayre Resort at Catskill Park DEIS was completed in early January, we have continued our work investigating the transportation operations of the Belleayre Resort. Of particular concern is the reported operation of the shuttle buses during the ski season. In particular, the assignment of shuttle trips and, for that matter, private passenger car trips for Resort guests appears to be missing. Shuttle buses are just that—presumably they operate on continuous routes entering and leaving the Belleayre Ski Resort lower level ever ten minutes. What we see in the DEIS traffic analysis (Appendix 25) are vehicles entering in the morning peak but none departing. The reverse is true in the evening peak. Moreover, so few project vehicles are evident that either no one at Big Indian, where 55% of all guests are expected to be housed, skis or skiers have simply been overlooked. This number of missing vehicle trips are not insignificant and must be included in a revised draft EIS.

1. The DEIS asserts that 80% of all project trips to and from the Belleayre Mountain Ski Center will be by shuttle bus. However, the assignment of trips does not appear to reflect all shuttle trips or non-shuttle trips. For example, Appendix 25 reports that Big Indian trips enter the Lower Driveway in the AM peak hour but none leave. The opposite should be true in the evening. Trips depart but none enter. Presumably, the same number of shuttle buses should enter and leave during the same hour. Three shuttle bus services serving Resort guests and employees are proposed.

2. The Ski Area Express, described on p. 2-49, would be able to handle 30 passengers per bus in 5 buses serving three hotels at 10 minute headways. As shown below, the entire round trip would take about 80 minutes, which would require 8 buses to maintain 10 minute headways. There is no description of the time of the routes shown in Figure 6 of Appendix 25 would take, but it can be calculated that to serve all three hotels, allowing for 10 minutes to load or unload at each site and 10 minutes to off-load at the Ski Center, plus travel times of between 5 to 15 minutes and a 5 minute average wait, the average total travel time for each skier will be 40-45 minutes. This is shown in Table A-1.

   Given the premium that skiers place on getting to the slopes before the crowds, a prime reason for staying at the Resort, many people will be unwilling to wait for the shuttle. The alternative, to provide two routes, one for Wilderness Acres and one for Big Indian will require 10 buses and still take 20-25 minutes average travel time, including loading. The realistic number of trips are clearly not accounted for, especially the approx. 100 veh. trips per peak hour from Big Indian that are likely to add to traffic on Route 28, increasing resort-generated trips to more that 1,000 in the p.m. peak hour, more than doubling traffic volumes measured in 2003.

3. Since it will take 5 to 10 minutes to reach by car from Resort lodging, there will be a strong tendency for many people to drive. Any restriction on driving to or parking at the ski area may be impractical because it would impose on Resort guests a greater travel time disadvantage than people driving from lodging within 15 miles of the Ski Center. Thus, there are likely to be many more auto trips than projected, altogether, at least, doubling DEIS estimates and existing travel.

175 Pacific Street
Brooklyn, NY 11201
phone 718.330.0550
fax 718.330.0582
communityconsulting.org

Access to Belleayre Ski Resort - Shuttle Travel Time

One way trip, all stops

1	Leave Big Indian	0
2	Travel to Route 28	8
3	Travel to CB 49A	4
4	Travel up 49A to Ski Lodge	3
5	Unload/Load	10
6	Travel to Wildacres Resort	3
7	Unload/Load	10
8	Travel to Lower Lodge	7
9	Unload/Load	10
10	Travel to Route 28	5
11	Return to Big Indian	12
12	Unload/Load	10
	Total Round Trip Travel Time	82

One way trip, Wildacres/Lower Mountain Resorts

1	Leave Ski Area	0
2	Travel to Wildacres Lodge	4
3	Unload/Load	10
4	Travel to Lower Lodge	7
5	Unload/Load	10
6	Travel to Ski Area	4
7	Unload/Load	10
	Total Round Trip Travel Time	45

Prepared by Community Consulting Services 3/7/04

One way trip, Big Indian to Ski Area only

1	Leave Big Indian	0
2	Travel to Route 28	8
3	Travel to CB 49A	4
4	Travel up 49A to Ski Lodge	3
5	Unload/Load	10
6	Travel to Route 28	5
7	Return to Big Indian	12
8	Unload/Load	10
	Total Round Trip Travel Time	52

The traffic analysis review was undertaken by Fitzgerald & Halliday, Inc. under F&A's direction.

Executive Summary

- The Applicant's traffic study needs to be updated to reflect a more realistic year of opening and full build out. The revised traffic study should also reflect the most recent attendance data at Belleayre Mountain Ski Center.

- The Applicant has identified an impact at the intersection of Route 28 and Route 49A and proposes signalization and turn lane construction. The Applicant is proposing a "fair share" contribution towards the improvements. The Applicant should consider paying the entire cost.

- The Applicant suggests that information signs be placed on the main roadways. The Applicant should prepare and submit a "way-finding" sign plan to the County and, if approved, should furnish and install the signs as part of the development proposal.

- We question some of the assumptions made in the traffic study including:
  - shared trips with the Belleayre Mountain Ski Resort (50% of the winter peak hour trips generated by the proposed resort will be shared).
  - 80% of the resort trips to and from the ski area will be on the shuttle bus
  - 40% of the resort trips to and from the golf courses will be on shuttle bus

- The traffic study indicates that various Transportation Management Initiatives are planned. The Applicant should provide greater details on the initiatives and provide an employee commute option program, including a ride matching service and ride board.

- The Applicant should provide sight distance analysis at all access points and internal intersections. The Applicant should also consider additional mitigation where desirable sight distance is not available, including the following locations:
  - County Road 49A and Middle Driveway/Belleayre upper driveway
  - County Road 49A and southern driveway
  - County Road 49 A and Highmount Estates Access
  - County Road 49 A and Maintenance Facility Drive
  - Gunnison Road and Golf Cart Crossing (hole 8 to 9)
  - Gunnison Road and Golf Cart Crossing (hole 1 to 2)

- Traffic impacts are identified at the following locations. The applicant indicates that signalization is not warranted but no other mitigation is considered.
  - Route 28 at Route 42
  - Route 28 at Route 214
  - County Road 49A at Gunnison Road/ Belleayre Mountain Lower driveway
  - County Road 49A and Belleayre Main (upper) driveway

- County Road 49A and Friendship Road are narrow (18-20 feet). We question whether they can safely and efficiently accommodate the traffic?

- The Applicant should provide more details on the shuttle service (i.e. hours of operation, cost etc.)

- A Transportation Demand Management plan should be developed if special/major events such as a golf tournament are planned.

- Winding Mountain Road is steep, narrow and not surfaced. This road is proposed as the main construction access road. We question the feasibility of this.

Page vi, Ulster County: Has any coordination occurred with Ulster County with regard to the plans to realign County Road 49A and the proposed entrances to 49A? Please include a letter in the FEIS from the County stating that the proposed plan and mitigation are reasonable/feasible.

Page xi, 5th paragraph: The Sound section of the DEIS discusses noise impacts related to construction activity but fails to mention if noise impacts are anticipated due to traffic generated along the proposed access roads. Please address/clarify.

Page xiv, 1st paragraph: Please provide a footnote indicating the date and facility name/location of the similar resorts used in the evaluation.

Page xiv, 1st paragraph: During the public meetings it was brought to our attention that the Martin Luther King, Jr. holiday weekend of Saturday, January 15, 2000 was not a worst-case condition. Please revise the traffic information based on more recent attendance records at Belleayre Mountain Ski Center.

Page xiv, 2nd paragraph: The DEIS states the analysis years are the year 2006 when the facility will first be opened and 2008 when all new facilities are expected to be in use. Please revise the traffic study to include a more realistic opening year and year when fully constructed.

Page xiv, Table following Item (3): Please indicate that the numbers in the first row are hourly volumes.

Page xiv, Item (3) following the Table: This paragraph states that "Similar results are found at the other study area intersections in the project corridor. An increase in traffic of this magnitude will typically not be noticeable." A comparison of Figures 3.2 and 3.10 in Appendix 25 shows the Route 28 (west of Route 47) anticipated 2008 winter Saturday PM peak hour volumes to be 784 vehicles per hour (vph) in the No Build and 1079 vph in the Build condition. This 37 percent increase may be noticeable. Please address.

Page xiv, Item (4): This paragraph states "...winter traffic peak hours will utilize 30 percent of the rated capacity of NY Route 28." Please define/explain rated capacity.

Page xv, Item (5): During the public meetings it was brought to our attention that the Martin Luther King, Jr. holiday weekend of Saturday, January 15, 2000 was not a worst-case condition. Please revise the traffic information based on more recent attendance records at Belleayre Mountain Ski Center.

Page xv, Item (9): Please indicate the proposed length of the westbound left-turn lane (taper deceleration and storage) at NY Route 28/Friendship Road (east). Is this turn lane warranted?

Page xv, Item (9): Please define what is meant by "fair share contribution." Please also indicate why the applicant cannot pay the full amount for the proposed signal and turn lane construction at the intersection of NY Route 28 and County Road 49A. It is typical for the developer to pay the entire cost for mitigation.

Page xv, Item (9): The last bullet states that "...it is recommended that information signs be placed on the main roadways guiding patrons to their proper destination." It is not clear whether the applicant is proposing this or suggesting that others do it. The applicant should prepare and submit a "way-finding" sign plan to the County, and if approved should furnish and install the signs as part of the development proposal.

Section 1 Introduction

Page 1-3 B. Big Indian Resort and Spa and C. Belleayre Highlands: Are all of the detached hotel lodging units time-shares? Please clarify.

Page 1-4, A. Wildacres Resort: Are the 168 detached hotel lodging units time-shares? Please clarify.

Section 2 Description of the Proposed Action

2.2.7 Traffic, Parking and Pedestrian Circulation

Page 2-40, Item 3: In the second sentence please define typical i.e. per Table 3-31, typical = based on median day of operation.

Page 2-40, Item 3: After the 5th sentence please add a sentence stating the Resort will generate 347 vehicle trips in the AM peak hour and 339 vehicle trips in the PM peak hour. The Applicant provides total resort numbers for the typical day but divides the vehicle trips by resort for the peak winter traffic.

Page 2-41, Item 3 continued: The first paragraph states "It is anticipated that approximately 50 percent of the peak hour trips generated by the proposed resort during the winter will be shared trips with the Belleayre Mountain Ski Center." Please indicate or reference how this, percentage was determined. Also please comment on the reasonableness of this given that approximately 50 percent of the lodging will be time-shares or extended stay type lodging.

Page 2-41, Item 4: The first sentence provides a discussion of traffic volume increases expected in vehicles per minutes; please also provide the increases in vehicles per hour.

Page 2-41, Item 4: The second paragraph states "This number of trips from the Resort would use less than 15% of the capacity of Route 28..." Please indicate how this was determined and please clarify that the trips are to and from the site. The second paragraph also states "An increase in traffic of this magnitude will typically not be noticeable." A comparison of Figures 3.2 and 3.10 in Appendix 25 shows the Route 28 (west of Route 47) anticipated 2008 winter Saturday PM peak hour volumes to be 784 vph in the No Build and 1079 vph in the Build condition. This 37 percent increase may be noticeable. Please address.

Page 2-41, Item 4: The last sentence of the third paragraph states "Traffic is not expected to increase on local roads, including the roadways in the Hamlet of Pine Hill." How can this be stated especially since most if not all patrons to the resort will arrive by private automobile and may at some point during their stay decide to sightsee or shop in the villages/hamlets? Please clarify.

Page 2-42 Item 6: In the first bullet, please indicate the proposed length of the westbound left-turn lane (taper, deceleration and storage) at NY Route 28/Friendship Road (east). Is this lane warranted?

Page 2-42 Item 6: In the second bullet, please define what is meant by "fair share contribution." Please also indicate why the applicant cannot pay the full amount for the proposed signal and turn lane construction. It is typical for the developer to pay the entire cost for mitigation.

Page 2-42 Item 7: This paragraph states that "it is recommended that information signs be placed on the main roadways guiding patrons to their proper destination." It is not clear whether the applicant is proposing this or suggesting that others do it. The applicant should prepare and submit a "way-finding" sign plan to the County and if approved should furnish and install the signs as part of the development proposal. Please address.

Page 2-42 Item 9: This paragraph states that "...various transportation management initiatives are planned that will reduce traffic impacts. These include the use of a shuttle bus for guests and employees, remote park-and-ride lots for the employees and scheduling check in/out times at hotels to occur during off-peak times." Are other management initiatives planned? For the FEIS, please provide a Transportation Demand Management plan that cleary lists all the planned transportation management initiatives and how they will be carried out. Since there are expected to be 872 employees, the applicant should provide some employee commute option programs such as a ride matching service and a ride board.

Page 2-43, B. Access: All proposed access points and internal project roadway intersections should be evaluated for intersection and stopping sight distance.

Page 2-44, C. Parking and Pedestrians: Please indicate how the amount of parking spaces was determined for each use. Please provide a table summarizing what is provided versus what is required.

Page 2-46, 1st paragraph and 3rd paragraph: The first paragraph states "The guest shuttle buses will be diverted to pick up and drop off employees at the employee lots during these off-peak periods." The third paragraph states "Separate shuttles will transport the employees to and from the employee parking lots." These two statements appear to conflict. Please clarify.

Page 2-47, Pedestrian Circulation, 2nd paragraph: The last sentence states ". pedestrians wishing to travel off-site will utilize the shuttle system or they will drive." Please clarify, as it does not appear that any of the shuttles are proposed to transport guests off-site, but rather between the various proposed uses.

Page 2-47, Golf Carts and Walking Golfers, 1st paragraph: The last sentence states "It is not anticipated that golf carts will be used on any other areas of the Resort besides the dedicated golf course cart paths." What about in the parking lots or for maintenance purposes? Please clarify.

Page 2-48, Pedestrian Connections Between Wild Acres Hotel and Other Areas: The paragraph states "Pedestrians would then follow a foot path..." Please define what a foot path is. Will these footpaths be handicap accessible?

Page 2-49, Shuttle Bus Service, 1st bullet: This bullet discusses the headways for the Ski Area Express during the peak periods. Please indicate what are the proposed headways during the off peak periods? Also please indicate what the proposed hours of operation are. Will there be a charge to use the shuttle bus?

Page 2-49, Shuttle Bus Service, 2nd bullet: This bullet discusses the headways for the Ski Area Local during the peak periods. Please indicate what are the proposed headways during the off peak periods? Also please indicate what the proposed hours of operation are.

Page 2-49, Shuttle Bus Service: No description is provided for the employee shuttle service; please include.

Page 3-118, Access to the Site and Existing Conditions, 1st paragraph: This first paragraph discusses additional vehicles that would be added to Route 28. Please provide hourly estimates not just estimates of vehicles per minute. Please clarify the fourth sentence which states," The addition of three vehicles during the peaks will not have a significant effect on the Route 28 traffic." There will be more than three vehicles generated during the peaks.

Page 3-118, Access to the Site and Existing Conditions, fifth bullet: This bullet describes County Road 49A and indicates that there are nine foot travel lanes in each direction. Can these narrow travel lanes safely and efficiently accommodate the anticipated traffic generated by the proposed development? Please address.

Page 3-119, Access to the Site and Existing Conditions, second bullet: This bullet describes Friendship Road and indicates that the overall pavement width is between 18-20 feet. Can this narrow roadway safely and efficiently accommodate the anticipated traffic generated by the proposed development? Please address.

Page 3-120, Access to the Site and Existing Conditions, 1st paragraph: The first paragraph indicates that two seasonal traffic conditions were evaluated to select the peak period for the year. Please explain why a special event such as a golf tournament was also not evaluated. It is possible that special events may take place at the resort. Please provide a Transportation Demand Management (TDM) plan for a special event.

Page 3-120, Access to the Site and Existing Conditions, 2nd paragraph: The second paragraph discusses the winter conditions analysis. During the public meetings it was brought to our attention that the Martin Luther King, Jr. holiday weekend of Saturday, January 15, 2000 was not a worst-case condition. Please revise the traffic information based on more recent attendance records at Belleayre Mountain Ski Center.

Page 3-121, Access to the Site and Existing Conditions, 3rd paragraph: This paragraph indicates the vehicles per minute during the typical winter traffic peak hours and during the typical fall peak hours. Please define "typical" and provide the estimates in hourly volumes.

Page 3-121, Potential Impacts and Mitigation Measures Analysis of Traffic Conditions with the Project, 1st paragraph: The first paragraph indicates that the proposed project will open during the year 2006 and continue with construction through 2008. Please revise this and the traffic study based on a more reasonable project completion date.

Page 3-122, A. Trip Generation, 1st paragraph: Two sources of trip generation are cited: *The Institute of Transportation Engineers Trip Generation* and counts of similar resort facilities. Please provide a reference for the similar resorts including location and date of data.

Page 3-122, A. Trip Generation, 2nd bullet: Please indicate the date/year the rate was determined for the facilities at Sunday River and Killington.

Page 3-123, A. Trip Generation, 1st bullet: Indicates a single golf course; however two golf courses are described in the project description. Please rectify.

Page 3-122, A. Trip Generation: No trip generation estimates were described or provided for delivery/service trucks. Please provide and indicate the likely routes the delivery/service trucks will use to access the development.

Page 3-122, A. Trip Generation, 2nd paragraph: The first sentence states "Shuttle buses will play a significant role in reducing the trips from the development." Please edit this to state "...trips within the development."

Page 3-122, A. Trip Generation, 2nd paragraph: The third sentence states "As a conservative estimate it has been assumed that 40 percent of the trips to and from the golf courses on peak days will be made on shuttle buses." Please indicate how this was calculated and determined to be a "conservative estimate".

Page 3-122, A. Trip Generation, 2nd paragraph: The fourth sentence states" In the winter the main activity will be skiing and it has been assumed that 50 percent of the peak hour trips generated by the Resort will be to and from Belleayre." Is this a "conservative estimate"? Please indicate or reference how this percentage was determined. Also please comment on the reasonableness of this, given that approximately 50 percent of the lodging will be time-shares or extended stay type lodging.

Page 3-122, A. Trip Generation, 2nd paragraph: The fifth sentence states "Of these trips it has been assumed that 80 percent of them will be on shuttle buses." Please indicate or reference how this percentage was determined.

Pages 3-124 and 3-125, A. Trip Generation, Tables 3-31, 3-32 and 3-33: These tables provide a summary of the estimated trip generation for the Resort. Information is provided for Design, Estimated Maximum and Typical. Please revise the title of "Estimated Maximum" to "Similar Resort", as this figure was based on a limited amount of data collected at a few facilities.

Pages 3-124 and 3-125, A. Trip Generation, Tables 3-31 and 3-32: The total "Design" trip generation for the fall Friday PM peak and Sunday PM peak should include trips for the golf courses, as the courses will be open to the public. The "Design" scenario is actually not based on a full occupancy of the lodging but rather on ITE rates. The *ITE Trip Generation Manual* indicates that these rates for Land Use 310 (Hotel) had an average occupancy rate of 83 percent.

Page 3-127, F. Sight Distance Analysis: Please provide an intersection and stopping sight distance analysis for all proposed access points and internal project roadway intersections.

Page 3-127, F. Sight Distance Analysis, 1st paragraph: The sixth sentence states "The sight distance for the golf cart crossings was conducted using the local road speed limit on Gunnison Road of 30 - mph." Please indicate why the 85th percentile speed was not used or make note that the 30mph posted speed is indeed the 85th percentile operating speed.

Page 3-127, F. Sight Distance Analysis, 1st paragraph: Please also indicate which movements do not meet the criteria and include Table 4.2 Sight Distance Evaluation from Appendix 25.

Page 3-127, F. Sight Distance Analysis, 1st bullet: Indicates that the realignment of Route 49 A is expected to improve the sight distance at the Middle Driveway and Belleayre Mountain driveway. Please indicate what the improved sight distance will be in feet and if it will be adequate to meet the desirable criteria.

Page 3-128, F. Sight Distance Analysis, 2nd bullet: Indicates that sight distance is limited at the intersection of County Road 49A and the Southern Driveway. The third sentence states, "Clearing on the west- side of County Road 49A would improve the sight distance looking to the left." The fourth sentence states "However, to further mitigate the sight distance deficiency due to the vertical profile, it is recommended that driveway ahead warning signs be installed on the northbound and southbound County Road 49A approaches to the intersection." It is not clear if the applicant is proposing to clear the west side and install signs or if they are hoping the County will do this. Please clarify. Please indicate what the sight distance is expected to be with these mitigation measures. Also please evaluate additional measures to improve the sight line such as changes to the vertical profile.

Page 3-128, F. Sight Distance Analysis, 3rd bullet: Indicates that sight distance is limited by both vertical and horizontal curvature of County Road 49A. The second sentence states "It is recommended that the side slopes be cleared and regraded to provide additional sight distance." The third sentence states, "Advisory speed signs and intersection ahead warning signs should be installed on the County Road 49A approaches to this intersection." It is not clear if the Applicant is proposing to clear the side slopes, re-grade and install advisory speed signs or if they are hoping the County will do this. Please clarify. Please indicate what the sight distance is expected to be with these mitigation measures. Also please evaluate additional measures to improve the sight line such as changes to the vertical and or horizontal profiles.

Page 3-128, G. Capacity/Level of Service Analysis, 1st paragraph: The second sentence indicates that highway capacity software, HCS version 4.1a was used. Please use the latest version 4.1c in the FEIS.

Page 3-129, G. Capacity/Level of Service Analysis, continuation of bullet from previous page: This bullet discusses impacts and mitigation to NY Route 28 and County Road 49A. The applicant is proposing a fair share contribution to the improvements. Please define what is meant by "fair share contribution." Please also indicate why the applicant cannot pay the full amount for the proposed signal and turn lane construction. It is typical for the developer to pay the entire cost for mitigation.

Page 3-129, G. Capacity/Level of Service Analysis, 1st bullet, NY Route 28/NY Route 42: A poor level of service (LOS E) is expected in 2008 Build for the southbound approach during the PM peak hour. It is indicated that a traffic signal is not warranted. Please consider and address other mitigation such as the use of a police officer to direct traffic during the peak winter Saturday peak hours.

Page 3-129, G. Capacity/Level of Service Analysis, 2nd bullet, NY Route 28/NY Route 214: A poor level of service (LOS F and E) is expected in 2008 Build for the northbound and southbound approaches, respectively during the AM peak hour and LOS D and F for these approaches respectively during the PM peak hour. It is indicated that a traffic signal is not warranted. Please consider and address other mitigation such as the use of a police officer to direct traffic during the peak winter Saturday peak hours.

Page 3-130, G. Capacity/Level of Service Analysis, 1st bullet, County Road 49A/Gunnison Road: During the PM peak hour (2008 Build), the eastbound Gunnison Road approach will experience LOS F and the westbound Belleayre Lower Driveway will experience LOS E. It is indicated that a traffic signal is not warranted. Please consider and address other mitigation such as the use of a police officer to direct traffic during the peak winter Saturday peak hours. The applicant also indicates that it is recommended that signs be placed within the Wildacres Resort to divert the existing traffic to the southern resort driveway. Again, please clarify is the Applicant proposing to furnish and install the signs. Was this diversion considered in the capacity analysis? Please clarify.

Page 3-130, G. Capacity/Level of Service Analysis, 3rd bullet, NY Route 28/Friendship Road: Please indicate the proposed length of the westbound left turn lane (including taper, deceleration, and storage lengths) and indicate if it is warranted. Also please consider improvements to Friendship Road between NY Route 28 and the resort access and address in the FEIS.

Page 3-131 I. Conclusions, Item 3: Please see comment to Page 3-122, A. Trip Generation, and 2nd paragraph.

Page 3-131 I. Conclusions, Item 4: Please provide traffic volume increases in hourly volumes not just by the minute.

Section 4.7 Traffic

Page 4-2, 4th paragraph: Please indicate where the construction workers will park.

Section 5.6 Alternative Site Access

Page 5-43, A. Access from Existing Roads, 2nd paragraph: Winding Mountain Road is proposed as the main access road for the construction phase of the project. Winding Mountain Road is not surfaced, is steep and in most places is only wide enough for one-way travel. The amount of heavy vehicles anticipated to use this road could destroy it. A bond should be posted by the applicant to cover any repairs or regrading to the road.

Page 5-44 A. Access From Existing Roads, 3rd paragraph: The last sentence indicates that five access points are proposed to County Road 49A. Please provide a sight distance analysis at each one.

Appendix 25 Traffic Impact Study

Page 2, 2nd paragraph: Please see comment to Page xiv, 2nd paragraph.

Page 4, last paragraph: Please see comments to Page xiv, 1st paragraph and Page 3-120, Access to the Site and Existing Conditions, 1st paragraph.

Page 6, 5th bullet: Please see comment to Page 3-118, Access to the Site and Existing Conditions, fifth bullet.

Page 7, 2nd bullet: Please see comment to Page 3-119, Access to the Site and Existing Conditions, second bullet.

Page 19, 1st and 2nd bullet: Please see comment to Pages 3-124 and 3-125, A. Trip Generation, Tables 3-31 and 3-32.

Page 20, 1st paragraph: Please see comments to Page 3-122, A. Trip Generation, 2nd paragraph and Page 3-122, A. Trip Generation, 2nd paragraph and Page 3-122, A. Trip Generation, 2nd paragraph.

Pages 21 and 22, Tables 3.2, 3.3, and 3.4: Please see comment to Pages 3-124 and 3-125, A. Trip Generation, Tables 3-31, 3-32 and 3-33. Also please explain why the 18- hole golf course trips differ for the design scenario between these two sets of tables.

Figures 3.6, 3.7 and 3.8: Please provide a figure that shows the total trip generation for the entire resort, i.e. sum of Wildacres, Big Indian Plateau and Highmount Estates.

Figure 3.8: The note indicates the remaining 40 percent will come to/from the south on Route 49A outside the study area boundaries. Please explain/validate how this was determined.

Pages 38 and 39, Sight Distance Analysis: Please see comments to: Page 3-127, F. Sight Distance Analysis and Page 3-127, F. Sight Distance Analysis, 1st paragraph and Page 3-127, F. Sight Distance Analysis, 1st paragraph and Page 3-127, F. Sight Distance Analysis, 1st bullet and Page 3-128, F. Sight Distance Analysis, 2nd bullet and
Page 3-128, F. Sight Distance Analysis, 3rd bullet.

Pages 39, 40, 41, 42 and 43, Capacity/Level of Service Analysis: Please see comments to Page 3-128, G. Capacity/Level of Service Analysis, 1st paragraph and Page 3-129, G. Capacity/Level of Service Analysis, continuation of bullet from previous page and Page 3-129, G. Capacity/Level of Service Analysis, 1st bullet, NY Route 28/NY Route 42 and Page 3-129, G. Capacity/Level of Service Analysis, 2nd bullet, NY Route 28/NY Route 214 and Page 3-130, G. Capacity/Level of Service Analysis, 1st bullet, County Road 49A/Gunnison Road and Page 3-130, G. Capacity/Level of Service Analysis, 3rd bullet, NY Route 28/Friendship Road.

Pages 44 and 45 Conclusions: Please see comments to Page 2-42 Item 7 and Page 2-42 Item 9 and Page 2-49, Shuttle Bus Service, 1st bullet and Page 2-49, Shuttle Bus Service, 2nd bullet and Page 2-49, Shuttle Bus Service, Page 3-122, A. Trip Generation, 2nd paragraph and Page 2-41, Item 4 and Page 3-127, F. Sight Distance Analysis and Page 3-127, F. Sight Distance Analysis, 1st paragraph and Page 3-127, F. Sight Distance Analysis, 1st paragraph and Page

3-127, F. Sight Distance Analysis, 1st bullet and Page 3-128, F. Sight Distance Analysis, 2nd bullet and Page 3-128, F. Sight Distance Analysis, 3rd bullet and Page 3-128, G. Capacity/Level of Service Analysis, 1st paragraph and Page 3-129, G. Capacity/Level of Service Analysis, continuation of bullet from previous page and Page 3-129, G. Capacity/Level of Service Analysis, 1st bullet, NY Route 28/NY Route 42 and Page 3-129, G. Capacity/Level of Service Analysis, 2nd bullet, NY Route 28/NY Route 214 and Page 3-130, G. Capacity/Level of Service Analysis, 1st bullet, County Road 49A/Gunnison Road and Page 3-130, G. Capacity/Level of Service Analysis, 3rd bullet, NY Route 28/Friendship Road.

<u>Appendix B - Trip Assignment</u>

Table B-1, 5th line item: We question the trip generation for the Saturday PM peak hour for the 183 Club Membership. The total generation for the 183 units is 67 vehicles. Once could expect it to be greater during this time as Saturday PM is typically prime time for time-share check in. This estimate seems low; please reconsider. The PM exit volume is missing a volume in parenthesis. Likewise the AM peak hour on a Saturday is generally a peak time for time-share unit users to check out. The total generation of 67 vehicles seems low. Please address and reconsider.

Figures B.1-B.12: Please provide a figure that shows the total trip generation for all components combined during the Saturday, Friday and Sunday peak hours.

<u>Addendum to the Traffic Impact Study, August 15, 2003</u>

Page 2, Response to Comment 1, 3rd paragraph: Referring to Winchell's Corners the sixth sentence states "The Resort sponsors will support the Town

(Olive) in its efforts to address this issue with State officials." Please elaborate what is meant by this and what it will entail.

Page 4, Response to Comment 2, 2nd paragraph: This paragraph states "Wherever cart paths pass over internal project roads, or in the case of Highmount Golf Club, where carts must pass over Gunnison Road, there will be signage for both the golfers and the motorists. This is illustrated on the attached Figure #1, Typical Pedestrian and Golf Cart Crossing for Gunnison Road. Stop signs will be put at the cart paths on their approaches to road crossings to stop both carts and walking golfers. Motorists will be advised via signage of pedestrian and golf cart crossings. The crossings themselves will be striped in a typical crosswalk fashion." Figure 1 shows the crosswalk for the golf cart crossing at an angle rather than at the typical 90 degrees. Please explain why this was done, as it makes the crossing path longer. Also Page 9 of this addendum provides a sight distance analysis of the golf cart crossings. At all three locations the sight distance to the left from the driveway is less than desirable and the sight distance from the right is also less than desirable from the maintenance facility drive. Please consider additional measures beyond just signage to ensure safety at these crossings. Additional measures may include adding flashing warning lights to the signs, providing pedestrian push buttons to activate flashing warning lights embedded in the pavement, and/or clearing to improve sight distance.

Pages 6 and 7, Response to comment 4: Please provide an overflow parking plan. The response indicates that additional on-site temporary grass surfaced parking areas that exist next to both hotels will accommodate any overflow parking from special events. Please indicate how many spaces are available in these grass areas.

Page 15, Response to Comment 22: In the Evaluation of Sight Distance table, the Wild acres resort -CR 49A/Southern Driveway (with realignment) and the Highmount Estates-CR49A/Access Road intersections are expected to have less than desirable sight distances. Please consider additional measures to mitigate this.

Page 19, Response to Comment 27: The fourth paragraph states "During the discussion with the Middletown planning board it was agreed that there may be a number of employee trips coming from the west that could impact the locations noted above. These trips would occur during non-peak resort generation hours because shifts will be scheduled in off-peak hours." Please indicate what the proposed work shifts are.

Page 20, Response to Comment 27: The second paragraph states "Although this level of traffic from the project does not indicate a need for mitigation along Route 28 west of the project, there are long standing concerns regarding the use of County Route 38 as a connector. The project sponsors should support the Town (Middletown) and County's efforts to address these concerns with the New York State Department of Transportation." Please explain what this means and what the applicant is proposing to do.

Z:\Shandaken and Middletown\Belleayre\Traffic\Traffic 040804.doc

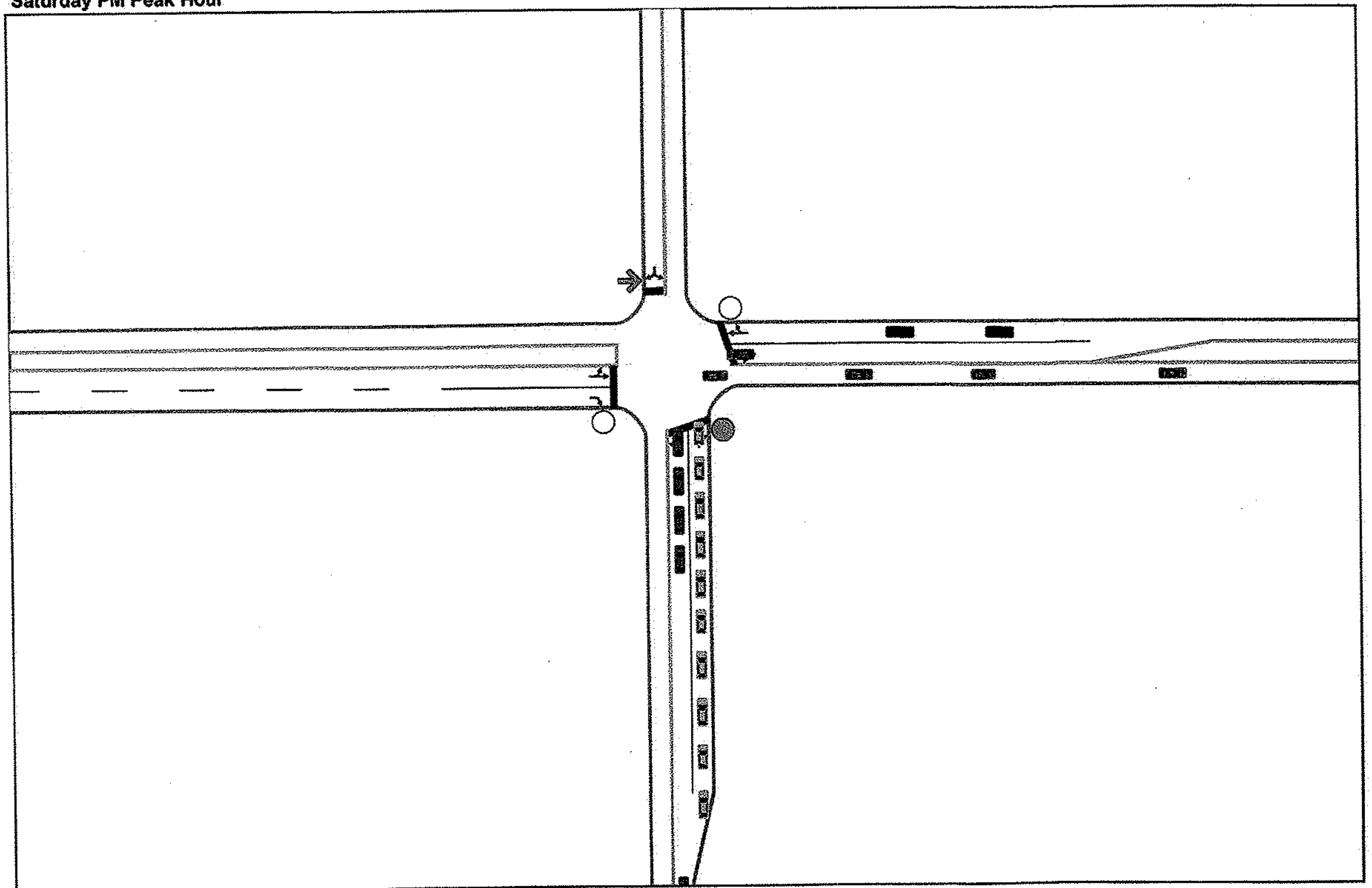
Community Consulting Services

SIMULATION MODELING OF THE TRAFFIC IMPACTS OF THE BELLEAYRE RESORT – ROUTE 28 AND CR 49A

Attached are two illustrations for the intersection of Route 28 and County Road 49A, the entrance to the Belleayre Mountain Ski Resort. The first shows traffic impacts assuming conditions reported in the Belleayre Resort DEIS for 2008. It shows a signalized intersection assuming the geometric improvements proposed in the DEIS, a northbound right turn lane and a westbound left turn lane. For conditions that are described in the DEIS for a Saturday PM peak hour, this intersection, with optimum signal timing and phasing, will operate at a Level of Service (LOS) C or better.

As I have noted my report dated March 14 2004, a more realistic worst case analysis for the year 2014, the year by which the Belleayre Resort is expected to be completed, will result in considerably more traffic than reported in the DEIS. The second figure shows the same signalized intersection configuration but with the amount of traffic that can be expected with the full build out of both the Ski Resort expansion and completion and 85% occupancy of the Belleayre Resort. The result is a considerable deterioration in service level for this intersection in spite of optimizing signal timing and phasing which still produces a LOS E (bordering on LOS F) for the northbound right turn exiting the Ski Resort and the westbound left turn entering CR 49A.

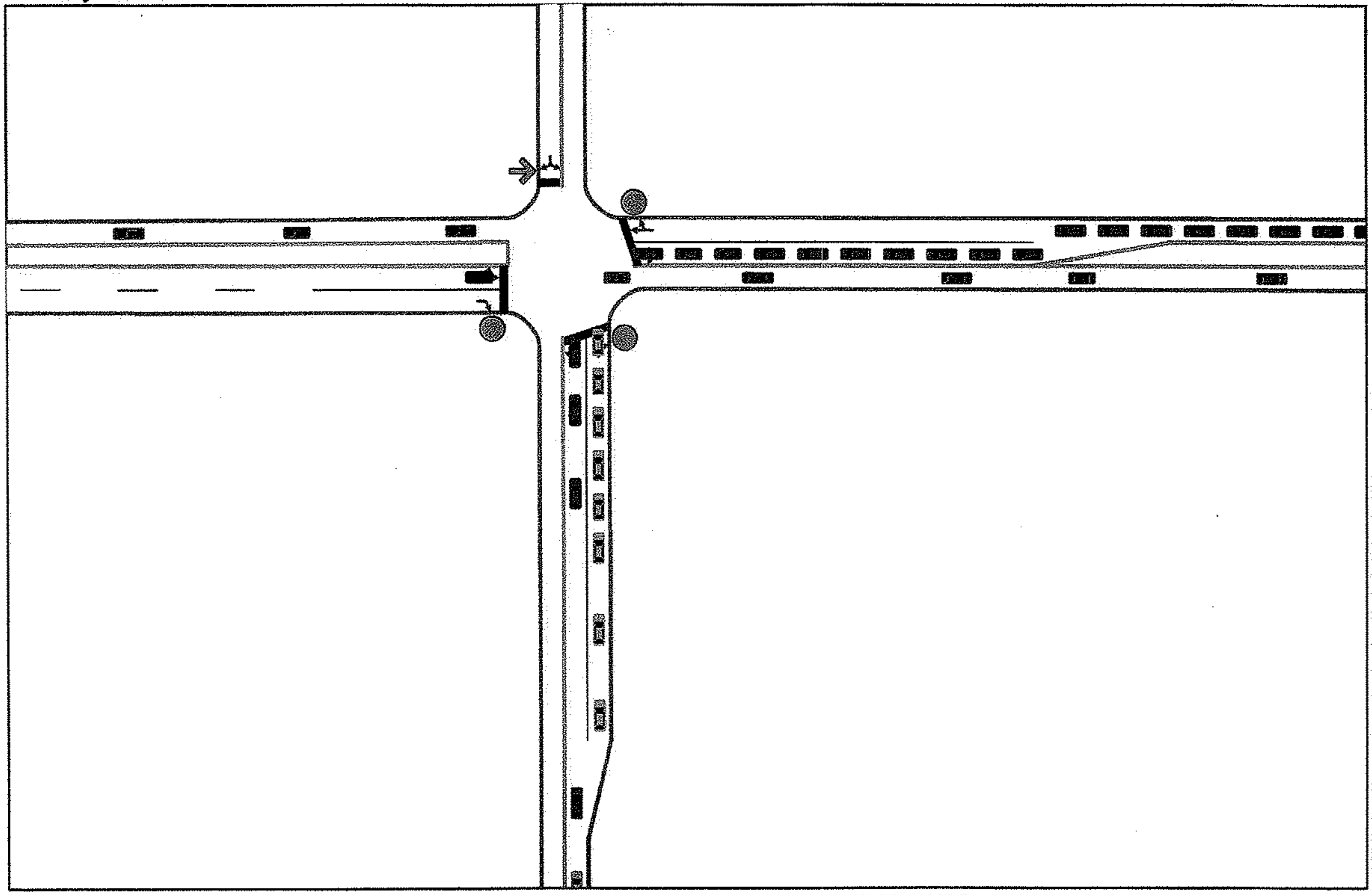
Brian Ketcham, P.E.
Executive Director
Community Consulting Services
April 22, 2004



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	1.00	1.00			1.00	1.00		0.95	
Frt		1.00	0.85	1.00	1.00			1.00	0.85		0.95	
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)		1876	1599	1805	1877			1793	1599		1751	
Flt Permitted		0.98	1.00	0.62	1.00			0.72	1.00		0.88	
Satd. Flow (perm)		1846	1599	1172	1877			1359	1599		1583	
Volume (vph)	10	144	38	113	178	3	312	5	618	6	0	4
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	160	42	126	198	3	347	6	687	7	0	4
RTOR Reduction (vph)	0	0	28	0	1	0	0	0	260	0	2	0
Lane Group Flow (vph)	0	171	14	126	200	0	0	353	427	0	9	0
Heavy Vehicles (%)	0%	1%	1%	0%	1%	1%	1%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		
Actuated Green, G (s)		25.0	25.0	25.0	25.0			42.0	42.0		42.0	
Effective Green, g (s)		25.0	25.0	25.0	25.0			42.0	42.0		42.0	
Actuated g/C Ratio		0.33	0.33	0.33	0.33			0.56	0.56		0.56	
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Grp Cap (vph)		615	533	391	626			761	895		886	
v/s Ratio Prot					0.11							
v/s Ratio Perm		0.09	0.03	c0.11				0.26	0.43		0.01	
v/c Ratio		0.28	0.03	0.32	0.32			0.46	0.48		0.01	
Uniform Delay, d1		18.4	16.8	18.7	18.7			9.8	9.9		7.3	
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		1.1	0.1	2.2	1.3			2.0	1.8		0.0	
Delay (s)		19.5	16.9	20.8	20.0			11.8	11.7		7.3	
Level of Service		B	B	C	C			B	B		A	
Approach Delay (s)		19.0			20.3			11.8			7.3	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt		1.00	0.85	1.00	1.00			1.00	0.85		0.94	
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)		1876	1599	1805	1876			1793	1599		1743	
Flt Permitted		0.97	1.00	0.45	1.00			0.72	1.00		0.84	
Satd. Flow (perm)		1825	1599	851	1876			1350	1599		1499	
Volume (vph)	15	221	58	204	274	5	490	8	1102	9	0	6
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	17	246	64	227	304	6	544	9	1224	10	0	7
RTOR Reduction (vph)	0	0	46	0	1	0	0	0	135	0	3	0
Lane Group Flow (vph)	0	263	18	227	309	0	0	553	1089	0	14	0
Heavy Vehicles (%)	0%	1%	1%	0%	1%	1%	1%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		
Actuated Green, G (s)		21.0	21.0	21.0	21.0			46.0	46.0		46.0	
Effective Green, g (s)		21.0	21.0	21.0	21.0			46.0	46.0		46.0	
Actuated g/C Ratio		0.28	0.28	0.28	0.28			0.61	0.61		0.61	
Clearance Time (s)		4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Grp Cap (vph)		511	448	238	525			828	981		919	
v/s Ratio Prot					0.17							
v/s Ratio Perm		0.14	0.04	c0.27				0.41	0.77		0.01	
v/c Ratio		0.51	0.04	0.95	0.59			0.67	1.11		0.02	
Uniform Delay, d1		22.7	19.7	26.5	23.3			9.5	14.5		5.7	
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		3.7	0.2	47.5	4.8			4.3	63.8		0.0	
Delay (s)		26.4	19.8	74.0	28.1			13.7	78.3		5.7	
Level of Service		C	B	E	C			B	E		A	
Approach Delay (s)		25.1			47.5			58.2			5.7	
Approach LOS		C			D			E			A	

Intersection Summary			
HCM Average Control Delay	51.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

The Potential Impact On Fish Habitat Of The Proposed Belleayre Resort At Catskill Park

Piotr Parasiewicz, PhD
49 Janivar Drive
Ithaca, NY 14850

Introduction

Although much of the Northeastern United States receives over 45 inches of precipitation annually, intense urban and residential development has resulted in water shortages in some areas, and difficulties obtaining new water supplies in others. The allocation and preservation of water resources in the face of mounting water demand is an ongoing and increasing challenge. There are growing concerns not only regarding future water availability, but also the ecological and recreational quality of our nation's fresh water systems. This concern is due in part to a growing understanding of the social value of aquatic ecosystems, and appreciation of the complexity of running water ecosystems. Silk et al. (2000) eloquently suggest that, "The natural ecosystem of any river is the product of millions of years of adaptation and evolution, which have created a myriad of variables and subtleties more complex than we can imagine." Due to this complexity, plus continuing conflicts of interest among competing water users, very precise planning and evaluation of potential development impacts is required.

Water allocation issues are not new, and many techniques have been developed in recent decades to address these problems (Stalnaker 1995, Dunbar et al 1998). However, we learned only recently to recognize that not just the quality and quantity of water released below hydropower or irrigation dams is important, but also that modifications of hydrological patterns can have detrimental effects on aquatic life (Richter et al 1997). A recent study in the Ipswich River (Armstrong and others, 2001) demonstrated that ground water withdrawals cause chronic low flows and impair riverine fauna. The process of urbanization changes seasonal hydrographs by increasing peak flows and decreasing base flows (e.g., Bedient and Huber 1988, Dunne & Black 1970, Parasiewicz and Goettel 2003, Petersen, 2001). In the Northeast United States, this hydrological pattern appears to be a regional phenomenon and a lasting legacy of historic deforestation. Even in areas such as the Catskill Mountains that superficially appear to have recovered from historical impacts of timber harvest, similar effects can still be observed (Parasiewicz 2001).[1]

The Catskill Mountain's watersheds are generally rural and topographically steep, with shallow, permeable soils overlaying restrictive bedrock or fragipans. Heightened flow peaks cause severe erosion, leading to down cutting and over-widening of river corridors. The lack of woody debris structure documented in the Stony Clove Creek study in the Catskill Mountains (Parasiewicz et al 2003) is most likely a consequence of increased peak flows, as faster water removes logjams before they can stabilize. Another factor is frequent "cleanups"

[1] Modeling experiment on Town Brook watershed in the Catskill Mountains have shown that reduction of topsoil cover by only a few inches causes a dramatic change of flow pattern, increasing annual amplitudes and shifting timing of high and low flow events (Parasiewicz et al. in print.).

of woody debris as a flood protection measure. These changes, in combination with reduced stream flows and groundwater levels, increase summer water temperatures and cause anchor ice to form in winter. In addition, many river corridors, especially those in urbanized areas, have been physically modified (e.g., straightened, widened, dredged or impounded), altering the character of the corridor (e.g. from braided to straightened) and leading to further modifications in the hydrological regime (Hewlett, J.D. & A.R. Hibbert 1967). The most apparent consequences of such changes in hydrological patterns are a reduction in fish densities and modification of the fish community structure from specialized riverine species towards more generalized species. This phenomenon has been documented in several recent studies in the Northeast Region (eg. Parasiewicz and Goettel 2003b, Parasiewicz et al 2003a, Armstrong et al. 2001).

Project area

The proposed Belleayre Resort at Catskill Park is located in the headwaters of Lost Clove Brook and tributaries to Birch Creek, (third and second order tributaries of Esopus Creek), as well as in headwaters of tributaries to Emory Brook (a second order tributary of the Bush Kill). These high gradient, coldwater streams are classified as *Trout Spawning* streams, or are recommended for upgrade to TS classification, and support a relatively vibrant fish fauna. Electrofishing data collected in 2000 by the NYS DEC (Mike Flaherty, Region 3) show a fish community dominated by trout species. However, differences were noted in the faunal composition between upstream areas dominated by native brook trout and the lower portion of Birch Creek (below the confluence with Crystal Spring Brook), dominated by brown and rainbow trout. The number of juvenile trout recorded indicates healthy reproduction in these streams. The accompanying species include low numbers of slimy sculpin, longnose dace, blacknose dace and white sucker, as is characteristic of New York coldwater streams. The existing electrofishing data provides only a rough assessment of the relative density of species within the fish community, but the overall community appears appropriate for this type of stream.

Upstream of Pine Hill, the habitat quality of Birch Creek appears relatively unimpaired. It has diverse habitat features and is well shaded, meaning low water temperatures can be anticipated. However, the woody debris dams that provide important habitat for brook trout are infrequent. Further downstream, between Pine Hill and the confluence, substantial channel modifications can be observed. Lack of vegetation along some reaches of this section of the stream corridor may result in elevated water temperatures. This would help explain the lower number of brook trout recorded.

There are three stream gauges available for analysis of flows in the effected streams: one is situated on the Bushkill at Arkville (drainage area 46.7 mi^2); one on Birch Creek at Big Indian (12.5 mi^2); and one on the Esopus Creek at Allaben (63.7 mi^2). Of the three gauges, only the latter has sufficient data to allow for a calculation of minimum flows using the widely used method developed by D. L. Tennant (1976). Nevertheless, four years of records on the Big Indian gauge will allow us to analyze flow patterns in Birch Creek and determine the duration and frequency of low flow events.

Hydrogeologist Dr. Andrew Michalski, in his report for the Ashokan/Pepacton and Catskill Mountains chapters of Trout Unlimited, *Comments On Groundwater Issues Of DEIS For Belleayre Resort,* has demonstrated that flows in the evaluated streams are very flashy, with a relatively low amount of ground water contributing to summer flows. These flashy conditions may be caused by shallow soils due to historic deforestation of the region (Parasiewicz 2000). This pattern has been documented in most Northeast streams and is dramatic in the Catskill Mountains, where the high instability of post-glacial till accelerates topsoil removal. The flashiness of flows is clearly visible on the Big Indian hydrograph. Flows in Catskill mountain streams can increase by a magnitude of 45 (see Figure 1). Another characteristic of the flow regime, caused in part by the low storage capacity of surface soils, is extended duration of low flows.

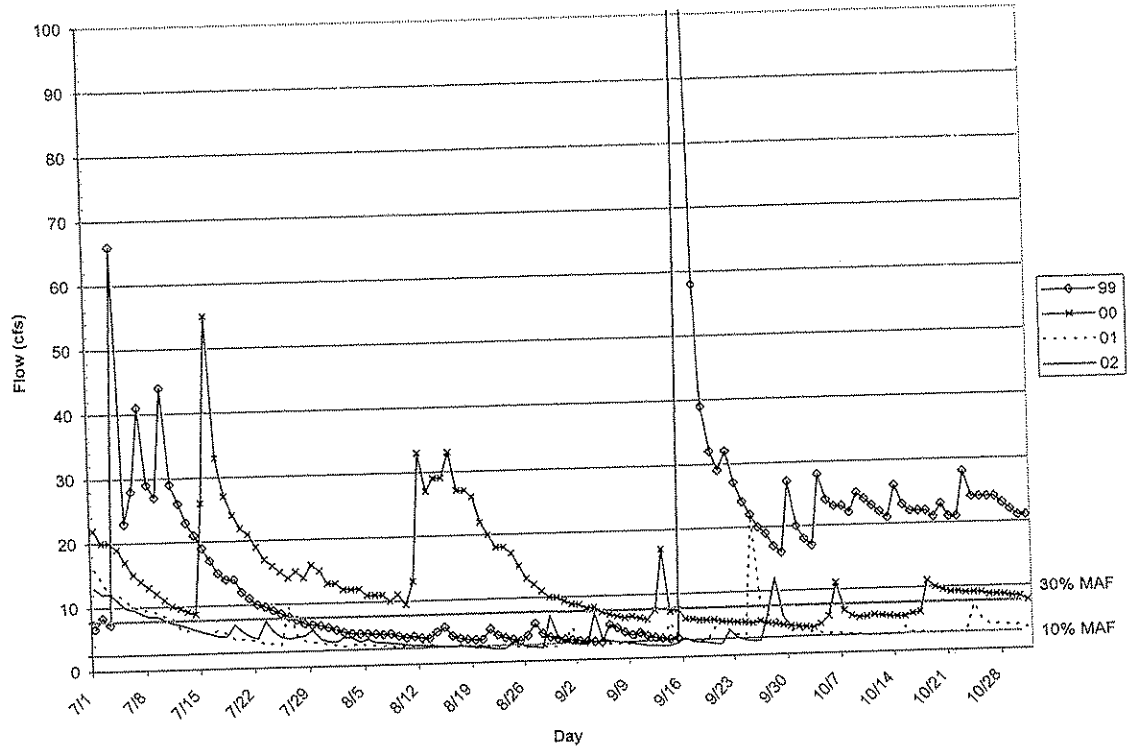


Figure 1: Summer and fall flows in Birch Creek measured at Big Indian gauge.

Tennant argues that 60% of the average flow, "is a base flow recommended to provide excellent to outstanding habitat for most aquatic life forms;" that 30% of the average flow, "is a base flow recommended to sustain good survival habitat for most aquatic life forms;" and that 10% of the average flow, "is a minimum instantaneous flow recommended to sustain short-term survival habitat for most aquatic life forms." According to Tennant, flows below 10% of the average flow, "will result in catastrophic degradation to fish and wildlife resources and harm both the aquatic and riparian environments."

During four summer and fall seasons recorded at the Big Indian gauge, stream flows remained under the 30% Tennant threshold for 63% of the time. During the drought years of 2001 and 2002, flows fell below the 30% threshold for 90% of the time, and for over 70 days without interruption. In addition, flows can stay below the 10 % threshold (indicating "catastrophic degradation") for a period of two weeks continuously. In Birch Creek, low flow durations are likely extended by early withdrawals of water for snowmaking, starting in September. The usual consequences of extended duration and frequency of low flow conditions are elevated temperatures and pollution levels (Figure 2). Canopy cover shading, variability in habitat structure, and a substantial base flow are essential factors in mitigating these impacts.

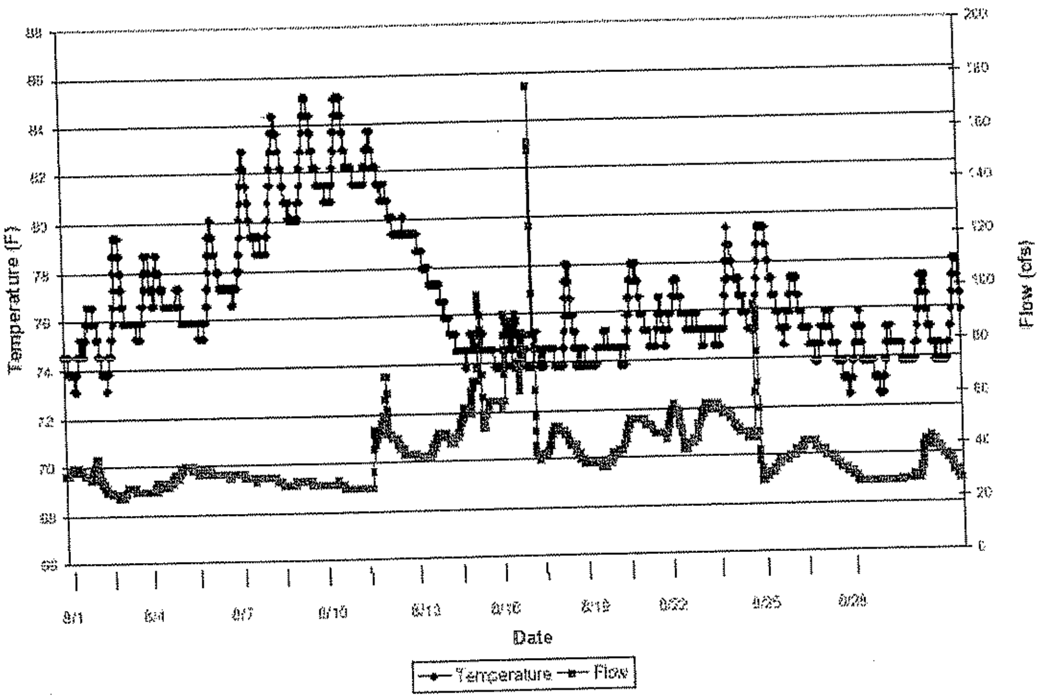


Figure 2: Measurements of flows and temperature at the same location in Quinebaug River. During very low flows temperature steadily increases reaching over 85 F before flow increase reduces it by 10F.

Despite the reduced flows, the temperature measured in the project area creeks is relatively low, likely due to ground water springs entering the surface waters. According to Dr. Michalski, the groundwater contribution in Birch Creek is nominal (only 2.5% of total summer runoff), but it is apparently enough to maintain low temperatures and provide good habitat for salmonid fish species. Ground water intrusions are particularly important for spawning of salmonids, as they are necessary for trout redds and egg survival. Successful spawning of trout is a good indicator of the presence of underwater springs.

Dr. Michalski's analysis indicates that surface and ground water flows are well interconnected in the project area. Consequently, existing ground and surface water withdrawals for domestic use and snowmaking must contribute to the extended duration of low flows in the creeks.

Possible impacts of the resort on Birch Creek and its tributaries.

The data available for the project area are very fragmented, and the type of accurate and precise impact assessment that should be required for a project of this size is not possible at this time. The most complete data are available for Birch Creek, where I will focus my analysis of potential project impacts.

In Birch Creek, the primary impact of the proposed project on aquatic fauna will be through modification of flow regime. This will result in: (1) a reduction of Birch Creek flows due to increased ground water pumping and surface withdrawals for snow-making; and (2) faster surface runoff due to increased impervious area, removal of forest cover, filling and fragmentation of wetlands and compaction of soils on the ski slopes. Increased volume of runoff leads to higher peak flows, increased frequency of bankfull events, increased sediment transport and subsequent channel alteration. The proposed detention basins will most likely do little to mitigate increased volumes, and these increases will result in additional fine sediments being transported downstream, not only from the detention basins, but also due to erosive processes below the ponds. Fine sediments reduce the interstitial space in the gravel substrate, reducing macro-invertebrate production, as well as the survival of trout larvae, as trout larvae actively utilize interstitial spaces immediately after hatching. A secondary effect of detention ponds will be elevated temperature of retained water entering streams after a storm event. The removal of forest vegetation and reduction of wetlands will inevitably lead to reduced subsurface water storage capacity within the watershed, also contributing to lower stream flows during the summer months. Reduced storage will also very likely reduce recharge of ground water and lead to lower ground water intrusion into the streams.

Using recent data from the Big Indian Gauge, we can roughly estimate potential effects of future water withdrawals on flow in Birch Creek. Dr. Michalski indicates the reduction of surface flows could easily be equivalent to pumping rates at Rosenthal wells R1 and R2. In comparison with the present situation, the proposed project would conservatively increase withdrawals by 0.3 cfs. Because the majority of ground water withdrawals take place above the confluence of Birch and Crystal Spring Brook, the impact on flows should be measured at the confluence. The drainage area at this point is approximately 7.2 mi2. Figure 3 presents flows calculated at this location for the period July – October by reducing flows at the Big Indian gauge proportionally to the drainage area (i.e., 57%). The 30% Tennant threshold at this point is *ca.* 4.8 cfs, and the 10% threshold is 1.6 cfs. An additional reduction of flows by 0.3 cfs would increase the durations of flows below the 10% threshold from 11% to 25% (more than twice). In dry years, such as 2001, the flows could remain below this critical level for an entire month. Upstream of the confluence, the flow modification could be more dramatic, and would impact the most valuable fish community in the system. Although this estimate indicates a dramatic change, it is very conservative and does not include any of the flow regime changes described previously. A quantification of such regime changes is possible and highly recommended.

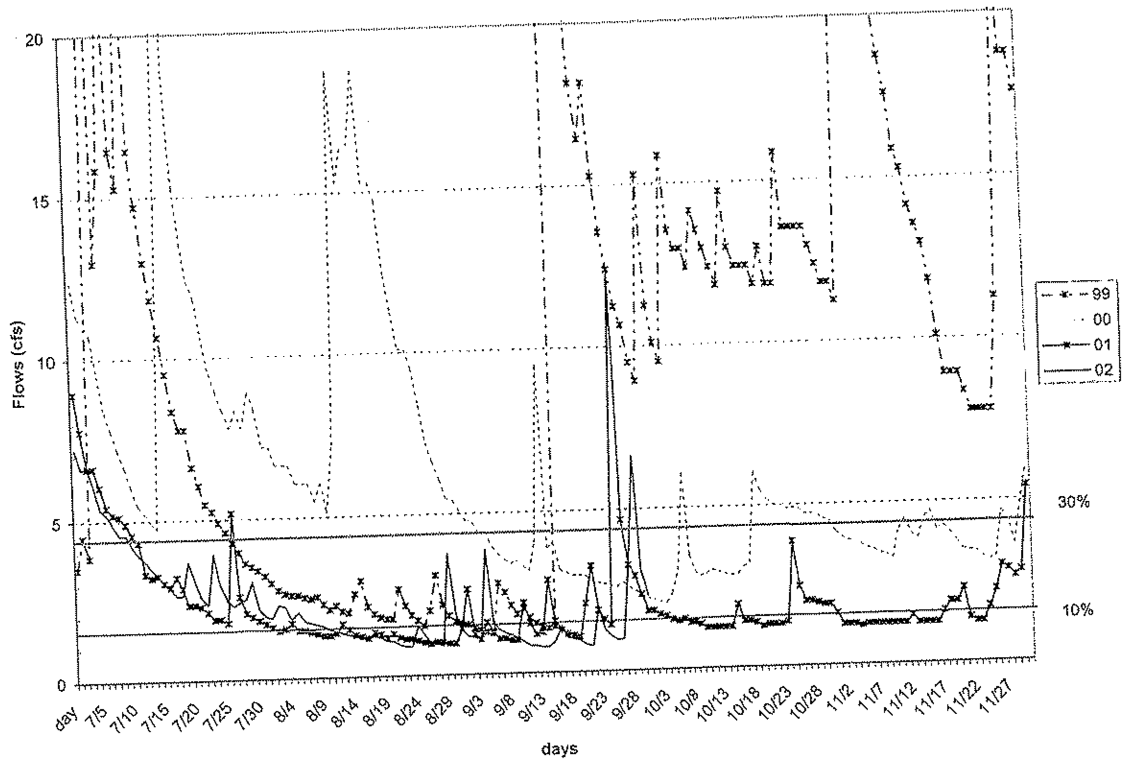


Figure 3: Projected summer and fall flows below the confluence of Birch Creek and Crystal Spring Brook with flows reduced by 0.3 cfs.

The consequences of flow reduction on habitat availability can be severe. Less water means less wetted area (i.e., a smaller river), which limits fish mobility and increases the vulnerability of small fish to predation as shallow margins are removed first. A quantitative study performed on the alpine stream Bregenzerach in Austria documented this phenomenon (Parasiewicz 1997). Reduced flows suppress the separation between juvenile and adult trout habitats, forcing young fish to use high-risk locations. Lower water depth and flow velocities also create habitat that is much less suitable for fluvial specialists that require flowing waters. The expected result is a shift of the fish community structure from specialized species towards habitat generalists. More shallow, slower moving water also warms faster, especially if ground water contributions are diminished. In these conditions, increased effluent discharges from wastewater treatment plants can not only elevate concentration of pollutants, but can also create a thermal barrier, keeping trout from upstream migration. Reduced intrusions from underwater springs may reduce spawning success of trout and negatively affect their populations, not only in Birch Creek but also in the entire Esopus system. In the winter, ground water intrusions increase water temperature in streams, limiting creation of anchor ice. Lack of spring water can catalyze creation of anchor ice that can impact fish larvae as well as channel morphology. Further impacts to fish habitat are associated with destabilization of the flow regime. Higher peak flows can modify channel geometry, creating over-widened channels, as is the case on other rivers in the Catskills, including the Beaver Kill. Reduced number of pools leads to less diverse habitat structure, and reduction of canopy cover elevates summer temperatures even more. Increased sediment transport during higher flows can cause large deposition areas, and even impact bridges and culverts in the watershed.

Furthermore, the project comprises more than 10%-20% of the drainage area, mostly headwaters. It is anticipated that many very small intermittent or even perennial streams will be damaged or filled and eliminated from the stream network by the project. Dr. Michalski has indicated that ground water pumping will affect both Emory and Lost Clove brooks, as well as Birch Creek, and this will therefore likely impact intermittent and perennial streams even outside the project area. It can be expected that the project will not only extend the duration of low flows in larger brooks, but also the duration of dry spell in intermittent streams. For animals depending on water availability in specific periods of the year (e.g. trout larvae), this extended drought will be quite detrimental. As pointed out in a letter to the Headquarters of the Army Corps of Engineers, signed by twenty-one renowned scientists, our country faces a dramatic decline in the quantity and quality of headwater streams. Those streams are an essential element of our landscape, fulfilling important ecological and hydrological functions. Because of their hydrological dynamics, small, perennial and intermittent, streams are fragile environments. The organisms living in such streams are highly specialized and depend strongly on a "concerted" hydrological cycle, i. e., one which provides the right flows at the right times. These factors, too, need to be considered and addressed when planning the Belleayre Resort at Catskill Park.

For all the above reasons, the location of the project in the headwater area demands very thorough impact analysis. Due to the complicated geological nature of the area and the project size, it is impossible to adequately identify impacts on stream flows and aquatic habitat without using a precise watershed-wide hydrological model. To estimate the consequences of flow and morphological changes on resident fish fauna, a quantitative habitat model needs to be coupled with hydrological simulation.

Conclusions

The primary conclusion of the above analysis is that the consequences of building The Belleayre Resort at Catskill Park could be very dramatic, affecting human occupation of the landscape, as well as fish habitat. Therefore, precise planning of such a large undertaking is absolutely necessary. Development of quantitative simulation models of watershed hydrology and aquatic habitat should be prerequisites, before any permits are granted. Precise models can be created only on a basis of thorough collection of biological and physical data (such as flows or temperature) performed over an adequate period of time (2-3 years).

The analysis presented in the DEIS is not convincing, as the non-impact statement can be easily proven wrong using even available data and very conservative scenarios. At a minimum the following impacts can be expected:

- reduction of ground water levels and loss of base flow in adjacent streams,
- increased duration of low flows,
- increased water temperature,
- increased pollution levels, and
- modification of stream morphology.

The biological consequences of these changes would be detrimental to fish fauna, not only causing a reduction of fish densities, but also a shift from a community structure dominated by trout toward one dominated by generalist, warm water species (e.g. bluegill). Convincing proof that this will be avoided has not been provided in DEIS documentation.

Cited Literature

Armstrong, D.A., Richards, T.A., and Parker, G.W., 2001, Assessment of habitat, fish communities, and streamflow requirements for habitat protection, Ipswich River, Massachusetts, 1998-99: U.S. Geological Survey Water-Resources Investigations Report 01-4161, 155 pp. Report on-line

Bedient, P.B. and W.C. Huber 1988. Hydrology and Floodplain Analysis. Addison-Wesley Publishing Co. New York. p.650.

Dunbar, M.J., M.C Acreman,., A. Gustard, and C.R.N. Elliott, (1998): Overseas Approaches to Setting River Flow Objectives. Phase I Report to the Environment Agency. – Environment Agency R&D Technical Report W6-161, Bristol.

Dunne, T., and R.D. Black. 1970. Partial area contributions to storm runoff in a small New England watershed. *Water Resour. Res.* 6: 1296-1311.

Petersen, N. 2001. Philadelphia Inquirer, Thursday edition, September 13, 2001.

Parasiewicz P., (1997): Morphometrisch/hydraulische & fischökologische Nachuntersuchung des KW Alberschwende Bregenzerach, Fachbereich Morphologie/Hydraulik – Report for Hydroelectric Company of Vorarlberg, 174 pp.

Parasiewicz, P. (2001): Strategy for Sustainable Management of the Upper Delaware River Basin. Trout Unlimited. NY. 21pp.

Parasiewicz, P. Kitson, H.,Snopkoski, L. Jackson, S. & S. Destefano (2003a). Measuring ecosystem health in western Massachusetts – The Mill River, Hatfield, MA. Report for
The Nature Conservancy and Massachusetts Environmental Trust. Ithaca, NY. 146pp.

Parasiewicz, P. Ehmann, S. B. & P. Corp (2003b). Fish habitat assessment on Stony Clove Creek, NY using MesoHABSIM. Report for New York City Department of Environmental Protection and Green County Soil and Water Conservation District and New York State Water Resources Institute. 410pp.

Parasiewicz, P. and Goettel, M.T. (2003), "Ecohydrology Study of the Quinebaug River, Final Report", *Instream Habitat Program and New York Cooperative Fish and Wildlife Research Unit*, Department of Natural Resources, Cornell University, July.

Richter, B.D., J.V. Baumgartner, R. Wigington, and D.P. Braun (1997). How much water does a river need? Freshwater Biology, 37 (1): 231-249.

Stalnaker, C (1995): The Instream Flow Incremental Methodology: A primer for IFIM. – National Ecology Research Centre, Internal Publication. U.S Dept of the Interior, National Biological Service, Fort Collins, Colorado.

Silk, N., Mc Donnald, J. and J. Wigington (2000). Turning instream flow water rights upside down. Rivers, 4 (7).

Tennant, L. T., Stream Flow Regimens For Fish, Wildlife, Recreation And Related Environmental Resources. Fisheries, Vol. 1, No. 4, August 1976, pp. 4 – 10.

ATTACHMENT 2

Wellbore Short-Circuits in a Fractured-Rock Aquifer, Catskill Mountains, New York -- Management Considerations

By Heisig, Paul M., U.S. Geological Survey, 425 Jordan Rd., Troy, NY 12180

The 0.3 mile wide Batavia Kill valley in the Catskill Mountains of southeastern New York is underlain by a fractured-rock aquifer consisting of gently dipping sandstones, siltstones, and mudstones in repeating, 50-100 ft fining-upward cycles. Local relief is about 1,500 ft. The predominant water-bearing zones in the valley are hydraulically separate, low-angle bedding-plane fractures within the upper 200 to 300 ft of bedrock. Hillside areas are most fractured within the upper 150 ft and have nearly equal occurrences of low-angle and high- angle fractures. Reported yields from driller's logs indicate that fractured bedrock is most productive within, or adjacent to, the valley bottom area. Saline water in deeper fractures in valley-bottom and hillside areas represents the lower boundary of the aquifer.

Data on the fractured bedrock-aquifer indicates that open wellbores in the bedrock can act as short circuits within the ground-water flow system. Borehole-geophysical logs and depth-specific, water-quality analyses indicate that such wellbores can interconnect previously isolated fracture zones of differing water chemistry and hydraulic head. Water-level responses during a 48-hour aquifer test (75 gal/min) indicate that the bedrock aquifer has very little storage. Measured and estimated vertical flow in nine observation wells suggest as much as 25 percent of the pumped discharge is from short-circuited flow. This water is drawn (short circuited) from zones that were naturally isolated from zones that the production well draws water from. Some parts of the aquifer may risk contamination as a result of vertical borehole flow. Pumping of supply wells could induce saline water at depth in some wells may be induced to flow up the wellbores and into fractures containing fresh water.

Based on the results of geohydrologic testing, the following water-management considerations are presented:
1. Reported yields of bedrock wells that tap the same fracture zone(s) are probably not realistic because of aquifer storage is limited; therefore, aquifer testing at a proposed supply well warrants water-level measurements in bedrock wells as far as 1 mi up- and down-valley, and use of multiple withdrawal rates (in conjunction with withdrawals from local supply wells) that can be used to identify (bracket) yields that can be maintained without depleting the aquifer.
2. Borehole-flow data imply that borehole short circuits at new outlying wells could increase the yields of bedrock supply wells that tap only deep fractures. The most productive short circuits interconnect shallow fractures, in hydraulic connection with overlying saturated valley-fill, with deeper isolated fractures.
3. Borehole profiling of specific conductance at new and existing wells can indicate the presence for saline water, and filling such wells with grout and abandoning them would prevent upward movement and contamination of the aquifer.

Citation: Heisig, Paul M., 2002, Wellbore short-circuits in a fractured-rock aquifer, Catskill Mountains, New York -- Management considerations [abs]: in Fractured-Rock Aquifers 2002, Denver, Colo., 2002, Proceedings: National Ground Water Association, p. 177-178

Back to USGS in New York State

April 19, 2004

Neil F. Woodworth, Counsel
Adirondack Mountain Club
301 Hamilton St.
Albany, NY 12210-1738

Dear Neil Woodworth,

In response to your inquiry regarding the potential impacts of the proposed Belleayre Resort on Forest Preserve lands in the Catskill Park, my opinion is that there will be substantial negative impacts on Forest Preserve lands due to very large increases in visitation as projected in the Crossroads Venture Draft Environmental Impact Statement (DEIS).

The projected visitation as outlined in Appendix 26 of the DEIS (pages 4-23) is difficult to completely assess because the units seem to vary between visitors per year and visitor nights per year. Assuming these are mostly people per year, there are more than 637,800 people projected (435,860 persons at the timeshare and Club interval ownership units; 195,250 visitors or visitor nights per year at various hotels; and 6,707 people or visitor nights per year at Highmount Estates) to be customers and residents each year in these facilities. Given that the project is targeted toward a non-skier market that will access the Catskill Forest Preserve, then the question is where does the DEIS address this enormous increase in use and potential impacts on the surrounding Forest Preserve lands?

The relative scale of this development is environmentally significant because it will bring in more than ten times the current reported annual use of 39,107 to 49,368 trail visits on all Forest Preserve trails in all areas of the Catskill Park (during 1994 through 2003). Even if we make an extraordinarily conservative assumption that only one half of those visitors and seasonal residents will spend **only one trip per year** on those Forest Preserve lands, it will be an average of a 700% increase in use across all Forest Preserve trails. If the impacts are more localized in the immediate area of the proposed projects, the increase in visitation becomes even more profound and troubling because it has not yet been addressed in the DEIS. Furthermore, the existing NYSDEC Unit Management Plans for the Wilderness and Wild Forest areas must be considered along with the Catskill State Land Management Plan in the DEIS. For example, the Slide Mountain Unit Management Plan specifically notes that overuse is one of the largest threats to the integrity of that area – and that was stated well before this project was proposed.

I am greatly concerned about the need for a complete environmental impact assessment of these potential devastating and long-term impacts to a valued NYS resource and legacy. The potential types of impacts include changes to the biological/ecological, physical, and social conditions within these Forest Preserve areas. Let me briefly give several examples of each to illustrate the types of information that will be necessary for management with substantially increased visitation:

- Biological and ecological impacts include more trampled and disturbed vegetation, sound and sight disturbance of human presence on breeding and nesting birds, animal behavior change to avoid areas of human influence, and changes in the ecosystem due to physical changes like soil erosion and human waste.
- Physical changes include trail erosion due to soil compaction and vegetation trampling, trial widening and multiple trail treads due to visitor avoiding each

other and eroded and wet trail conditions, increased soil compaction and vegetation trampling at scenic overlooks and resting places, and increasing amount of litter and human waste on or near the ground surface.

- Social conditions change with increasing visitation such as users attempting to avoid each other at congested or crowded areas by temporally or spatially redistributing themselves and causing more biological and physical impacts, decreased satisfaction with the experiences in spite of using coping mechanisms, and more safety issues and rescues for unprepared people attempting to travel in conditions that are intended to be wilderness.

These public land areas are legislatively protected for specific types and amount of visitation and use to preserve these wild forest settings and wilderness conditions for present and future generations -- all of which is carefully specified in the Catskill State Land Management Plan.

Please let me know if I can provide any further information.

Sincerely,

Chad P. Dawson

Chad P. Dawson
Professor and Chair
Faculty of Forest and Natural Resources Management
SUNY College of Environmental Science and Forestry
320 Bray Hall
One Forestry Drive
Syracuse, NY 13210
315-470-6534

Environmental Research and Education
Science for Conservation

Hudsonia
a non-profit institute

Hudsonia, Ltd.
PO Box 5000
Annandale, NY 12504-5000

Phone: (845) 758-7053, 758-7023
Fax: (845) 758-7033

Review of the DEIS for the Proposed Crossroads Ventures Belleayre Resort at Catskill Park, Ulster and Delaware Counties, New York, with Respect to Biological Diversity

by Erik Kiviat, Ph.D.

Hudsonia Ltd.

P.O. Box 5000, Annandale NY 12504-5000

Report to the Catskill Center

21 April 2004

At the request of the Catskill Center, Hudsonia reviewed selected portions of the Draft Environmental Impact Statement (DEIS) for the proposed Crossroads Ventures LLC The Belleayre Resort at Catskill Park residential, resort, and golf course development project. The proposed project is located on Belleayre Mountain (eastern portion of the site) and Fleischmanns Mountain (western portion), with the existing Belleayre ski area in the middle. My review focused on biological resources and biological diversity issues. In addition to examining the DEIS, I spent a day in the vicinity of the project site, and studied various maps. The maps including some of those associated with the development proposal, and the U.S. Geological Survey 7.5 minute topographic maps (Fleischmanns, Seager, Shandaken, and West Kill quadrangles) and the Central Catskill Trails map (New York - New Jersey Trail Conference 1989). I also referred to literature on the natural history and ecology of the Catskill Mountains including Lawrence (1953), McIntosh (1972), McAllister and Ochman (1989), Bierhorst (1995), Adams (2001), and Kiviat and Stevens (2001).

Hudsonia Ltd. is a non-advocacy organization and does not support or oppose land use projects. We examine environmental documents, other existing information, and characteristics of a site and analyze biological and ecological impacts of a proposed project.

Field Reconnaissance

On 16 April 2004, accompanied most of the time by James (Spider) Barbour, I visted the margins of the site. We walked from the Lost Clove Road trailhead up the Lost Clove Trail and down the Pine Hill - West Branch Trail to Woodchuck Hollow Road. We then drove public roads around the western portion of the site. Finally, I walked near the site boundary in Belleayre Beach Park. I was in the area ca. 1000-1700 h EDT. The weather was sunny, temperatures mild to cool depending on aspect, and the wind about Beaufort 2. There were small remnants (each $< 1\ m^2$) of snow and ice in spots sheltered from the sun, and small patches of snow were also visible in the distance on the upper north-facing slope of Balsam Mountain.

Large areas of the forest near the Lost Clove Trail are dominated or co-dominated by beech (*Fagus grandifolia*) along with several other hardwood species including sugar maple (*Acer saccharum*) and white ash (*Fraxinus americana*). The abundance of beech in extensive areas was striking. The DEIS refers to forests co-dominated by beech. McIntosh (1972) stated that the most notable change in the Catskill Forests he sampled since surveyors' records of witness trees ca. 1800 was the decline of beech, and beech is subject to a fungal disease (Robinson et al. 2001) which may be responsible for continuing declines of this species. A history of logging on the eastern portion of the site may have promoted the dominance of beech which may undergo colonial (vegetative) reproduction following logging (see Robinson et al. 2001). Forests with such a large component of beech may be unusual in the Catskill Mountains and could have special biodiversity values such as associated rare specialist insects or fungi, or animals that use beech mast as a critical resource.

In one area along the Pine Hill - West Branch Trail, there was a mature forest with sugar maple, white ash, beech, yellow birch (*Betula alleghaniensis*), and hop-hornbeam (*Ostrya virginiana*;

rare in this stand?). Many trees were 35 cm diameter-at-breast-height (dbh). In this area, and locally elsewhere, were numerous rock outcrops bearing lush growths of bryophytes, shining clubmoss (*Lycopodium lucidulum*), and other small plants. There was a substantial area of mature forest along the Lost Clove Trail, with trees to 30-35 cm dbh at lower elevations, and much larger trees to 60 cm at higher elevations. These forests contained beech, sugar maple, red maple (*Acer rubrum*), striped maple (*Acer pensylvanicum*), red oak (*Quercus rubra*), white ask, black birch (*Betula lenta*), yellow birch, hemlock (*Tsuga canadensis*), hop-hornbeam, basswood, and black cherry (*Prunus serotina*), with beech and sugar maple abundant. McAllister and Ochman (1989) referred to a 9.9 mile stretch of "virgin forest" along the Pine Hill - West Branch Trail; however, it is unclear from this reference whether the segments of the trail on or near the proposed resort site are bordered by this forest. Kudish (1994) discussed the importance of "first-growth" (or "virgin") forest in the Catskills.

There were plant species indicative of somewhat calcareous soils, including occasional basswood (*Tilia americana*) along Lost Clove Trail, wild columbine (*Aquilegia canadensis*) locally common on the Lost Clove Trail trailbed, white ash locally common in the forests, golden saxifrage (*Chrysosplenium americanum*) in a spring near the headwaters of Giggle Brook, and wild leek (*Allium tricoccum*) near Giggle Brook headwaters. Soils in the Catskill Mountains tend to be somewhat acidic, and it may be unusual to find areas of calcareous soils. There may be pockets of calcareous glacial drift from the Helderbergs or other limestone terrains to the north of the Catskills. Calcareous soils *per se*, and also any soil that may be limited in extent, could support rare species and should be investigated further. Generally, soils along the Lost Clove Trail were extremely stony, and in places verged on scree or talus. This also may be unusual in the Catskills.

Limited observations suggested a diverse community of forest floor wildflowers in the general vicinity of the head of Giggle Brook. Species included blue cohosh (*Caulophyllum thalictroides*), wild leek, Virginia waterleaf (*Hydrophyllum* cf. *virginianum*), *Dicentra* cf. *cucullaria*), trout-lily (*Erythronium americanum*), and spring beauty (*Claytonia virginica*). The unusual-looking fungus, scarlet cup (*Sarcoscypha coccinea*), was fruiting in this area. We also saw *Viola rotundifolia* on the Lost Clove Trail trailbed. Areas of seeps and springs generally associated with headwaters of Giggle Hollow Brook and tributaries are potential habitat for the federally-listed Threatened species northern monkshood (*Aconitum noveboracense*) (Mitchell and Sheviak 1981; J. Barbour, personal communication). Rock outcrops, especially calcareous rocks, and woodlands with rich soil may support moschatel (*Adoxa moschatellina*), a New York State Threatened species (Mitchell and Sheviak 1981); this species could occur on the site in the Giggle Hollow Brook watershed.

Birds seen or heard on or close to the site included downy woodpecker, yellow-bellied sapsucker, eastern phoebe, tree swallow, American crow, white-breasted nuthatch, black-capped chickadee, tufted titmouse, brown creeper, American robin, and dark-eyed junco. Several sapsuckers were drumming and calling at widely scattered locations. We also saw porcupine sign and a dead porcupine, and red squirrel.

Japanese knotweed (*Fallopia japonica*) was scattered along Woodchuck Hollow Road, and common in Belleayre Beach Park. At the latter location knotweed has extensively colonized graded and rip-rapped slopes and banks. Japanese knotweed is a potentially serious pest that is likely to invade areas where soil has been graded, moved, or disturbed in other ways in connection with the proposed development. Once established on streambanks, knotweed will spread downstream by water dispersal of vegetative fragments, and infest downstream areas that have not been disturbed by development activities (see Talmage and Kiviat 2003).

The overall picture of the site, based on my limited reconnaissance, is one of very extensive hardwood forests. Forests vary from mature with good-sized trees to sprout growth after heavy logging. There are areas of very stony soils, and areas with rock outcrops. Spring and seep habitats, and streamside habitats, support a diverse wildflower community and are potential habitat for rare plants. Topography is rugged on the eastern portion and somewhat gentler on the western portion.

DEIS

The DEIS contains brief descriptions of forests, lists of plants identified in association with wetland delineations, and the results of spring-summer surveys of birds, reptiles, and amphibians. I could not find the names and qualifications of the biologist(s) who conducted the zoological surveys. More highly experienced field workers find more species and individuals in field surveys, therefore the biologists' qualifications are very important. The surveys are referred to as "extensive" (DEIS 3-97) but apparently occupied only 8 days. For a site covering nearly 2000 acres, this was a small amount of effort. Ornithologists typically consider 3-5 visits per habitat unit to be sufficient to detect all or almost all of the breeding birds in a unit, and it seems impossible to reach that level of coverage on a site of the size and variety, and with topography as rugged and road access as limited, as the Belleayre site in 8 days.

The survey of the literature on Catskill Mountain zoology was apparently limited to the 5 references cited in Appendix 20, only 1 of which pertain directly to the region. It surprises me that the biologists conducting the zoological surveys apparently did not refer to important references on the region (e.g., Lawrence 1953, Bierhorst 1995, Adams 2001) as background for planning and executing the Belleayre surveys. Conducting biological surveys "in a vaccuum" increases the likelihood of missing rare or otherwise significant species or communities. In addition to the lack of a regional literature survey, it is surprising that key references such as *Birds of North America* were not cited for information on species of concern such as sharp-shinned hawk (DEIS 3-98).

Although the DEIS discusses onsite forests, the potential significance of the extensive forests onsite relative to forests offsite is not addressed. The site is part of a very extensive forest that includes the two largest designated Wilderness Areas of the Catskill Park; in fact the eastern portion of the site lies directly between these two Wilderness Areas. In the absence of evidence to the contrary, these extensive blocks of forest must be presumed essential features of the Catskill Mountains that support wide-ranging, area-sensitive, or forest-interior species such as black bear, fisher, bobcat, barred owl, many other bird species, and timber rattlesnake. Potential impacts of the proposed resort development on such species should be addressed. In addition, the potential of the black bear and porcupine to become pests and possibly a danger to inhabitants and structures should be considered. It may be appropriate to design structures that are bear-proof and porcupine-proof.

Biological surveys for a project the size of the proposed resort development should not have been limited to birds, reptiles, and amphibians, nor should the concern about rare species be restricted to those animals listed as Endangered, Threatened, or Special Concern, and plants or animals ranked as S1, S2, or S3 by the New York Natural Heritage Program. A rare plant survey should have been conducted by field botanists familiar with northern monkshood, moschatel, and other rare species of the Catskills in flowering and non-flowering condition. Sedges (*Carex* spp.) of the Catskills are poorly known (J. Barbour, personal communication), and rare sedges of statewide or regional significance could be present onsite, e.g., in the seeps and calcareous woods of the Giggle Brook watershed. The list of "Flora of the wetlands and uplands of the Belleayre Resort site" (Table 1, Wetland Delineation Report) is not a complete flora of the site and this survey is unlikely to have detected any rare plants that may be present onsite because the survey was incidental to another task (wetland delineation).

There seems to have been no concern that rare or uncommon small mammals of well-developed forests or rocky habitats might be present. Among such species are the smoky shrew (*Sorex fumeus*), woodland jumping mouse (*Napaeozapus insignis*), and rock vole (*Microtus chrotorrhinus*) (see Whitaker and Hamilton 1998). DEIS page 3-98 dismisses the possibility of Indiana bats (*Myotis sodalis*; federally listed as Endangered) using the site with a weak explanation of the reasoning behind this conclusion. For example, Indiana bat is stated to select trees 30-57 cm dbh for maternity roosts and DEIS 3-98 states that average dbh of trees onsite is less than 30 cm. Yet there are many trees greater than 30 cm dbh near the Lost Clove and Pine Hill - West Branch trails, both onsite and just offsite. In addition to maternity roosts, are there other activities such as foraging, or roosting by males, that might bring this species to the site?

Bierhorst (1995) reported timber rattlesnake (*Crotalus horridus*) sightings and a possible historic den area in the Town of Olive. Although that location is distant from Belleayre Mountain, Bierhorst's reports illustrate the possibility that there survive rattlesnake populations outside the two well-known populations of the Catskills (see Perri 2002). The DEIS (Appendix 20) noted that a black rat snake (*Elaphe obsoleta*) was found at a "steep rockslide on the south-facing slopes of the western section of the property." This brief habitat description suggests a potential timber rattlesnake den habitat. That habitat could also be suitable for a variety of other rare or vulnerable species including long-tailed shrew (*Sorex dispar*), rock vole, worm-eating warbler (*Helmitheros vermivorus*), and eastern small-footed myotis (a bat; *Myotis leibii*).

DEIS Appendix 20 reported an observation of a "booming" common nighthawk during the breeding season that might have nested on a powerline right-of-way. It is unclear why special observations were not made to determine if nighthawks were indeed breeding at the site. This species has essentially disappeared from the Hudson Valley - Catskill Mountains region as far as I know, and a breeding record would be of great interest. Other birds reported in Appendix 20 that require more attention are the sharp-shinned hawk (*Accipiter striatus*), broad-winged hawk

(*Buteo platypterus*), barred owl (*Strix varia*), common raven (*Corvus corax*), and several forest-interior breeding songbirds. The DEIS (3-97) dismisses the possibility of red-shouldered hawk (*Buteo lineatus*; Special Concern) breeding at the site because this species was not found during the bird surveys; however, red-shouldered hawks are most vocal and easiest to locate in early spring (e.g., April), and the bird survey included only 1 day in April. Development of the Belleayre site will fragment the forest and open it to increased activity of nest predators and brown-headed cowbird (*Molothrus ater*). This impact is likely to affect many forest bird species disproportionately to the actual area of forest removed.

Breeding birds are not the only birds of significance. For example, Parkes (1954) reported hawk owl (*Surnia ulula*) and gray jay (*Perisoreus canadensis*) in winter at Oliverea, not far from the site. Both species were first records for the Catskills and both are still of great interest. It is unknown whether the Belleayre site offers special habitats to birds in winter or during migration.

Wood turtle (*Clemmys insculpta*) and spotted turtle (*Clemmys guttata*), both Special Concern species in New York, could occur on or just downstream of the site. I doubt that the herpetological survey was intensive enough to have a high probability of detecting these species if indeed they are present.

Spring salamander (*Gyrinophilus porphyriticus*) and red salamander (*Pseudotriton ruber*), both known to occur in the Catskills region and both probably regionally-rare, were not found during the applicant's biological surveys (DEIS Appendix 20). I question whether survey intensity was adequate to detect these species of stream salamanders. The DEIS apparently does not mention potential impacts of the project to stream salamanders (species found and not found during the surveys), most of which depend upon good water quality. Northern dusky salamander (*Desmognathus fuscus*), for example, was found in one area on three different dates. This species was formerly common in Dutchess County, according to 1930s state stream survey data and my own observations, but is now very hard to find in Dutchess. Pervasive changes to hydrology and water quality are likely the cause of this decline.

The DEIS reports fish survey data showing that all the streams of sufficient size on and near the site support trout including brook trout (*Salvelinus fontinalis*). Slimy sculpin (*Cottus cognatus*) has also been documented (DEIS 3-102). Brook trout and slimy sculpin depend on cool flowing water with high dissolved oxygen content and otherwise good water quality. The proposed development is likely to cause massive soil erosion on the steep slopes, and the resulting siltation would increase turbidity, nutrient levels, and temperature, and decrease dissolved oxygen in the local streams. Operation of the golf courses and other proposed components would add additional nutrients, as well as pesticides, to the streams. Although the lake in Belleayre Beach Park is apparently fed by a bypass from the stream that flows just north of the lake, construction upslope (south) of the lake could cause direct runoff to pollute the lake with sediment and nutrients.

The DEIS does not address offsite impacts of the proposed development on biodiversity. The resort project is intended to attract large numbers of outdoor recreationists year-round, and many of these people will be hiking, fishing, birdwatching, and ski touring offsite as well as in undeveloped areas of the site itself. Recent research has shown that recreationists simply walking through forests can have substantial behavioral impacts on breeding songbirds. Recreation could affect Bicknell's thrush (a federally listed species; *Catharus bicknelli*), other birds, snakes, stream salamanders, brook trout, slimy sculpin, the virgin forest, and other species and communities within several miles of the site.

The DEIS does not accord any recognition to the importance of invertebrates in biological diversity. A rare species of tiger beetle (*Cicindela ancocisconensis*) has been found near the site (The Nature Conservancy, *fide* Tom Alworth). This is a streamside species. Possible occurrence on the site, as well as potential downstream impacts of development on offsite populations, should be considered. The site could support rare butterflies and moths. Bierhorst (1995) reported that two undescribed species of noctuid moths in the genera *Anomogyna* and *Idia* have been found in the Town of Olive. There is potential habitat for early hairstreak (*Erora laeta*); this rare butterfly will probably be added to the New York Natural Heritage Program Active Inventory List in 2004 (J. Barbour, personal communication). A ground beetle (*Platypatrobus lacustris*) otherwise known only from outside New York has also been found in Olive (Bierhorst 1995). This information indicates the limited knowledge of the Catskill insect fauna. At the very least, rare species and new species known from areas nearby such as Olive should be searched for in appropriate habitats on the Belleayre site.

Several wetlands onsite are reported in the DEIS to be "isolated" (i.e., lacking surface water connections to stream systems) and thus not under federal jurisdiction. The hydrology of these wetlands should be checked by an experienced, independent wetland scientist to confirm that they are indeed "isolated" and also to determine if they are potential habitat for pool-breeding amphibians or have other important biodiversity support functions.

DEIS 3-97 states that a letter from the New York Natural Heritage Program (NHP) dated 4 May 2000 reported no known records of rare species or communities at the site. NHP routinely requests that inquiries be updated annually to find any newly acquired data, and this inquiry is now almost four years old. The inquiry to NHP should be updated.

Although the DEIS states that 73% of the site will remain undeveloped, the impacts of the proposed development will extend into undeveloped areas onsite and offsite. The DEIS does not provide adequate information to allow reasonable analysis and assessment of the impacts of such a massive project on biodiversity.

References Cited

Adams, M.S. 2001. Catskill ecosystem health: Proceedings of a symposium. Purple Mountain Press, Fleischmanns, New York. 201 p.

Bierhorst, J. 1995. The Ashokan Catskills: A natural history. Purple Mountain Press, Fleischmanns, New York and The Catskill Center for Conservation and Development, Arkville, New York. 117 p.

Kiviat, E. & G. Stevens. 2001. Biodiversity assessment manual for the Hudson River estuary corridor. New York State Department of Environmental Conservation, New Paltz, New York. 508 p.

Kudish, M. 1994. First-growth forest in the Catskills. Catskill Center News 23(2):10-11.

Lawrence, J.E. 1953. Snakes of the Catskills: A guide to their recognition. Published by the author, Woodstock, New York. 36 p.

McAllister, L. and M.S. Ochman. 1989. Hiking the Catskills. New York - New Jersey Trail Conference. 377 p.

McIntosh, R.P. 1972. Forests of the Catskill Mountains, New York. Ecological Monographs 42:143-161.

Mitchell, R.S. & C.J. Sheviak. 1981. Rare plants of New York State. New York State Museum Bulletin 445, 96 p.

New York - New Jersey Trail Conference. 1989. Catskill Forest Preserve: Central Catskill trails. Trail Map 42. Fourth Edition. NYNJTC, New York, New York. 1 map sheet.

Parkes, K.C. 1954. Notes on some birds of the Adirondack and Catskill mountains, New York. Annals of the Carnegie Museum 33 (Article 8):149-178.

Perri, P. 2002. Timber rattlesnakes and changing land use: A management plan for the Catskill Park, New York. M.S. thesis, Bard College, Annandale, New York. 76 p.

Robinson, G.R., N.D. Wright and I.P. Robinson. 2001. Land use history and spatial variability in the beech bark disease. P. 31-52 in M.S. Adams, ed. Catskill Ecosystem Health: Proceedings of a Symposium. Purple Mountain Press, Fleischmanns, New York.

Talmage, E. & E. Kiviat. 2003. Japanese knotweed and water quality on the Batavia Kill in Greene County, New York: Background information and literature review. Report to Greene County Soil and Water Conservation District, and New York City Department of Environmental Protection. Hudsonia Ltd., Annandale, NY. 29 p.

Whitaker, J.O., Jr. & W.J. Hamilton, Jr. 1998. Mammals of the eastern United States. Third edition. Comstock Publishing Associates, Ithaca, New York. 583 p.

Audubon New York

200 Trillium Lane, Albany, NY 12203

Comments for the public meetings on the Belleayre Resort at Catskill Park, Jan. 14 and 15, 2004, and submitted in a revised form April 23, 2004.

My name is Graham Cox. I am coordinator of Audubon New York's forest and wetland programs. I have an M.S. in economics and a Ph.D. in ecological economics from RPI. Ecological economics is, put simply, the economic study of sustainable development.

Audubon New York is a conservation organization with 45,000 members and 30 chapters across New York State. The mission of Audubon New York is the protection of birds and other wildlife and the habitat that supports them. We are part of a national organization with half a million members throughout North and Central America.

The following chapters represent members in the area impacted by this project: Northern Catskills, Capital Region, Delaware-Otsego, Orange County, Sullivan County, as well as our New York City chapter (with 10,000 members) and seven chapters in the NYC metro area in Putnam, Westchester and Rockland counties. These are all members who are served by the NYC metropolitan water supply, both east and west of the Hudson River. You will be receiving additional comments from several of our chapters, including substantive comments from Audubon's New York City chapter.

It is obvious that many of our members in the Catskill Region and metropolitan area chapters will be directly impacted by the adverse impacts of this resort project -- impacted by the likely changes in water quality and by the tax and fee bills they will be presented with as a result of the adverse impacts of this resort project.

Audubon New York is guided by several policy resolutions which pertain to the Catskill Park and the New York City watershed counties. In summary, we oppose any projects that will adversely affect the drinking water resources of the region; we oppose projects that can harm bird habitat, especially at the higher elevations of the Park and the watershed; we support the state's habitat conservation and bird protection measures for the designated Bird Conservation Areas (BCAs) in the Park and watershed, included the BCA currently designated by the state DEC for the Catskill High Peaks.

Audubon New York has a resolution specific to this Belleayre resort project, stating in part, that we will be active in the SEQRA process, that we will scrutinize the likely impacts of this project on the habitat, regional water quality and water flows, and that we oppose the project as proposed and will do so until such a time that the developer and the state can show that the environmental, economic and social benefits can by far outweigh the costs, both locally and regionally.

The reasons for our opposition were outlined in a letter to the State DEC more than a year ago when the first draft of the EIS was released for review and comment. I will repeat them here:

1. The project involves clearing and altering the terrain on nearly one square mile of high elevation habitat in two watersheds -- the Ashokan and Pepacton river systems, both major parts of the bigger New York City watershed. We support maintaining this system in such a way that the city water does not have to be filtered, at considerable cost to all taxpayers.
2. We are concerned about protecting the integrity of higher elevation matrix hardwood forests, as habitat for an array of bird species. Though there is no one species that has been determined as threatened or endangered, it is the conservation of the variety and population numbers that is of most concern to wildlife biologists. This can only be done by protecting the forested habitat as a whole. This is the prime purpose of the Forest Preserve within the Catskill Park. Protecting the forest habitat has the secondary benefits of protecting the watershed and the water quality for all the other dependent uses.
3. Although Belleayre Mountain is not part of Audubon New York's existing Catskill Peaks IBA, it is part of the newly expanded Catskill IBA that we expect will be approved in the spring of 2004 by a technical review team. Belleayre Mountain is at the edge of this new IBA, which as delineated by the contiguous habitat. The new Catskill IBA was identified because it is one of the largest, most intact habitats for the assemblage of forest responsibility species in New York's portion of the Appalachian Mountains Bird Conservation Region Responsibility species are those for which the region has responsibility for their long-term conservation because they are found at high relative abundances and/or have a disproportionately high percentage of their populations in this BCR. The Catskill IBA supports the following species from the Appalachian Mountain BCR forest assemblage Black-and-white Warbler, Black-billed Cuckoo, Black-throated Blue Warbler, Blue-gray Gnatcatcher, Canada Warbler, Cerulean Warbler, Eastern Wood-Pewee, Least Flycatcher, Louisiana Waterthrush, Northern Flicker, Rose-breasted Grosbeak, Scarlet Tanager, Sharp-shinned Hawk, Wood Thrush, and Yellow-throated Vireo. From an Audubon New York bird conservation position, we would oppose large, fragmenting developments within this IBA, because they degrade the intactness and quality of the habitat for breeding birds.
4. The project is totally out of proportion to the needs and resources of the existing communities along the Route 28 corridor through the Catskill Park. This pertains to the ecological, economic and social environments in total. We are dealing here with the scale and the location of the facilities. In essence, the proposal is akin to a Wal-Mart being located in a struggling rural community. It may look attractive to the economic developers, but it is devastating to the existing business and social structure. It will destroy the existing business, take away their customers, raise their property taxes to support the services needed and cover the additional costs for a host of social services. Further, it will generate and concentrate traffic problems, take precious drinking water resources from the local communities, result in surface and groundwater pollution and so result in a degradation of the watershed resources.
5. We believe there are better alternatives to this project which have not been considered seriously by the developer and the State DEC. These alternatives would provide many more benefits to the ecological and social communities in the watershed. Investing in the existing communities, putting the golf courses and conference center in existing communities, investing in the small businesses (shops, restaurants, bed & breakfast units) along the length of the Route 28 corridor, are some suggestions. We believe that this sort of alternative -- small scale, fitting in to the existing communities, minimizing the impacts, following the precautionary principle -- have not been seriously considered in this impact statement because the developer is locked in to the two properties they have purchased.

A first review of the Draft EIS as published now has not changed our opinions about this project.

Our prime concerns focus on the "smart growth" implications, that is to say, this does not follow the smart growth principles which are now becoming accepted by the planning community across this and many other states and which are now being embodied in the policies of this state governor and this state government. They are summarized by the governor's Quality Communities executive order of January 2000, the report of the Quality Communities Task Force of February, 2001, and in state legislation introduced in sessions of the State Legislature since 2000. We will remind you of some of these smart growth principles:

1. The basic idea is to encourage the use of the existing development infrastructure, rather than foster sprawl, so as to preserve open space, natural habitat and agricultural resources. It is to enhance urban centers and neighborhoods, support traditional cities, villages and hamlets, and where possible support the continued viability of rural communities.
2. This can be achieved by local communities developing a collaborative smart growth plan of their own, laying out their own vision for their own communities. This does not include a vision imposed from outside, nor does it include development of such a scale that it overwhelms the community and their resources.
3. The principles work to enhance a sense of community; protect investment in existing communities and neighborhoods; protect environmental quality and conserve open space; protect the farming community; decrease congestion by providing alternative modes of transport; use energy conservation as a foundation for planning and design; and make efficient use of limited public financial resources.
4. The key to this is coordinated planning at the community, regional and state levels.

We are of the opinion that these basic principles are violated by the sheer size and character of this project. Furthermore, the process of community involvement and collaboration on a development plan for this region that is of an appropriate scale and character has been ignored and thwarted by the developer and by the state. Put bluntly, this is not by any measure a development that could be considered a sustainable development project; it violates all the principles I have listed above.

Thank you for considering our concerns.

For further information, please contact: Graham L. Cox, Ph.D., coordinator of forest and wetlands programs, Audubon New York, 200 Trillium Lane, Albany, NY 12203; telephone 518-869-9731; e-mail to gcox@audubon.org.

Comments prepared by Dr. Graham Cox and reviewed by Dr. Michael Burger, director of bird conservation, Audubon New York, mburger@audubon.org.

Designation Criteria

Find an IBA by re
Find an IBA by n
What is an IBA?
Designation Crit
Election Process
Goals and Outlo
Contact Us
Home

Criteria and Sites: How they fit together

A site meeting any one of the criteria in the following three categories may qualify as an Important Bird Area. Many sites will meet several criteria. These criteria should not be considered absolute, and other factors, such as relative importance to other sites, may be weighed in making final site selections. Another category, Important Bird Research Areas, has been developed to cover sites that are important to bird conservation for the research accomplished there, yet do not qualify in any of the other three categories.

Category NY-1: Sites where birds concentrate in significant numbers when breeding, in winter, or during migration.

Criteria:

(1a) The site regularly supports at least 2,000 waterfowl (at one time) during some part of the year. The designation "waterfowl" includes such birds as loons, grebes, cormorants, geese, ducks, coots, and moorhens.

(1b) The site regularly supports at least 100 pelagic seabirds and/or terns (at one time) or 10,000 gulls (at one time) during some part of the year. Human-made food sources for gulls (landfills, dumpsites, sewage outflows, etc.) will not be considered as IBAs. The designation "pelagic seabird" includes such birds as shearwaters, storm-petrels, fulmars, gannets, jaegers, and alcids.

(lc) The site regularly supports at least 300 shorebirds (at one time) if an inland site, or 1000 shorebirds (at one time) if coastal, during some part of the year. The designation "shorebirds" includes such birds as plovers, sandpipers, snipe, woodcock, and phalaropes.

(1d) The site regularly supports at least 100 wading birds during some part of the year. the designation "wading birds" includes such birds as bitterns, herons, egrets, and ibises.

(1e) The site is regularly an important stopover site, "bottleneck", or migratory corridor for at least 8,000 raptors (seasonal total) during spring or fall migration.

(1f) The site supports an exceptional diversity of bird species. This would include sites that do not necessarily harbor large numbers of birds but that provide important habitat for more bird species than found at most sites. No absolute thresholds have been set owing to the scarcity of quantitative data. Sites should be clearly unique from other sites in the local area.

(1g) The site supports a significant number of a particular species but supports a smaller total number of birds than any of the criteria above (1a-1e). Sites should support many more of the species in question than other sites where the species occurs. Ideally, the site should be known to hold or thought to hold more than 1% of the state population of a species. In practice, however, it will be difficult to estimate state population sizes for most species.

This category is meant to cover sites of importance for dense populations of breeding birds (such as a heronry), high concentrations of waterfowl or shorebirds in any season, and migratory "bottlenecks" where geographical features (such as ridges) concentrate large numbers of migratory birds. The numerical criteria (la-1e) are guidelines only, and other factors (quality and location of habitat, distribution and importance of species, etc.) may be considered. Criterion la should exclude sedentary Canada Geese and Mallards. Criterion If is meant to cover exceptional sites to which numerical criteria may not be easily applied, such as migrant traps for land birds.

Category NY-2: Sites for endangered, threatened, or special concem species.

Criterion:

The site supports a significant population of a species that is endangered, threatened, or of special concern.(Go to the NY state-listed species.

Category NY-3: Sites containing assemblages of species characteristic of a representative, rare, threatened, or unique habitat.

Criteria:

The site contains an assemblage of species characteristic of a habitat type that is-
(3a) rare, threatened, or unusual within the state or region.
(3b) an exceptional representative of a natural or near-natural habitat within the state or region.

This category is mainly meant to cover relatively large areas capable of supporting significant bird populations, especially of species with particular habitat requirements such as grassland or forest nesting birds (for example, Henslow's and Grasshopper Sparrow, Cerulean Warbler). Small remnants of an exceptional habitat type may be included, however. Selection of sites will be based on avian assemblages within the habitat community type, not on the habitat community type alone. Therefore, whenever possible, characteristic species of birds (and other wildlife) indicative of the habitat type should be identified and quantified.

Category NY-4: Sites for long-term avian research or monitoring.

Criterion:

(4) The site is a natural area where a long-term research and/or monitoring project is based that contributes substantially to ornithology and bird conservation.

An indicator of such a site will often be a long record of data collection resulting in publication in ornithological journals, such as The Auk, Condor, Wilson Bulletin, Journal of Field Ornithology, American Birds (Audubon Field Notes), The Kingbird. Insofar as these sites are not necessarily essential habitats for birds, they are technically not Important Bird Areas, but they nevertheless are considered important to identify and conserve.

Robinson Square
313 Hamilton Street
Albany, N.Y. 12210

Marc S. Gerstman

Attorney at Law

Telephone:
(518) 432-4100
Fax (518) 432-4200

September 21, 2004

Mr. Daniel Ruzow, Esq.
Whiteman, Osterman and Hanna
Attorneys for Crossroads Ventures, LLC
One Commerce Plaza
Albany, New York 12260

Re: Belleayre Resort at Catskill Park; Application Number 0-9999- 00096/00005

Dear Judge Wissler:

Enclosed is the final copy of Dynamic Models of Land Use In Northeastern USA report by Mary L. Tyrell, Myrna H.P. Hall and R. Neil Sampson. This report is Exhibit "O" in the Catskill Preservation Coalition Petition for Party Status.

Very truly yours,

Law Office of Marc S. Gerstman

Anne Marie Fernandez

Anne-Marie Fernandez

W:\Clients\CATSKILL PRESERVATION COALITION\CORRESPONDENCE\9-21-04 ltr to Ruzow.doc

CPC revised exhibit O

GISF Research Paper 003

Dynamic Models of Land Use Change In Northeastern USA

Developing Tools, Techniques, and Talents for Effective Conservation Action

Mary L. Tyrrell, Myrna H.P. Hall
and R. Neil Sampson

Global Institute of Sustainable Forestry

Program on Private Forests

Yale University
School of Forestry & Environmental Studies
Global Institute of Sustainable Forestry

Dynamic Models of Land Use Change In Northeastern USA

Developing Tools, Techniques, and Talents for Effective Conservation Action

Mary L. Tyrrell
Program on Private Forests
Yale School of Forestry and Environmental Studies

Myrna H.P. Hall
College of Environmental Science and Forestry
State University of New York

R. Neil Sampson
Yale School of Forestry and Environmental Studies
and the Sampson Group

August 2004
GISF Research Paper 003
Program on Private Forests

Yale University
School of Forestry and Environmental Studies
Global Institute of Sustainable Forestry
360 Prospect Street, New Haven, Connecticut 06511 USA

This project was supported by a grant from the USDA Forest Service, Cooperative Forestry

Acknowledgements

This project was made possible through the contributions, ideas, and support of many people. We are grateful to Larry Payne, Ted Beauvais, and Rick Cooksey of the USDA Forest Service, Cooperative Forestry, who understood the potential and provided funding for the project. The Yale School of Forestry and Environmental Studies (FES), Global Institute of Sustainable Forestry, and the State University of New York College of Environmental Science and Forestry (SUNY ESF) provided additional resources to support the project.

We would like to acknowledge the work of graduate students Steve Dettman and David Hobson at Yale FES and Susan Nixson and Sarah Deacon at SUNY ESF who worked on data collection, analysis, and formatting. Tagan Blake, now at Georgetown University, spent a summer collecting, formatting and organizing the Connecticut and Massachusetts data into one Thames data set, a significant contribution to the project. Michelle Decker, undergraduate at SUNY ESF, also contributed to the New York data collection.

We are grateful to Dan Civco and James Hurd at the University of Connecticut Center for Land use Education And Research (CLEAR) for their contribution of a newly created set of temporal land cover maps, which was an enormous benefit to the project. We would also like to acknowledge the work of Stephen Ambagis, at Clark University graduate student, now at Winrock International, who created the 2001 land cover map for the Catskill/Delaware area. New York City Department of Environmental Protection's (NYC DEP) GIS unit provided other very important data, in particular the 2000 tax parcel information. Our sincere thanks to Terry Spies and Barbara Dibeler of the NYC DEP. The many folks in state, town and county offices, who answered questions and provided data, are too numerous to mention, however we sincerely appreciate their help. The U.S. Census data used in the analysis was obtained from GEOLYTICS, E. Brunswick, NJ.

Tim Gregoire (Yale FES), René Germain (SUNY ESF), Steve Broderick (University of Connecticut), and Jack Mc Shane (Catskill Landowners Association) reviewed the first draft of this report and provided very thoughtful comments. The final report is much improved thanks to their input. René Germain also provided the 1984 parcelization data for the portions of Greene, Schoharie, Sullivan, and Ulster Counties that lie within the NYC Catskill/Delaware watersheds, which enabled us to analyze land parcelization as a driver of forest fragmentation.

And finally we would like to give special thanks to the following people for their ideas and support, particularly for connecting us to the local organizations and people in Connecticut, Massachusetts and New York, and for helping organize the community workshops: Steve Broderick, Senior Extension Educator/Forester for Connecticut; Bill Toomey, Quinebaug Highlands Project Director at The Nature Conservancy; and René Germain, at SUNY ESF, Coordinator of the New York City Watershed Model Forest Program

Table of Contents

Summary

America's productive private forests are at risk, under threat of being converted to malls, housing developments, and personal green space. Conservationists and officials in many localities are asking what they can do to help conserve their forests and maintain local forest-based economies. This study is designed to test the ability of a dynamic simulation modeling tool—GEOMOD—to illustrate local and regional land use changes, both in the recent past and in the near future. It stems from the idea that if people know how rapidly their forest resource is being lost, where it is being lost, and what forces seem to be driving the losses, they will be better equipped to take effective conservation action.

With this project, we have successfully demonstrated the utility of using GEOMOD as a land use planning tool in areas under pressure from unplanned development and sprawl. Working with two sites, the Thames River Watershed in Connecticut and Massachusetts and the Catskill/Delaware water supply watersheds and surrounding region in New York, we have demonstrated a scientifically rigorous method of projecting likely future scenarios of development based on analysis of past rate and patterns of land use change.

In the Catskill/Delaware region we found that private forests are being converted to non-forest uses at a rate of a little over 1% per year, in a fragmented pattern. Without strong conservation intervention, that rate is likely to proceed for the next decade, resulting in the loss of another 162,000 acres of private forestland, and a much more fragmented forest resource, by the year 2011. Through statistical analysis, we found that in this mountainous region, the fragmentation that has occurred since 1992 follows a pattern of sprawling up the valleys and is most influenced by the proximity of urban areas, roads, and topography, particularly elevation and slope. Using a simple measure of "area of intact forest" vs. "perimeter of forest patches," the area:perimeter ratio was 187:1 in 1992; 150:1 in 2001 and is projected to be 105:1 in 2011. Forest patches are getting smaller, with more edge environment, which impacts everything from wildlife habitat, deer and tick populations, water quality, the potential for timber harvesting, recreation, aesthetics, and local economies.

Within the New York City Watersheds, forestland parcel size is decreasing and our analysis indicates that forest land that has been parcelized is 1.5 times more likely to be converted to other uses than land that has not been divided. The average parcel size in the region has gone from 18 acres in 1985 to 14 acres in 2000, clearly indicating increased parcelization of forestland since 1985. As evidence that parcelization (smaller ownerships) does lead to further forest fragmentation, our data from a sample of 122,000 acres, show that lands that had been parcelized between 1984 and 2000 experienced a higher rate of forest loss (8%) than those that had not been parcelized (5.5%).

In the Thames Watershed region, of the 740,000 acres of forest not permanently protected from development, 7.4% has been lost since 1985. This may seem like a fairly low rate over 17 years, but it is the pattern that is most troubling. If the same trend continues, we project that the Thames Watershed and surrounding towns will lose an additional 64,000 acres of forest, scattered across the landscape, in the next 17 years. The forests are more fragmented as shown by the area:perimeter ratio which was 421:1 in 1985, dropping to 381:1 in 2002. However, our projections out to 2022 indicate that the future trend may result in an infilling of developed areas hence elimination of smaller forest fragments and a mathematically higher area:perimeter ratio, although the remaining patches would not be larger than they were in 2002.

It is quite likely that our results in both regions actually overstate the amount of intact forest remaining. The land cover classification process, which uses 30-meter resolution satellite imagery, is much better at picking up

concentrated development than low density rural development. For example, a housing subdivision with large lots and trees would show up as partial forest in the satellite imagery. However, this is no longer the same forested habitat for wildlife as a large tract of unfragmented forest, nor is it a forest that can be managed for timber or other forest products.

Nonetheless, our results demonstrate that the rate and location of recent conversions of forest to non-forest cover, detected by modern interpretation of satellite imagery, can be used not only to study the past but to visualize possible future conditions. GEOMOD is able to take those past changes, compare them with a wide range of geophysical and socio-economic data, and derive a statistically robust correlation between past patterns of land use and land cover change and the most likely future continuation of those patterns.

The result is a visually powerful dynamic display of local land use change, coupled with a new understanding of the factors associated with that change. Using these tools, local leaders can bring new insight and energy to forest conservation and land use management programs. The local stakeholders in both areas have expressed tremendous interest in the results, which they believe would be particularly useful in local- and county- or regional-level planning efforts.

Introduction

There are some 10 million private forest ownerships in the United States, and that number has been estimated to be growing at the rate of around 150,000 a year.[1] At the same time, the area in privately-owned forest land has stayed roughly the same for decades. The obvious result is that America's forests are being divided into smaller and smaller ownerships. Nationwide, over 25 million acres of rural land were developed between 1982 and 1997, and over 10 million of those acres were forest before they were developed. The clear implication is that forests are increasingly under threat from urban sprawl and other dispersed development.

These trends raise concerns in two general categories. The first is forest fragmentation—the breaking up of large contiguous forest areas into smaller, disconnected parcels separated by non-forest lands, roads, or other land use. The impacts of this fragmentation are often described in ecological terms. A landscape sprinkled with little patches of disconnected forest does not function in the same way as that landscape functioned when it was a single large forest. The impact on wildlife habitat can be severe, as many species cannot thrive or even survive in fragmented landscapes. Other impacts may be felt, for example, on water quality, as non-forest land uses often are associated with higher rates of water runoff, soil erosion, and nutrient and sediment loading to waterways with subsequent impacts on drinking water quality and aquatic habitat.

The second category of change is parcelization, the dividing up of private land into smaller ownerships. The impacts here are more often economic. Small ownerships, particularly those of less than 50 acres, are seldom managed to produce sustainable yields of forest products. Increasingly, they become private "green space" for their owners. The trees remain, but opportunities for sustainable production are largely lost. That might not sound like much of a problem in a large country where there are ample supplies of forest products to meet consumer demand. But over half of the timber used to produce wood and paper products in the United States comes from the smaller private ownerships held by families, institutions, and companies. And those are the forest tracts that are being converted to smaller and smaller parcels. The long-term impact, if not the immediate effect, is an important national concern.

It can be an important local concern as well. As more of the local forest resource is withdrawn from timber production, local mills and forestry businesses suffer. At some point, they begin to go out of business or move elsewhere. Mill closings have been common in recent years, and in many areas, the lack of available timber is one of the reasons. When a local mill closes, the remaining forest owners have less access to markets, and the feasibility of keeping their forests in sustainable production may become questionable. Increasingly, they will look to sell the land, and often it will be most profitable to break it up into small pieces and sell it to potential developers or homeowners. In this way, the processes of parcelization and fragmentation take on a cascading effect, where each forest sale strengthens and hastens the rate of local forest conversion.

As people buy small forest tracts and build homes, the scattered patterns of rural housing become a local economic issue. Rural homes impose significant costs on local services. Their owners need roads, schools, transportation infrastructure, waste disposal, law enforcement and other local services, and the fact that they are dispersed thinly across the region makes the cost of providing each service higher than where people live in more compact arrangements. Seldom do the property taxes paid by scattered rural houses cover the increased burden placed on local services.[3]

Despite these and other concerns in many communities over forest changes, there often seems to be little that can be done to address the situation. By the time the problem is recognized, it's a *fait accompli.* Once the forest is fragmented, it can possibly be restored by intentional management actions, but that process may take decades, and will be highly unlikely where the non-forest land uses are long-lasting. A landscape with a thousand small landowners can be re-assembled, theoretically, back into a few ownerships, but only with great difficulty. So the general situation is that once these forests become fragmented or parcelized, it is nearly impossible to restore their integrity.

It is hard to evaluate how rapidly these processes are taking place. Change often comes in the form of one small, seemingly insignificant event at a time, and the full effect of the cumulative change may not be evident for years. By the time the impacts are known, it is too late to do anything to alter them. Before the parcelization or fragmentation occurs, however, there are effective preventative measures for a community to consider. Depending on the local situation, it may be possible to use local planning and zoning to guide development into more desirable patterns. Improving local incentives for sustainable forest management sometimes takes the form of special tax programs for producing forest lands, or other ways to make sustainable forestry an attractive reason to hold land in production. Sometimes land with high conservation values can be placed under a conservation easement that limits development while providing compensation for lost land sale values.

This leads to the idea that communities could, if they knew where forest parcelization and fragmentation were most likely to occur in the future, design locally adapted conservation measures that would slow these changes or reduce their undesirable impacts. The question becomes: How does one see such phenomena in advance of their actual occurrence?

This project is an attempt to harness modern scientific tools to that task. We begin by studying the trends in land change over the recent past, using satellite imagery to identify where forests have been altered through fragmentation or parcelization. Once those areas have been identified, we seek to understand what underlying factors or drivers might have been the most important contributors to the change. If that can be understood, perhaps we can assume that similar conditions or driving factors may continue to be important in future land use changes. With such knowledge conservation program efforts can be prioritized to those forests most at risk, with some hope that success will be improved.

The factors that often influence where people settle can include biophysical determinants such as topographic position (elevation and steepness of slope), distance from rivers, soil type, and/or socio-economic factors such as infrastructure, already-established settlements, distance to roads and markets, and density of population engaged in agriculture and forestry. Demographic factors, such as such as an aging population, which are available via population census may also explain why certain land is attractive to developers, or simply available for sale, .

The model allows for regional stratification in order to capture, for example, the effect of different government policies in different political units on the pattern and rate of landscape development. The basis for analysis is a time series of land cover maps derived from satellite imagery or aerial photographs. At least two time periods are necessary, with sufficient time between the two for change in forest cover to have occurred.

A model is a simplification of a complex system. An architect's model of a building to be constructed is an example. A computerized ecosystem model tries to capture and represent how the system works. We like to think of it as a formalization of our assumptions about that system. Building a model that can be relied upon requires a circular process of *calibration* and *validation* until the model gets as close to reality as is possible given the information we have at the current time. A good model thus begins by using historical, or what we call empirical data—measured and recorded—to calibrate the model. Some of these data must be held in reserve to validate the model's projections, in other words to see if the model is predicting correctly.

An example would be a model that predicts the growth of trees based on the type of soil they are planted in, and the amount of sunlight and precipitation they receive. To *calibrate* the model the researcher first needs data that show how much trees actually have grown in different soil, sun and moisture conditions. Then he/she writes the model to grow trees across the landscape based on the conditions found at each location. Finally, to determine how well the model is doing, the modeler checks his/her predictions against the growth information for other trees distributed across the landscape that were not used in the calibration process, and determines statistically how well the model has matched the real growth (volume or biomass) of this validation set of trees. The model's mathematical equations that express the relation between tree growth response and environmental conditions continues to be adjusted until the predictions match as closely as possible the real world.

An analysis of landscape change with GEOMOD is performed in the same way, testing the importance of different variables like "distance from roads" or "slope" of the terrain to determine where development has occurred at one point in time. Then, taking this information, the model projects where development is likely to occur in the future and then checks against a map of the "real" landscape at that point in time. The closer we are able to match the second time period, the more confidence we have that those are the important factors that will affect the future distribution of development in a region.

How well one factor, or a combination of factors, allows GEOMOD to predict the future time is measured by the kappa-for location ($K_{location}$) statistic. The kappa statistic tells us how much better than chance alone the model is in predicting areas that will be converted from forest to non forest (with "0" being no better than chance alone and "1" being a perfect predictor), i.e. the higher the kappa statistic the higher the factor's ability to identify correctly those forested areas that will be converted to non-forest in the future based on their attractiveness for development. Percent cells correctly simulated can be deceiving especially when little change has occurred in the landscape. The kappa adjusts for this. One could also test whether a predicted quantity of change is accurate using the kappa-for-quantity measure.

Objective

Our objective in this study was to test whether the land use change model GEOMOD, heretofore applied principally in tropical forested landscapes of the less developed world,[7] could reveal important insights into how quickly, where, and in what pattern the working forested landscape of the highly developed northeastern United States is being lost to other forms of land use. In its application in the developing tropics the model's inputs have been limited to maps of primarily bio-physical properties, but seldom included spatially distributed socio-economic or demographic information. In the United States we wanted to test whether the addition of such information in the form of, for example, US census data, county tax parcel maps, and real estate and labor statistics, might enhance the model's predictive power. The model has previously been applied to one other area of the northeast, the Ipswich Watershed in Massachusetts, but there it primarily examined the influence of topography.[8]

Study Sites

After considering several possible sites in the northeast, the final selection was narrowed to two places, based on criteria developed by the project team in the early planning stages (see box on this page): a portion of the Catskill/Delaware region in New York, including most of the New York City municipal water supply watersheds; and the Thames River Watershed and surrounding towns in Connecticut, later expanded to also include the Massachusetts towns in the watershed.

These largely forested places are under tremendous pressure from local development and the sprawling metropolitan areas of New York City, Boston, Hartford and Providence (figure 2). As the largest unfiltered surface water supply in the country, the New York City Watershed is extremely vulnerable to potential changes in land use. Protecting the remaining forested landscape is a high priority for both the local communities and the urban population of New York City. The Thames River Watershed, in northeastern Connecticut and south-central Massachusetts, known as the "Last Green Valley" between New York and Boston, is home to the Quinebaug-Shetucket National Heritage Corridor, honoring both its present rural character and its past industrial history. Development pressures are typical of those being experienced throughout the northeast, and there are active forest conservation efforts in both places.

Criteria for Choosing Research Sites

- Local or regional interest and willingness to partner in the project on the part of conservation organizations, local governments, and citizens' groups.
- A reasonably-scaled study area that makes political sense to the local partners; is large enough to allow landscape inferences (such as watershed impacts); and fits within the technical constraints of GEOMOD for data analysis.
- Adequate existing data sets on physical, social and economic conditions so that the analysis can be readily constructed without the need for gathering a significant amount of new data.
- Land cover maps derived from remote sensing imagery enabling construction of past land cover history extending back 10-20 years.
- Contains large tracts of intact, privately-owned forest as well as areas that are already developed.
- Considered to be at risk of losing forest to development and of further forest fragmentation.
- Located within a region of conservation focus in order to maximize the project's contribution to the larger forest conservation agenda.
- At least one member of the research team familiar with the area to aid in background.

Figure 2. Night lights over northeastern North America. The Catskill/Delaware (left) and Thames (right) watersheds are in the areas circled in red. Image from NASA Lights of the Earth web site.

The Catskill Mountains of New York[9]

Our New York study site lies in the Catskill Mountains about 100 miles northwest of New York City. Encompassing more than six counties and over 6,000 square miles of mountains, forests, rivers, and farmland, the Catskills are often referred to as America's First Wilderness because scholars trace the beginnings of the environmental conservation movement to this beautiful area. With almost three dozen mountain peaks over 3,500 feet in elevation and six major river systems that annually attract the world's most devoted fly fishermen, the Catskills are an ecological resource of significant importance. The region's rugged terrain has contributed over the years to a sense of the area as remote wilderness, in spite of its nearness to the country's largest population center.

The two most prominent features of the Catskill region today are the nearly 300,000 acres of public Forest Preserve land located largely within the Catskill Park, and the 1,584 square miles of catchment known as the Catskill/Delaware Watersheds that provide 90 percent of the New York City water supply. This unfiltered water supply has been made possible largely because in 1885 the New York State Legislature established the Catskill Forest Preserve to be set aside as Forever Wild. In 1904 the Catskill Park was created to establish an imaginary boundary, called the "blue line," around the Forest Preserve, and surrounding private land. Together the Preserve and the Park have grown over the years to approximately 700,000 acres, of which about 60% is private land.

But this is also a working landscape, and the coexistence of the two—wilderness and human society—side by side is considered a grand and visionary landscape experiment in the Catskills. Farms and forests of the region have provided livelihood to families for centuries. Catskill tanneries supplied most of the saddles used in the Civil War. Hides were shipped from South America for processing into leather. High-tannin bark was stripped from hemlock trees and used to tan hides. The furniture making industry followed, using the trees left behind. Cleared land was often sold for 50 cents an acre to mountain farmers. Furniture makers, lumberjacks, charcoal producers, hoopmakers (hoops were used to hold barrels together), and wood acid manufacturers all exploited the Catskill forest. Today, the cleared valleys and hillsides have returned to forest and forestry remains important on private lands, primarily as a source of lumber. But little by little that landscape is being carved into ever smaller parcels of land, and the effects of New York City weekend sprawl and development may have significant impact on the long term viability of forestry in this region.

The Thames River Watershed of Massachusetts and Connecticut[10]

The New England study area covers most of the Thames River Watershed and adjacent towns, almost 1900 square miles of rural and forested land in northeastern Connecticut and south-central Massachusetts. An estimated thirteen percent of this land is permanently protected from development, either in the form of public land or conservation easements. Known as the "Last Green Valley," it is one of the last largely rural areas remaining in the highly-developed section of the east coast between Boston and Washington, D.C. It is home to the Quinebaug Highlands, a 269 square mile region of mostly privately owned forestland in Connecticut and Massachusetts, identified as one of Connecticut's Last Great Places by The Nature Conservancy; the 4,000 acre Norcross Wildlife Sanctuary in Massachusetts; the Yale Myers Forest, a 7,000 acre research and teaching forest; several state forests; and the Pawcatuck Borderlands, a 200 square mile area of largely contiguous forest along the Connecticut-Rhode Island border. The Quinebaug-Shetucket Rivers Valley was declared a National Heritage Corridor in 1994, to help with efforts to protect the unique history and rural character of this New England valley.

The region is rich with wildlife and healthy hardwood and coniferous forests. The larger landowners manage their forests for timber and other forest values, and there are numerous small saw mills operating throughout the area. Now this rural region is under pressure from the intense development of surrounding urban and suburban areas. Bordered by Worcester, Massachusetts to the north, New London, Connecticut to the south, Providence, Rhode Island to the east, and Hartford, Connecticut to the west, the area has undergone significant land use changes over the past fifty years as housing and industrial development has encroached upon formerly rural and forested land. Because so much of the forestland is privately owned, there is no guarantee that unique natural areas like the Quinebaug Highlands will remain intact or immune to development pressures, and therefore a number of conservation organizations have mobilized an effort to protect this region from development.

Community Input

Local input was considered vital to ensure both that assumptions could be tested against local knowledge and that the results would be meaningful and useful to the communities who are working to conserve their forested landscapes and rural character. Two community workshops were held, one in New York on March 19, 2002, the other in Connecticut on May 21, 2002. Attendees included representatives of various local and regional conservation organizations and government agencies; local citizens; and forest landowners. (See appendix A for workshop summaries and lists of attendees). Follow-up workshops were held in each location to present the results and discuss ways to get this information into the local planning processes. Input and feedback from the participants was incorporated into the project plan, wherever feasible.

Working Hypotheses

A working hypothesis about what is driving land use change in each area was developed during the first community sessions, based on local knowledge and intuition. In some cases, these conclusions were supported by the findings in the project; in others, the findings seem to point elsewhere. In either case, developing and testing a working hypothesis helps focus the study on important factors and provides a useful way to bring out new or surprising findings in the study.

New York Catskill/Delaware Watersheds

Hypothesis: Parcelization is more of a current factor than fragmentation and will be hard to detect or predict.

Findings: Parcelization and fragmentation are both occuring; parcelization tends to lead to fragmentation—land that is parcelized is 1.5 times more likely to be subsequently fragmented than land that has not been divided into smaller ownerships; parcelization cannot be detected via satellite imagery unless accompanied by fragmentation.

Hypothesis: The pattern of forest fragmentation and conversion is determined primarily by distance from New York City, distance from major roads, distance from ski resorts/new resorts (growth nodes); New York City water supply watershed regulations; taxes; age of landowner; and population of permanent residents vs. housing units (second home development).

Findings: The pattern of forest fragmentation is driven primarily by distance from urbanized areas (meaning those areas characterized by residential, commercial, or industrial building), elevation, slope, distance from local and secondary roads and population density. Second home development is an important factor in regional land use change dynamics. Ski resorts and landowner age were slightly less important in predicting where development has occured in the past. However, it should be noted that the scale of the window of analysis means that more importance will be given in the model to urbanized areas (since there are more of them) than rural development, such as ski resorts. Regulations and taxes were not tested due to unavailability of adequate time-series spatial data for these factors.

Thames River Watershed

Hypothesis: Threats to forests are from parcelization, fragmentation, habitat destruction, and conversion.

Findings: Fragmentation of forestland has occurred since 1985, although new development is projected to happen mostly on smaller, isolated fragments of forestland near already developed land. This is partly due to the fact that much of the forestland in this region is under some type of protection from development. It was not possible to examine parcelization effects since we did not have sufficient data about land ownership changes.

Hypothesis: The rate of forest fragmentation and conversion are being driven mainly by population growth; zoning regulations; changes in timber markets; casino development; economic growth in nearby major cities; land prices; distance from major cities; upgrade and expansion of roads; and the collapse of the dairy industry. We assumed that the pattern would be a function of distance to roads, to major urban areas, casino development, and perhaps a variety of socio-economic factors that make places more attractive or more likely to be undergoing change.

Findings: The pattern of forest loss in this region is best predicted by distance from 1985 agricultural lands, soil type, and distance from urban areas. Population, casino development, and roads were somewhat less important drivers of land use change, as were most socio-economic factors anaylzed. However, socio-economic factors, prior seltlement patterns, and soil types are inter-related and thus probably co-dependent with the top three drivers. We did not have a way to incoroprate the collapse of the dairy industry into the analysis; and data was not available at a useful scale and format for analyzing zoning regulations or changes in timber markets.

Data Creation and Collection

Two data sets are required in this method of modeling land use change over time: land cover, which is the dependent variable; and the so-called potential driving factors, or independent variables. The assumption is that land use change (using land cover as a surrogate for land use) is a function of one or more biophysical and socio-economic factors, such as land prices, population growth, and proximity to natural amenities.

Dependent Variable—Land Cover[11]

Land cover maps for each region were the primary source of information for both the rate and location of change in forest cover in the two regions over time. For the New York study we relied on the USGS 1992 National Land Cover Data (NLCD) with 21 categories (figure 3) as our time 1 baseline (model calibration). Classifying satellite imagery into land cover/land use classes is as much an art as a science, as totally different land uses can sometimes have the same reflectance values. Thus a critical step in classifying satellite imagery is to perform an accuracy assessment, by either ground-truthing or comparing with aerial photographs. For the region of our analysis (figure 4), we compared the 1992 land cover values to 1994 aerial photos and found 90% accuracy.[12] For a second time period we classified a May 2001 satellite scene to use for model validation (also visible in figure 4). Our post-classification assessment yielded 99% accuracy at the pixel level when compared to year 2001 digital orthorectified quarter quadrangle (DOQQ) aerial photographs.

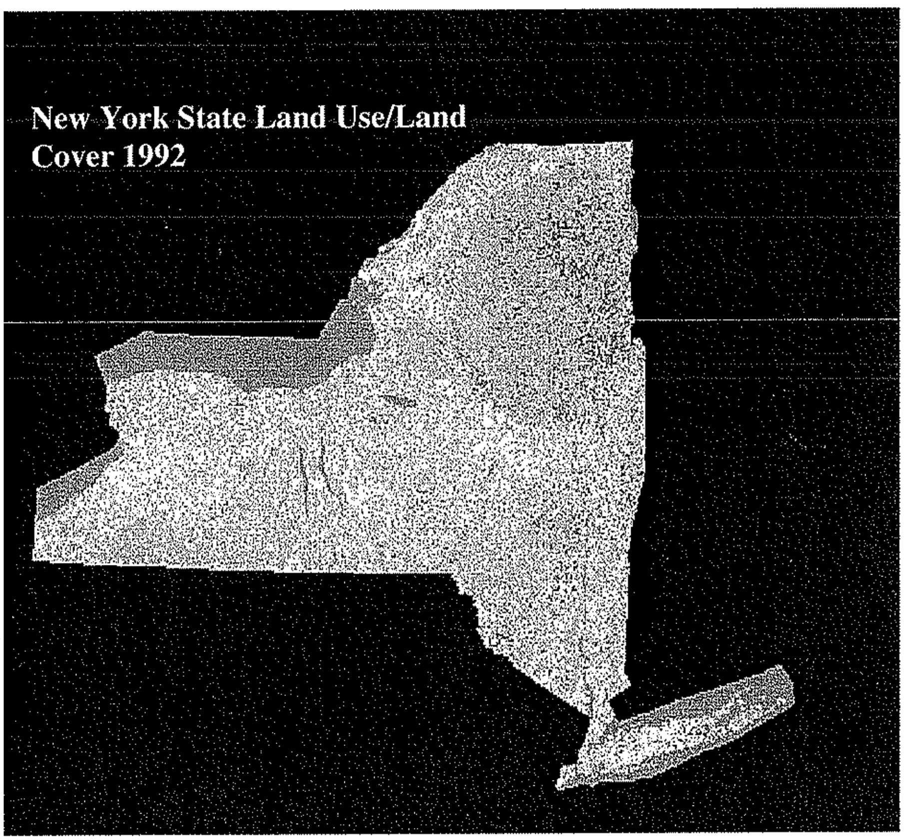
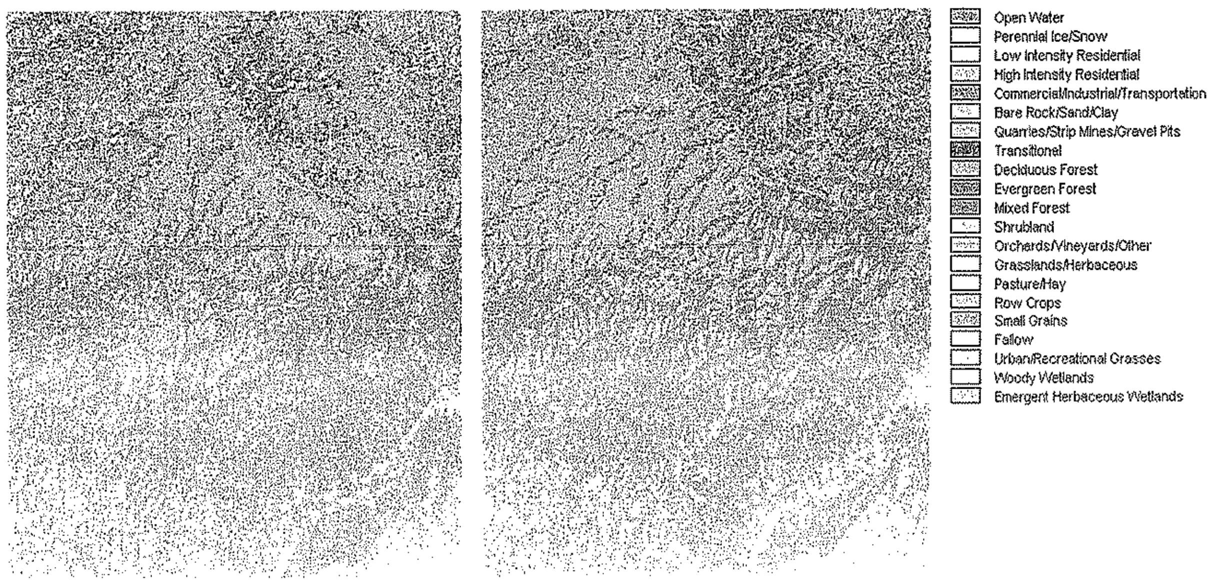


Figure 3. Baseline Map for Catskill-Delaware Study. Source: USGS National Land Cover Data Set.



1992 2001

Figure 4. Window of analysis showing NLCD 1992 data juxtaposed with classified 2001 land cover for the Catskill-Delaware Region of analysis.

In the case of the Thames study, the Center for Land use Education And Research (CLEAR) at the University of Connecticut provided us with a four-year (1985, 1990, 1995, and 2002) land cover time series derived from satellite imagery (figure 5). Eleven categories are delineated. "Agriculture" includes both cropland and pasture. As in other studies we have undertaken, agricultural lands are easily confused in the classification process with grasslands such as parks, and/ or with other grass and shrub-covered lands such as large lawns, fields, or meadows associated with residential or municipal property.

We used 1990 as time 1 (model calibration), and 2002 for time 2 (model validation). The 1985 map allowed us to look at the relation of lands newly developed in 1990 with respect to lands already developed in 1985. It should be noted that, as we did not have more than two time series land cover maps for New York, it was not possible to use this "change from a previous time period" in the New York analysis. Our results, therefore, cannot be fully compared across both regions.

We stratified each region by political units. The New York region included parts of five counties centered on the New York City water supply catchments (figure 6). The Thames site included 59 individual towns in Connecticut and Massachusetts lying within the Thames watershed or immediately adjacent (figure 7). Public and private lands that are currently under conservation protection in the Thames, as well as public lands in New York acquired by both New York City and State to protect city drinking water quality, were excluded from analysis, as these lands are assumed to be unavailable for future development or other land use change (figures 8 and 9). Eighteen percent of the New York study area and thirteen percent of the Thames area is in this category.

Finally, all maps were reduced to two main categories. Those classified with the value "1" represent all forested land. A value of '2' indicates land that is in other uses such as agriculture, residential, industrial, commercial properties, etc. In the Thames the "Forest" class includes deciduous and coniferous forests and forested wetlands, while "Non forest" represents the developed, turf and grass, agriculture, barren and utility classifications (Figure 10).

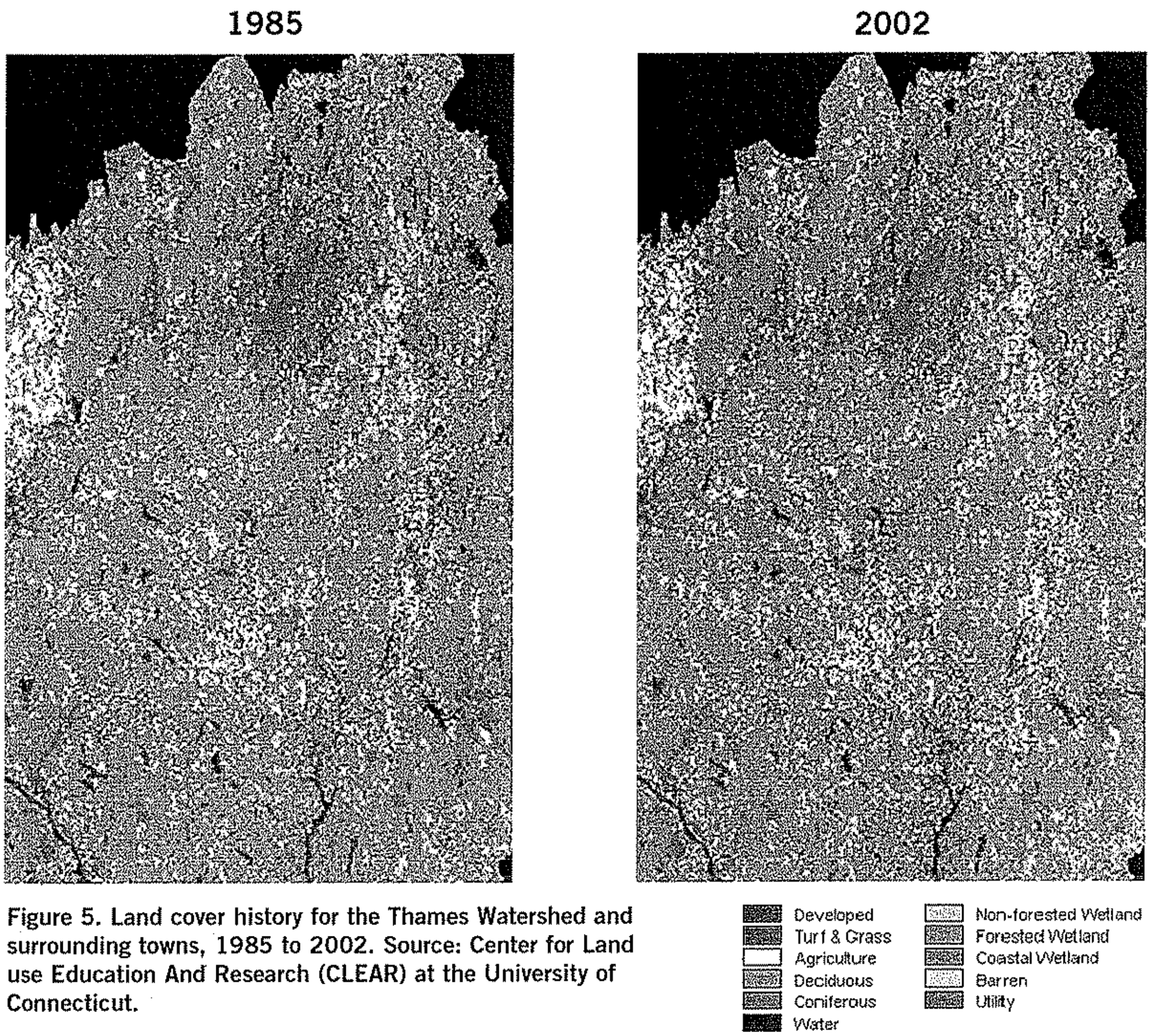
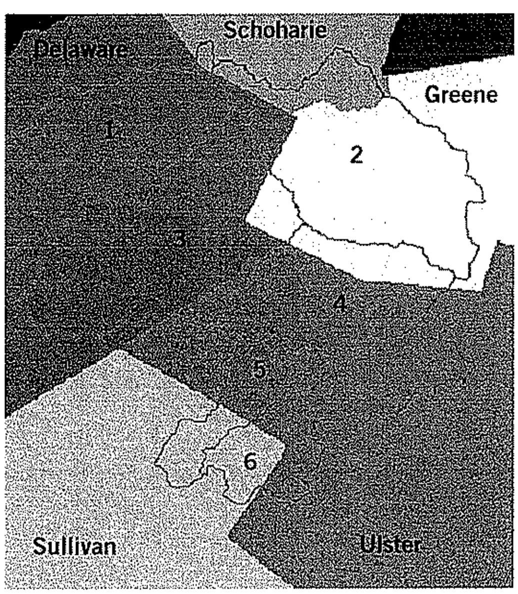


Figure 5. Land cover history for the Thames Watershed and surrounding towns, 1985 to 2002. Source: Center for Land use Education And Research (CLEAR) at the University of Connecticut.



Watersheds

1 - Cannonsville
2 - Pepacton
3 - Schoharie
4 - Ashokan
5 - Neversink
6 - Rondout

Figure 6. Study area boundary. Areas of New York City water supply watersheds and portions of counties included in study area.

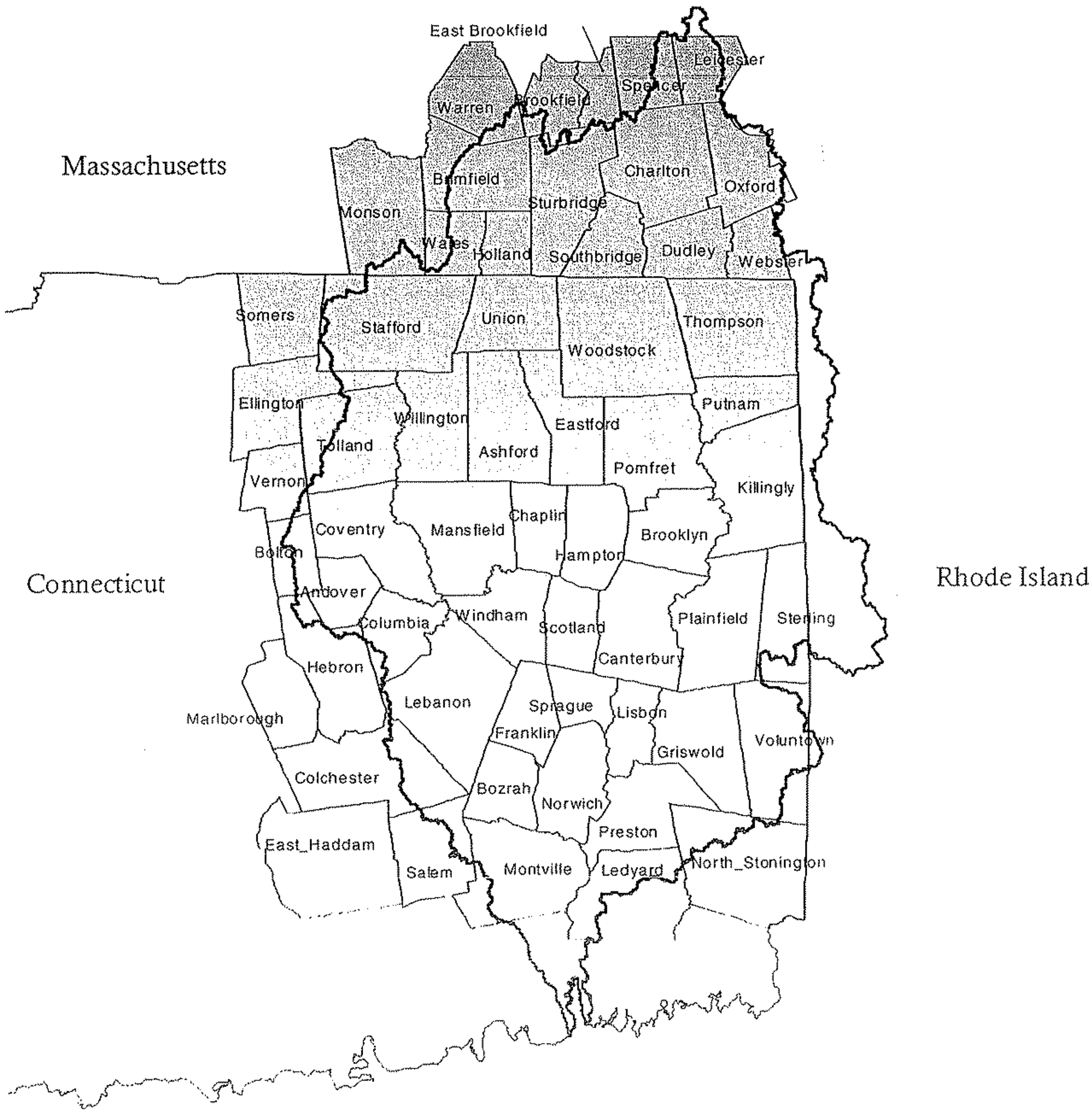


Figure 7. Towns of Massachusetts and Connecticut included in Thames Watershed study. The outline of the Thames Watershed is in dark blue

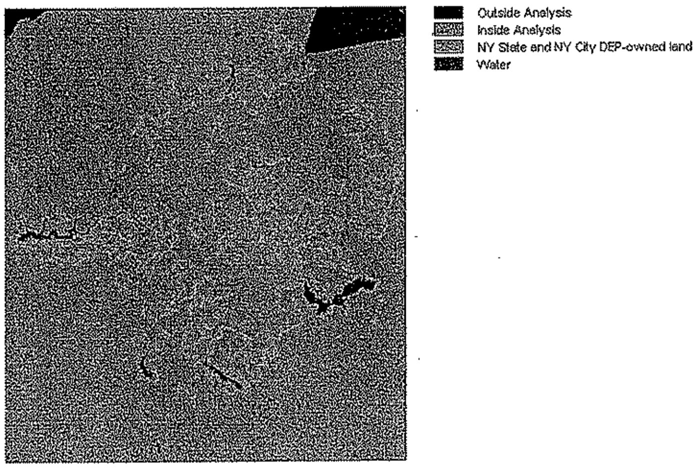


Figure 8. Public land excluded from New York study.

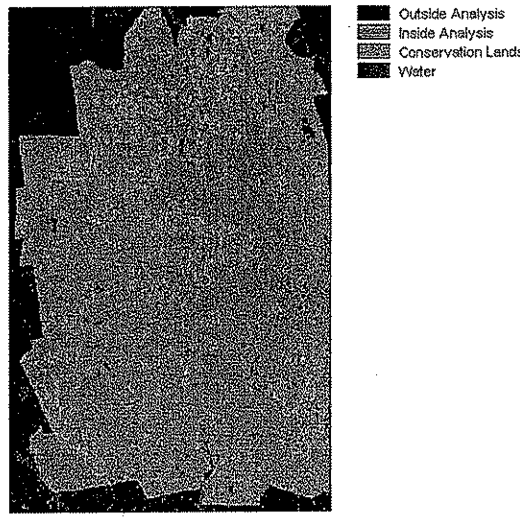


Figure 9. Thames Watershed public and private conservation areas excluded from analysis.

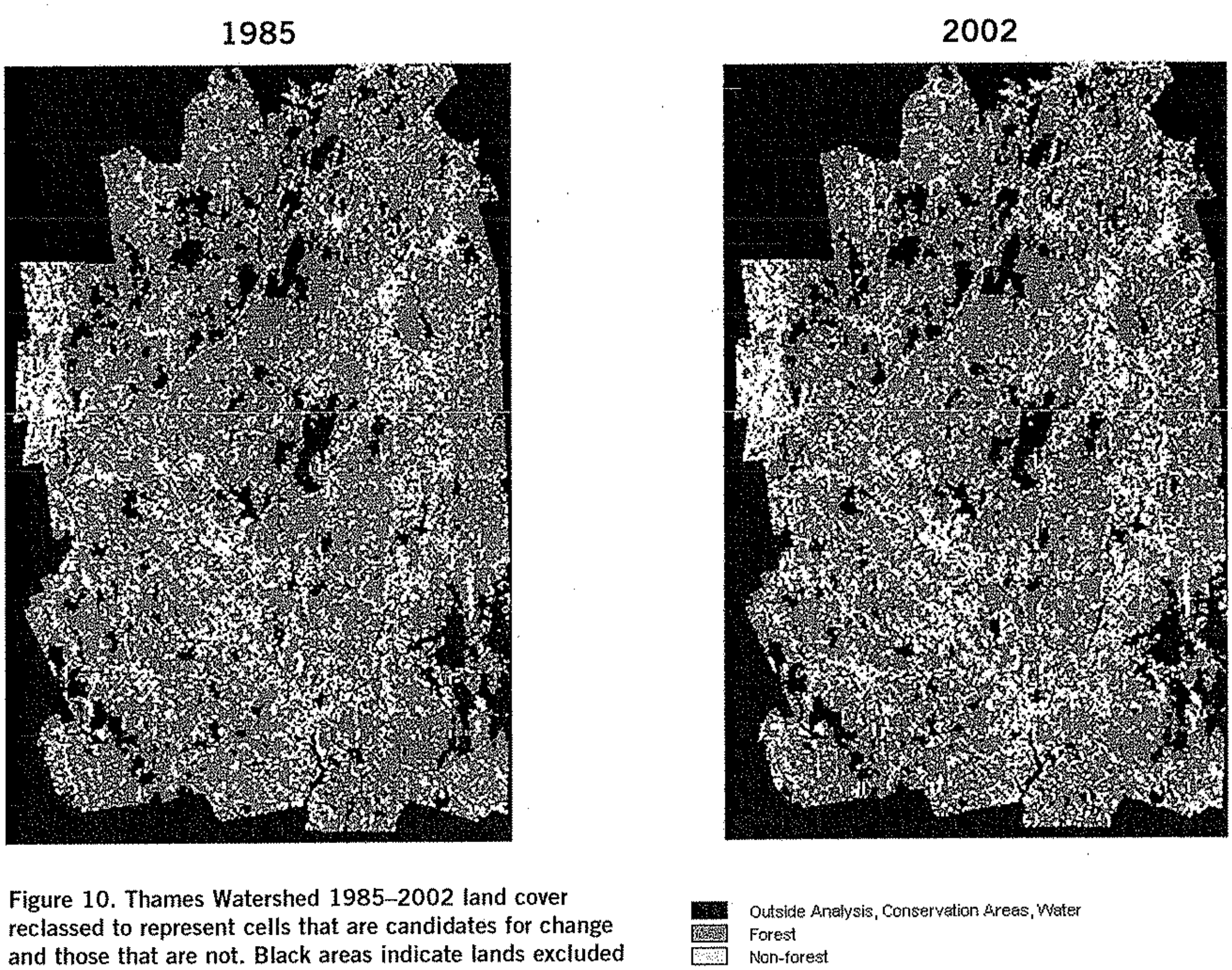


Figure 10. Thames Watershed 1985–2002 land cover reclassed to represent cells that are candidates for change and those that are not. Black areas indicate lands excluded from analysis—conservation lands and water.

In the Catskill-Delaware Region (figure 11) "Forest" includes deciduous, evergreen and mixed forest, and woody wetlands while "Non-forest" includes low and high intensity residential, commercial, industrial, transportation, hay, pasture, row crops, urban, recreational grasses, quarries, strip mines, and gravel pits. There is much debate about whether lands classified as "agricultural" in 1992 are in fact clear cuts reforesting or pasture lands reverting to forest, and whether the NLCD map overstates or understates the amount of land actually "deforested" as of 1992. The New York City Department of Environmental Protection map for the same time period shows (within the NYC water supply watershed only – figure 12) a much larger area in agriculture in 1992, particularly in the Cannonsville Watershed in Delaware County. Our accuracy assessment of this area of discrepancy on the 1992 NLCD map used in our analysis yielded 90% accuracy (using 1994 aerial photos as the reference criteria).

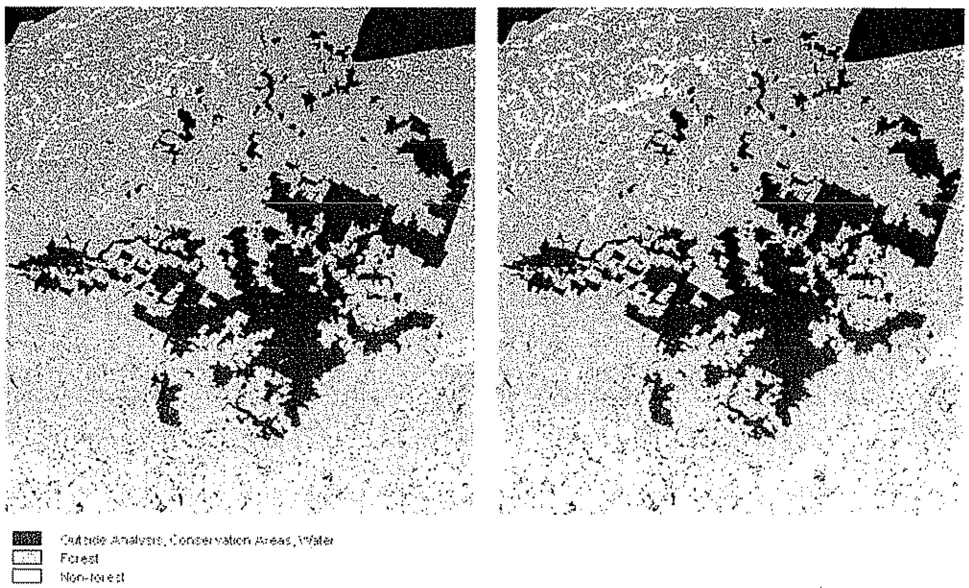


Figure 11. Catskill-Delaware reclassified 1992 and 2001 land cover. Black areas represent areas of water, wetlands, reforestation and NYC DEP and NY State lands masked out, i.e. not candidates for change from forest to non-forest.

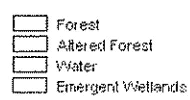


Figure 12. For comparison, the NYC DEP classification of Forest/Non-Forest in the watersheds is shown next to the NLCD '92 land cover map.

Independent Variables—Factors Affecting Location of New Developed Areas

An initial list of many possible drivers of land use change in the northeastern United States was derived from a combination of literature search, team experience/knowledge, and community input. The resulting list was then used to determine availability and usability of various data sets for incorporation into the modeling process (table 1).

		Included in Analysis	
		NY	CT/MA
Available for all three states in geospatial format at scale useful for analysis			
	Demographics: Population	x	x
	Distance from metropolitan growth nodes	x	x
	Housing density and type	x	x
	Hydrography	x	x
	Protected open space	x	x
	Railroads, utility lines		x
	Roads	x	x
	Second homes and non-resident owners	x	x
	Topography (elevation, slope, aspect)	x	x
Available, not in geospatial format; easily converted			
	Building permits		x
	Employment in the service economy		x
	Housing prices; housing sales		x
	Labor force by sector		x
	Unemployment rate		x
Available, not in geospatial format; not easily converted			
	Development nodes (casinos, ski resorts)	x	x
	Zoning regulations		
Available but at too course a scale for useful analysis			
	Economic cycles		
	Federal spending programs: Education, Transportation, Sewer & Water; Infrastructure		
	State spending programs: Education, Transportation, Sewer & Water; Infrastructure		
	Tax policies		
	Timber prices		
Not readily available for all three states, or not in useable format			
	Education demographics		
	Local economy - relative importance of farming, forestry, ranching, mining		
	Malls, big box stores		
	Property taxes - rates and structure		
	Ratio of land sale prices to timber stumpage prices		
	Real estate conveyance taxes		
	Rural Industry		
	Soils		x
	Timber markets		
	Transportation		
Did not investigate due to project resource constraints			
	Commuting distance from employment base		
	County business patterns		
	Emergence of "edge cities"		
	Employment in surrounding areas		
	Farm income		
	High amenity value natural features		
	Income		
	Land pricing		
	Land tenure patterns		
	Level at which land use planning takes place (municipal, county, region, state)		
	Level of regional cooperation and coordination		
	New jobs created by sector		
	Office and industrial parks		
	Population in surrounding areas		
	Schools data by school district		
	State of the planning process: how long in existence; age of plan; volunteer or paid staff		
	Tax rates in surrounding areas		
	Vitality of older cities and suburbs		

Table 1: Potential factors influencing where forest fragmentation and loss from sprawl occurs

The project encompassed three states, and many data were not available in all three. Socio-economic data have to cover the same time period as the land cover data to provide meaningful analysis of drivers. So that the broadest possible set of factors could be tested in at least one of the sites, data that were available only in Connecticut and Massachusetts were used in the Thames analysis, even though they were not available for the Catskill/Delaware analysis. Although this approach gives us more robust information about the availability and utility of socio-economic data and its relationship to forest fragmentation and parcelization dynamics, the disadvantage is that it limits our ability to draw conclusions about commonalities across the two sites.

Thus, with the exception of the US Census data that we purchased for 1990 and 2000, these data sets are not equivalent across both regions. In the Thames study we had state labor department employment information by town, including the number of employees in each labor sector, such as construction, which we thought might be an indicator of growth. For the Thames we also had information on housing, such as the number of home starts, building permits and sales, and median sales price. And finally we had a soil map for the Thames that we did not have for the New York study.

On the other hand, in the New York region we had tax parcel data for 2000 made available by the New York City Department of Environmental Protection. This allowed us to analyze who owns how much forestland in the region and whether or not these owners are local residents. Finally, in New York, the elevation data were higher resolution, although of the same scale (1:24,000) as the Connecticut/Massachusetts data. In both instances the hydrography (water features) data were not of the same scale as the hypsometric (elevation) data.

Data Collection

Collecting, organizing, formatting and managing geospatial data is time consuming; thus we limited our efforts to those data that were either readily available in geospatial format, or easily converted. The exception was the location of "growth nodes", such as ski resorts and casinos. There is no geospatial data base of major developments (which would also include malls, and commercial and industrial parks), however, as input was strong at both community workshops that these growth nodes were important drivers of secondary development, we used a manual process to locate and georeference ski resorts and casinos in the study areas.

Data and sources included in the analysis are shown in appendix C. All three states have web sites where certain GIS (Geographic Information System) data layers (georeferenced, spatially explicit maps containing features such as rivers, roads, etc.) of mostly biophysical data and political boundaries can be downloaded. The United States Census Bureau is the original source of all population and housing data. The raw census data, available at the US Census Bureau web page, are very difficult to use, especially because the georeferencing is not automatic, but must be interpreted and managed by a technically proficient user. To avoid this resource intensive work on data preparation, we chose to purchase data in an easy-to-use GIS format from Geolytics, a commercial company, which produces CDs of census data to the census block level in ArcView shape files and tables.

If data were not accessible on the state GIS web site, then a more intensive search was conducted by contacting various government offices. The socio-economic data obtained this way were then converted from either spreadsheets or hard copies to GIS files.

Combining data from two states, Connecticut and Massachusetts, was a major undertaking. Even the state boundaries in each state's GIS system do not exactly line up. Other GIS data, such as roads, based on census TIGER files, and hydrological features matched up very well. Socio-economic data layers (other than census) were created from individual files and documents and georeferenced to town boundaries, which was a relatively easy task once the town boundary maps were corrected for the state line problem.

The soils data were the most problematic. Although both Connecticut and Massachusetts have GIS files of county soil maps, they use different nomenclature for what are obviously the same soil types (most apparent at the state border). To derive one soil map for the entire Thames study area, the soil series in each state were classified into general categories (e.g. "Agawam fine sandy loam" was reclassified to "fine sandy loam"), and obvious discrepancies at the state border were corrected.

Forest Products Industry Data

Loss of forestland inevitably leads to loss of the local forest products industry, hence feeding a vicious economic cycle where landowners have no ability to sell forest products to support the cost of owning the land. Consequently, we wanted to include in the analysis some indicator of the size of the forest products industry over time in each of the study sites. An extensive effort was made to find some applicable data for the Thames study area, to no avail.

Town- and county-level data on the value of the Connecticut and Massachusetts wood and forest products industries were not readily available. Federal and state government offices and databases did not have the desired information. For instance, the County Business Patterns database had economic data at the county resolution, but it was limited to employment and payroll information, with no data available on the actual value of the industries. Conversely, the Bureau of Economic Analysis had data on the value of wood and forest product industries, but only at the state level, and they were unable to provide the county- and metro-level data from which their state reports were presumably assembled. Queries with the New England Agricultural Statistics Service and the Massachusetts and Connecticut Departments of Economic and Community Development yielded no information.

Industry and trade groups such as the American Forest and Paper Association, the Massachusetts Forestry Association, the New England Forestry Foundation, the Massachusetts Maple Producers Association, and academic institutions such as the University of Connecticut had state-level data, but nothing at finer resolutions.

The best source of data was the 1997 Economic Census, which had data at the county- and metro-level for the shipment values of manufactured goods, in addition to the sales values for wholesale and retail trade. Industries covered included lumber, paper, and wood products. Unfortunately, industry data were often listed as, "withheld to avoid disclosure," and therefore unavailable. Additionally, the Economic Census is only held every five years, and 1997 is the first year in which specific wood products information is available; prior to 1997, the lumber, paper, and wood products data are grouped nonspecifically under "wholesale," and "manufacturing," with no way to separate them into industry-specific information. The 2002 Economic Census is currently underway, but until those data are compiled, 1997 is the only year for which the desired data are available.

After a similar search of government and industry sources for the Catskill/Delaware region, it was determined that the forest industry data available for the region were generally not of a spatial or temporal resolution that would allow comparisons between the recent history of the timber industry in this region and land use/land cover changes.

Results—Catskill-Delaware Region

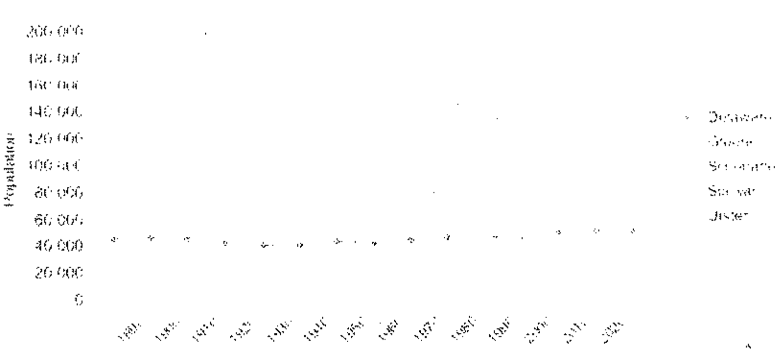
Empirical Rate of Forestland Loss and Apparent Causes

With the exception of Ulster County with prime Hudson Valley real estate, population growth in the counties included in our study area has been fairly flat going back as far as 1890 (figure 13). What these data do not reveal, however, is the flux in weekend and seasonal inhabitants, which promotes development of the facilities and services they require. Within the boundaries of the New York City Watersheds there are 68,400 parcels of private land covering over 900 thousand acres. As evidence of the ownership dynamics in this area, only 36,400 of these parcels covering 444,870 acres are owned locally, while people whose home address is outside the region own 32,000 parcels covering 482,250 million acres. This means that 52% of the private land is owned by non year-round residents, while 48% is locally owned. Thus resident population, as measured by the 10-year census, cannot be used in this region to predict a future rate of forest fragmentation. This is also evidenced by the widely varying discrepencies between the 1990 and 2000 population statistics and the Catskill forest cover in the five counties (figure 13).

Towns Included in Tax Parcel Ownership Analysis

Andes	Deposit	Hunter	Masonville	Shandaken
Ashland	Fallsburg	Hurley	Meredith	Sidney
Bovina	Franklin	Jefferson	Middletown	Stamford
Broome	Gilboa	Jewett	Neversink	Tompkins
Colchester	Halcott	Kortright	Olive	Walton
Conesville	Hamden	Lexington	Prattsville	Wawarsing
Delhi	Hardenburg	Liberty	Rochester	Windham
Denning	Harpersfield	Marbletown	Roxbury	Woodstock

Within the entire study area of 1.8 million acres, 376.000 acres are owned by the city and the state to protect NYC drinking water. Assuming that this land will be protected in perpetuity, we excluded it from our analysis, hence our results are focused on changes in the 1.4 million acres of private forestland in the region. Our findings indicate that private forests are disappearing at a rate of 16.187 acres (1.3 %) each year, for a total of 145.685 acres in the nine years between 1992 and 2001, in a pattern that is clearly evident of increased fragmentation of the forest resource. If that same trend continues, the region will lose another 162.000 acres of private forests by 2011. To arrive at this number, we derived the rate of forest conversion from the classified satellite imagery (1992-2001) and extrapolated that same rate into the future. This rate of forest loss may or



County	Population Change 1990-2000	Forest Cover Change 1992-2001
Delaware	1.76%	7%
Greene	7.72%	-3%
Schoharie	0.87%	-3%
Sullivan	6.77%	-6%
Ulster	7.53%	-5%

Figure 13. Population statistics for counties in the area of analysis (left) and population vs. forest cover change (right).

	Forest 1992	Non-forest 1992	Forest 2001	Non-forest 2001	% Forested in 1992	% Forested in 2001	Acres of 1992 Forest Lost	Acres 1992 Non-forest Reforesting	Net Acres 'Forest' Lost
Delaware	366425	64820	322781	108464	83%	75%	49844	6200	43645
Greene	174780	18871	161274	32376	88%	84%	17048	3543	13506
Schoharie	83071	11188	76825	17434	86%	82%	8000	1754	6247
Sullivan	262040	38350	236681	63709	86%	79%	30846	5487	25359
Ulster	360527	48002	326569	81960	87%	80%	39946	5988	33958
Total	1246843	181230	1124129	303944	87%	79%	145685	22972	122714

Table 2: Catskill/Delaware forest history (acres). All numbers include only privately-owned lands.

may not remain the same in future years, and will likely have some relationship with economic activity, however, we were not able to find an economic database for the last 10 years at a scale that would allow us to look for correlations between economic activity and land use change.

In 1992 privately-owned lands were 86% forested. By 2001, they were 79% forested. Delaware, Ulster and Sullivan, are losing forest faster than Greene and Schoharie (table 2). At the same time that private forests were being converted to other uses, some land was apparently "reforesting," i.e. land that was not classified as forest in 1992 was by 2001 showing up as forest on the satellite imagery. Some of this land may be working forest, i.e., regrowth after silvicultural treatment; some may be former agricultural land acquired by the NYC DEP. This merits further investigation. Considering the "reforesting" areas, the net change was 122,714 fewer acres in private land classified as "forest." In spite of the regrowth, the overall loss of 12% of the private forestland over the nine-year period far exceeds the amount that is "reforesting," which is 1.5% of the private forestland in 2001.

Including the publicly-owned forest, the entire region analyzed went from 87% to 81% forested over this nine-year period (table 3), and we project this to drop to 76% by 2011. This projection includes "reforestation." If "reforesting" land is not developed in the meantime, it will take more than the time period of our projections to grow back into a full closed-canopy forest. Therefore these projections are likely to be on the high side, with actual forest cover somewhat lower.

	% Forest Including Public Land	
	1992	2001
Delaware	83%	76%
Greene	90%	87%
Schoharie	85%	81%
Sullivan	85%	78%
Ulster	90%	85%
Total	87%	81%

Table 3: Percent forested, including all lands, by county 1992 and 2001

Within the New York City Watersheds, parcel size is decreasing and our analysis indicates that forest land that has been parcelized is 1.5 times more likely to be converted to other uses than land that has not been divided. The average parcel size has gone from 18 acres in 1985 to 14 acres in 2000,[15] clearly indicating increased parcelization of forestland since 1985. As evidence that parcelization (smaller ownerships) does lead to further forest fragmentation, our data from a sample of 122,000 acres, show that lands that had been parcelized between 1984 and 2000 experienced a higher rate of forest loss (8%) than those that had not been parcelized (5.5%).

Of the six New York City watersheds located in the region of analysis, all but the Cannonsville are entirely represented. Of the total 1.8 million acres analyzed, 877,354 acres lie within the NYC water supply catchments. Clearly those with the most publicly-owned land experienced the least loss of forest cover from 1992 to 2001 (table 4). The portion of the Cannonsville Reservoir catchment that lies within the study region, which is 97%

private land, has lost 10 percent forest cover during the 9 year period. The Ashokan Watershed, with only 37% private ownership has lost only 2 percent, while the Neversink, with 45% private land has lost 1 percent of its forest. The reader is reminded that "forest cover" includes some reforesting land. The actual loss of 1992 forest is 19 percent in the Cannonsville and 2 percent in the least impacted basin, the Neversink. Overall the NYC catchments have gone from 88.7 percent "forest cover" to 84.2 percent in a nine year period, which includes a loss of 8 percent of the 1992 forest but a net change of only 4.5% due to reforestation of agriculture and forestry lands since 1992. The true loss, therefore, is somewhere between 4 and 8 percent or 0.4 and 0.9 percent per year. The watersheds were analyzed as potential determinants of the pattern of landscape development, but ranked low among candidate drivers based on the kappa statistic of validation (table 5).

NYC Watershed Basins	Cannonsville	Schoharie	Pepacton	Ashokan	Neversink	Rondout	Total Basins	Outside NYC Watersheds	Total Area Analyzed
Proportion Public land/Basin	2%	22%	20%	58%	53%	46%	29%	7%	17%
Percent Private Land	97%	77%	78%	37%	45%	50%	69%	92%	79%
Percent Water	0%	1%	2%	5%	3%	4%	2%	1%	2%
Percent Forested in 1992	75%	88%	89%	97%	97%	96%	89%	84%	87%
Percent Forested in 2001	65%	85%	84%	95%	96%	92%	84%	78%	81%
% Change	10%	3%	5%	2%	1%	4%	4%	6%	5%
% Loss of 1992 Forest	19%	7%	8%	3%	2%	5%	8%	11%	10%

Table 4: Change in forestland in the NYC Watersheds basins 1992 - 2001 (percentages are rounded).

Pattern of Forestland Fragmentation, the Empirically-Important Factors and Their Ability to Predict the Future Location of Development

In the Catskill-Delaware study we tested the ability of 18 factors to accurately predict where development (defined as change from forest to non-forest) occurred between 1992 and 2001. The results of our analysis show that development in the Catskill-Delaware region is driven primarily by the increasing number of non-local land owners desiring a piece of rural forested America, and the establishment of the facilities and services to support that weekend/vacation time population. In the five counties that surround the heart of this region the most important biophysical factors influencing what land is selected for development are elevation and slope, which is not surprising in a mountainous region. The socio-economic factors are distance to "urban" areas, population density, and the economic "infrastructure" of local and secondary roads (table 5).

We compared the simulated 2001 results using the "vulnerability" map for each factor, to the actual 2001 land use map. The goodness of fit between the simulated map and the actual map is indicated by the kappa statistic, which measures how much better than chance alone the model is in predicting areas that will be converted from forest to non-forest (with "0" being no better than chance alone and "1" being a perfect predictor). In this case, with our best driver set we achieved overall a 90.9% agreement between the simulated and the real map, with a very high kappa of 0.7319. It is interesting to note that while population density returned the same kappa as distance to secondary roads, including it with the top five drivers reduced the kappa, and hence the predictive power of the first five combined. Each additional driver tested in the model reduced the "goodness of fit" even more.

Zooming in to get a better view in figure 14 we illustrate the "goodness of fit" between the simulated 2001 and the actual 2001 map. Working with 30 x 30 meter square cells, the four classes represent 1) cells left in forest by the model that were in fact still forested in 2001 (correct), 2) cells simulated as converted from forest that were in actuality still forested in 2001 (incorrect); 3) cells left in forest by the model that were actually non forest in 2001 (incorrect), and 4) cells simulated as non-forest that either remained as non-forest or were in fact

Individual Drivers - Unconstrained

Driver	Rank	Kappa	%Correct
Population Density	1	0.5370	84.31
Elevation	2	0.5255	83.92
Population over age 65	3	0.5239	83.86
Distance from Urban	4	0.5176	83.65
Distance from State Owned Lands	5	0.5176	83.65
Distance from Local Roads	6	0.5035	83.17
Distance from Agricultural Lands	7	0.5021	83.12
Slope	8	0.4983	83.00
Distance from Secondary Roads	9	0.4979	82.98
Distance from Ski Resorts	10	0.4970	82.95
Owner Occupied Housing	11	0.4939	82.85
Distance from Primary Roads	12	0.4901	82.72
Distance from Water	13	0.4885	82.66
Distance from Route 28	14	0.4854	82.56
Distance from NYC	15	0.4848	82.54
Aspect	16	0.4813	82.42
Distance from Hydrological Features	17	0.4812	82.42
Basins	18	0.4787	82.33
Top 5 Drivers		0.5633	85.27

Individual Drivers - Constrained Neighborhood

Driver	Rank	Kappa	%Correct
Distance from Urban Areas	1	0.7285	90.80
Elevation	2	0.7271	90.75
Slope	3	0.7263	90.72
Distance from Local Roads	4	0.7260	90.71
Distance from Secondary Roads	5	0.7255	90.69
Population Density	6	0.7253	90.69
Distance from State Owned Lands	7	0.7250	90.68
Distance from Primary Roads	8	0.7248	90.67
Distance from Hydrological Features	9	0.7241	90.65
Aspect	10	0.7241	90.65
Distance from Water	11	0.7241	90.65
Basins	12	0.7236	90.63
Distance from Route 28	13	0.7235	90.63
Population over age 65	14	0.7235	90.63
Distance from NYC	15	0.7232	90.61
Distance from Ski Resorts	16	.07229	90.61
Owner Occupied Housing	17	0.7227	90.60
Distance from Agricultural Lands	18	0.7224	90.59
Top 5 Drivers		0.7319	90.91

Table 5: Comparison of ability of individual drivers to re-create the 2001 landscape under an unconstrained simulation (left) and one restricted only to those cells falling within 30 meters of previously developed cells (right).

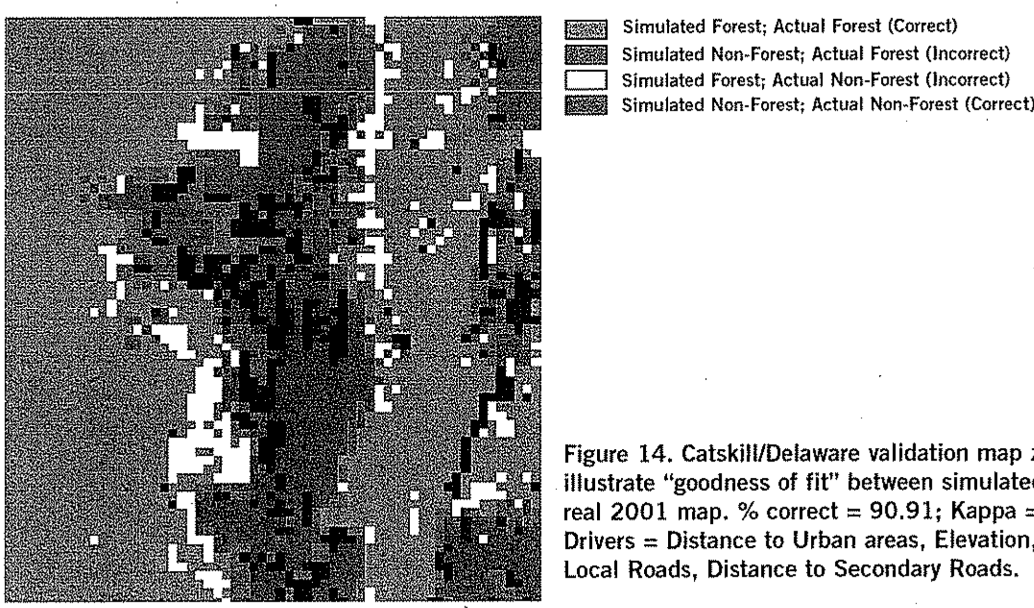


Figure 14. Catskill/Delaware validation map zoomed in to illustrate "goodness of fit" between simulated 2001 map and real 2001 map. % correct = 90.91; Kappa = 0.7319; Drivers = Distance to Urban areas, Elevation, Slope, Distance to Local Roads, Distance to Secondary Roads.

converted to non-forest use (correct). This is perhaps the most intuitive way to visualize how well the model can predict the actual pattern of development over the nine year period.

The model can be allowed to select all of the highest weighted cells across the region, or be constrained to a neighborhood. Under the unconstrained simulation the kappa was considerably less than that achieved when the model was constrained to select within a distance of 30 meters of already developed land. This suggests a strong clustering of development as opposed to dispersal of settlement.

Furthermore, the top six factors are not the most significant in all counties (table 6), highlighting the differences in the underlying topography, and we assume, the different socio-economic forces at play, as well as the land that is available for sale. For instance, the drivers of high development preference are distance from water in Delaware and Greene Counties, but distance from publicly-owned lands is more important in Schoharie and Sullivan Counties. Also, in the three counties with the greatest topographic variation—Schoharie, Sullivan and Greene, aspect is one of the top five factors. This illustrates a preference for both flat land, which lessens development costs, and aspect, an indicator of sunlight in a region of dark valleys. Elevation is one of the most predictive factors in 3 of the 5 counties.

Nonetheless, the kappa statistics are quite close for all factors, indicating the interdependence of topography, roads, population, and urban development. Using these factors in combination in the GEOMOD process has given us great predictive power to project the pattern of future land development. We believe such information can be very useful to communities, planners and developers.

Future Projections

Simulation of the future landscape was performed at the county level using the best set of drivers for each county (table 6). The time period selected for the projections was based on how far back we were able to analyze the rate of change, so that in the Catskills where we had land use data for only 1992 and 2001, we project forward only 10 years. For each county, we assumed the same rate and pattern of change that we have seen for the 1992-2001 period. Sites for future development were selected from the areas of highest weighting in the forest-fragmentation potentiality map (figure 15a).

Weights were derived based on the amount of development that has already occurred within each county on land with similar characteristics relative to the five factors from among distance from urban areas, elevation, slope, distance from local roads, secondary roads, primary roads, rivers, and population, that together yielded the best "goodness of fit" between the simulated and the real 2001 map for each county. For the final risk map used for future projections (figure 15a) "distance to urban areas," important in all five counties, was updated to reflect distance from all areas in "urban" uses by year 2001. This map, when summarized in three categories from high to low potential for development, allows communities to identify quickly those areas most at risk within their county. The areas of highest vulnerability exhibit a linear pattern that appears to follow roads, which follow streams up the narrow valleys, as has been the case in the past.

Although we received a lower kappa when analyzing the region as a whole, i.e. without stratification by county, figure 15b illustrates which areas regionally are most at risk based on previous development on land with similar characteristics relative to the five top factors for the region.

	TOTAL	DELAWARE	GREENE	SCHOHARIE	SULLIVAN	ULSTER
Distance from Urban Areas	90.80	90.70	90.97	91.64	90.55	90.80
Elevation	90.75	90.68	90.79	91.67	90.60	90.78
Slope	90.72	90.70	90.77	91.53	90.48	90.72
Distance from Local Roads	90.71	90.64	90.78	91.53	90.49	90.73
Distance from Secondary Roads	90.69	90.58	90.85	91.64	90.48	90.68
Population Density	90.69	90.61	90.80	91.48	90.42	90.73
Distance from State Owned Lands	90.68	90.49	90.72	91.64	90.58	90.71
Distance from Primary Roads	90.67	90.50	90.72	91.38	90.56	90.75
Distance from Hydrological Features	90.65	90.62	90.77	91.56	90.37	90.62
Aspect	90.65	90.43	90.80	91.59	90.50	90.69
Distance from Water	90.65	90.50	90.83	91.48	90.43	90.68
Basins	90.63	90.55	90.75	91.37	90.39	90.67
Distance from Route 28	90.63	90.43	90.70	91.54	90.59	90.62
Population over age 65	90.65	90.53	90.76	91.45	90.45	90.69
Distance from NYC	90.61	90.61	90.64	91.43	90.35	90.62
Distance from Ski Resorts	90.61	90.49	90.65	91.45	90.46	90.62
Owner Occupied Housing	90.60	90.43	90.70	91.46	90.43	90.66
Distance from Agricultural Lands	90.59	90.40	90.70	91.46	90.40	90.68
1ST						
2ND						
3RD						
4TH						
5TH						

Table 6: Although the first five drivers on the left provided the highest predictive power for the region as a whole, this table illustrates how different factors are important in different counties. For ease of interpretation the simple % correct is used here.

Using GEOMOD, we simulated the rate and pattern of forest fragmentation out into the future from 2001 to 2011 (figure 16). The results show Delaware and Ulster County respectively losing 55,000 and 44,000 acres of their 2001 forest cover by 2011 (figure 17). This is a reduction of 17% and 14% of each county's remaining privately-owned forest (table 7). For the entire region of analysis, using the 1992-2001 rates, we estimate that another 162,000 acres of privately owned forestland will be lost to development, leaving the area 76% forested (including public and reforesting lands) by 2011, down from 81% in 2001 (table 8). Not only does this imply loss of the working forested landscape but these results could have significant impact on New York City water quality as well. Of all the NYC water supply watersheds in the analysis, we project the greatest loss of forest cover in the Cannonsville Watershed—approximately 30,000 acres, amounting to 18% of its private forests by year 2011, followed by the Pepacton, which will lose 11% (figure 18).

Not only is there loss of forest, the remaining forest is more fragmented. Using a simple measure over the entire study area of "area of intact forest" vs. "perimeter of forest patches," the area:perimeter ratio was 187:1 in 1992; 150:1 in 2001 and is projected to be 105:1 in 2011. Forest patches are getting smaller, with more edge environment, which has implications for wildlife, invasive species, and water quality.

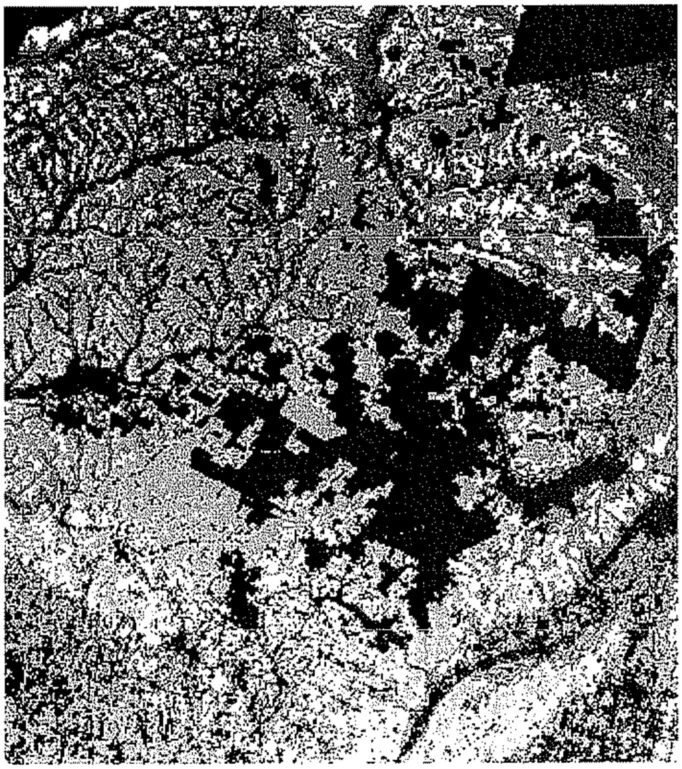


Figure 15a. Forest Fragmentation 'Potentiality' or 'Risk' Map calculated for each of the five Catskill-Delaware Counties included in the analysis. This map illustrates those areas within each county most and least likely to be developed based on which land has been the most desirable for development in the past.

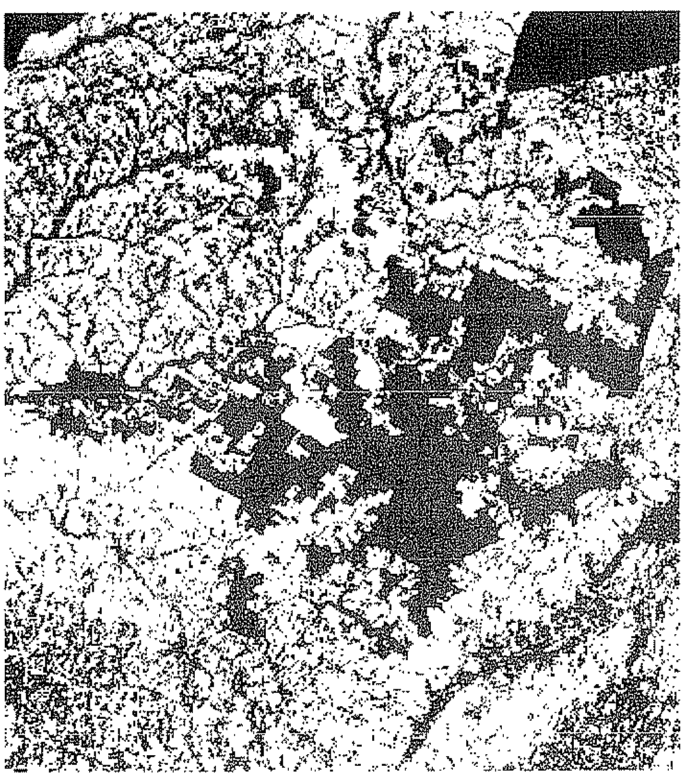


Figure 15b. Forest Fragmentation 'Potentiality' or 'Risk' Map for the Catskill-Delaware Region. In this map forested areas are categorized from high to low risk of development based on past regional patterns. Areas in red are those under greatest pressure for future development compared to other areas across the entire region.

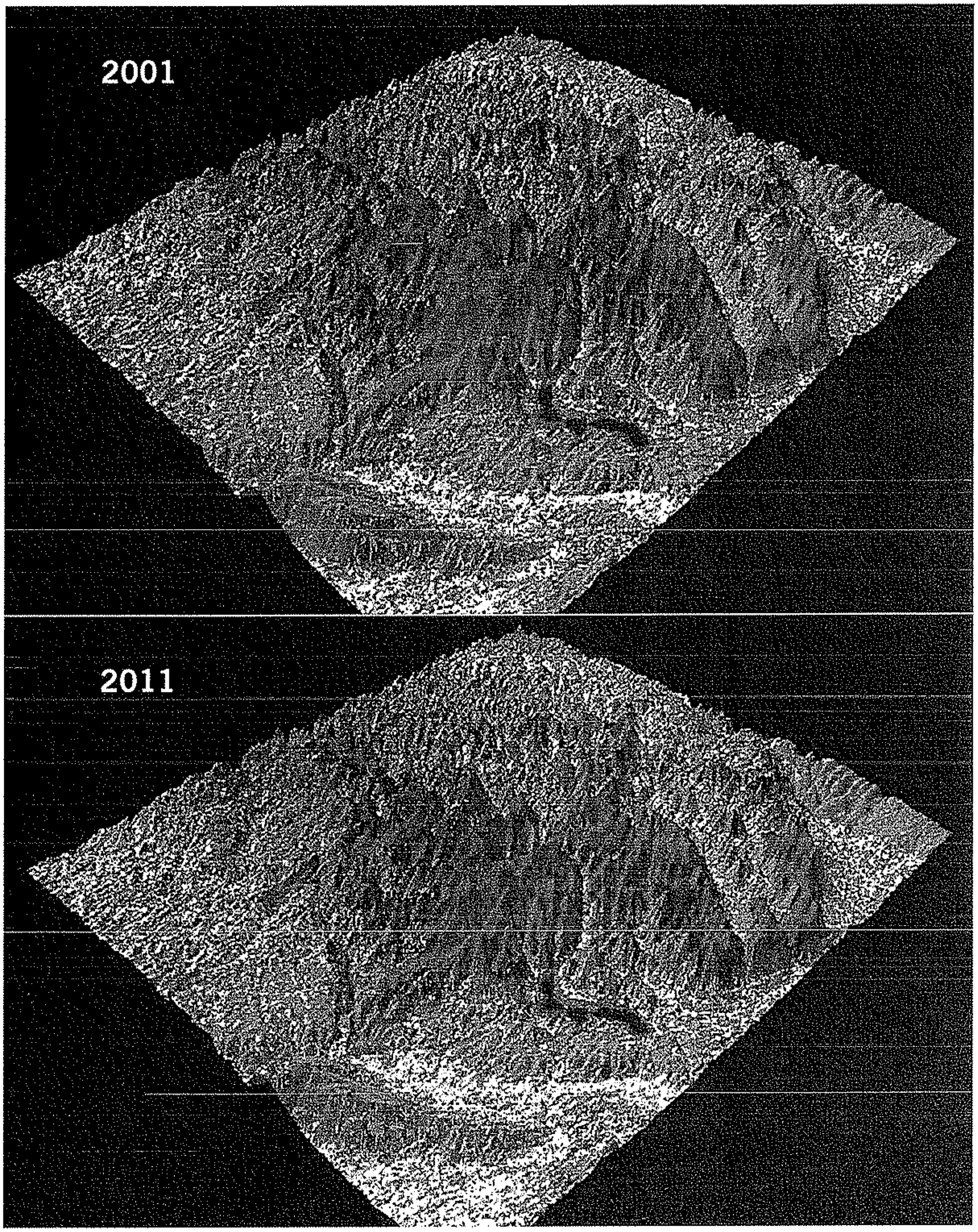


Figure 16. Catskill-Delaware forest fragmentation projections from 2001 (existing) to 2011. Green is forest, white non-forest, brown state- and city-owned lands, and blue water.

Acres Forest (Private Lands)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Delaware	[illegible]	[illegible]	305504	299966	294428	288889	283351	277813	272275	266736	261198
Greene	[illegible]	[illegible]	153943	152048	150154	148260	146365	144471	142577	140683	138788
Schoharie	[illegible]	[illegible]	73293	72404	71515	70626	69737	68849	67960	67071	66182
Sullivan	[illegible]	[illegible]	224339	220912	217485	214057	210630	207203	203775	200348	196920
Ulster	[illegible]	[illegible]	311704	307266	302828	298389	293951	289512	285074	280636	276197
Total Acres	[illegible]	[illegible]	1068784	1052596	1036409	1020222	1004035	987848	971660	955473	939286
Net (adjusted for reforestation)	[illegible]	[illegible]	1040708	1021968	1003229	984489	965750	947010	928270	909531	890791
% Private Lands Forested											
Delaware	[illegible]	[illegible]	71%	70%	68%	67%	66%	64%	63%	62%	61%
Greene	81	80	79%	79%	78%	77%	76%	75%	74%	73%	72%
Schoharie	80	[illegible]	78%	77%	76%	75%	74%	73%	72%	71%	70%
Sullivan	[illegible]	[illegible]	75%	74%	72%	71%	70%	69%	68%	67%	66%
Ulster	78	[illegible]	76%	75%	74%	73%	72%	71%	70%	69%	68%
Total Acres	[illegible]	[illegible]	75%	74%	73%	71%	70%	69%	68%	67%	66%

Table 7: Catskill/Delaware forest fragmentation projections 2001-2011 by county. All numbers include only privately owned lands.

Acres Forest (All Lands, Public and Private)

% County Area in Forest	Total Acres in County	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Delaware	492860	83	[illegible]	81	80%	80%	79%	78%	77%	77%	76%	75%	75%	74%	73%	72%	72%	71%	70%	69%	69%
Greene	288915	[illegible]	90	90	89%	89%	89%	88%	88%	88%	87%	87%	87%	86%	86%	85%	85%	85%	84%	84%	84%
Schoharie	106681	85	84	84	84	83%	83%	82%	82%	82%	81%	81%	80%	80%	80%	79%	79%	78%	78%	78%	77%
Sullivan	326570	85	84	83	82%	82%	81%	80%	80%	79%	78%	78%	77%	76%	76%	75%	74%	74%	73%	72%	72%
Ulster	590023	90	89	89	88%	87%	87%	86%	86%	85%	85%	84%	84%	83%	83%	82%	82%	81%	81%	80%	79%
Total	1805050	87	86	85	85%	84%	84%	83%	83%	82%	81%	81%	80%	80%	79%	79%	78%	77%	77%	76%	76%

Table 8: Total forest area historic and predicted by county (includes public and private land, and reforesting land).

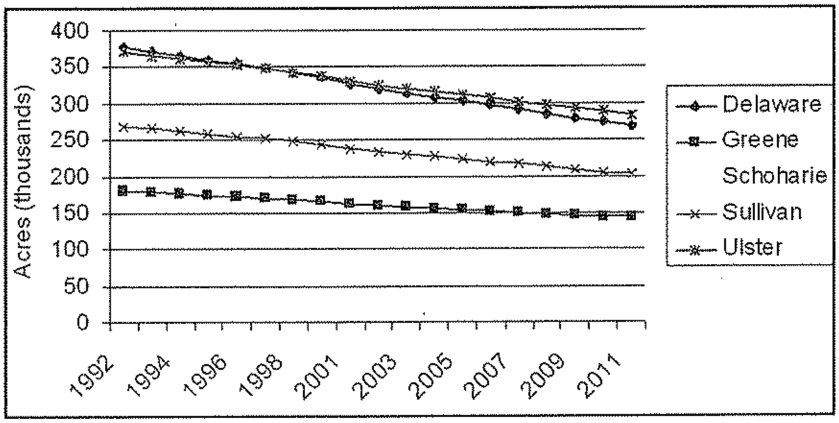


Figure 17(a). Forestlands per county 1992 - 2011. Empirical and linearly projected forest cover in the portion of the five counties included in the Catskill-Delaware study. Excludes public lands owned by the NY State DEC and NYC DEP and reforesting lands at 1992-2001 rate.

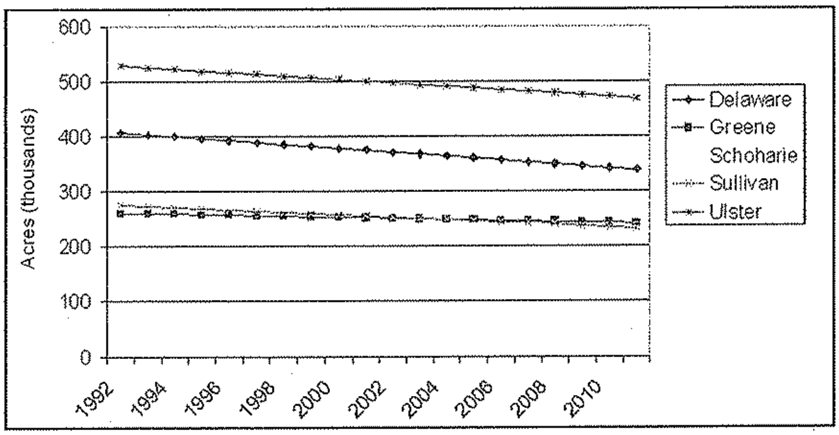


Figure 17(b). Forestlands per county 1992 - 2011. Empirical and linearly projected forest cover in the portion of the five counties included in the Catskill-Delaware study. Includes public lands owned by the NY State DEC and NYC DEP and lands reforesting at 1992-2001 rate.

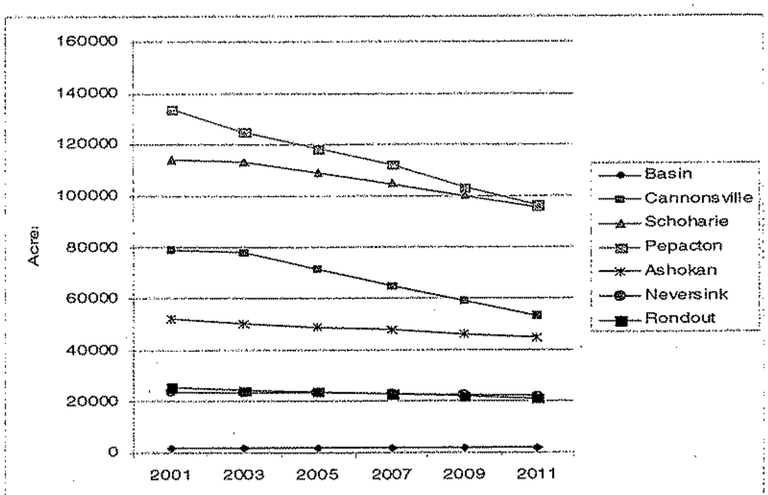


Figure 18. Catskill-Delaware forest area projections per NYC Water Supply Watershed 2001 - 2011.

Results—Thames Watershed

Empirical Rate of Forestland Loss and Apparent Causes

The Thames Watershed is part of the New England landscape, which has gone through tremendous changes in the past two centuries. From a completely forested wilderness in the 17th century, it was substantially cleared for farming by the mid-1800s. Then, as farms on these rocky soils were abandoned, much of the land grew back to a central hardwood forest. Dairy farming remained for much longer, but by the late 20th century, even that was mostly gone, with former pastures converted to housing developments with names like "Orchard Lane." Thus, the forests changed from being patches in a landscape of agriculture and industry in the mid-1800s to being the predominant landscape feature in the late 20th century.

Now, it seems as if the trends are reversing, with more and more forestland being cleared for development (table 9). In 1985 the land in our study area was 79% forested—by 2002 it had declined to 74%. Private lands not protected from development dropped from being 74% forested in 1985 to 69% forested in 2002. This loss of forest is not evenly distributed, but exhibits a pattern of distinct fragmentation. Some towns remain virtually unchanged in forest cover, while others have lost 10–12 % of their forest. Considering only the land that is available for development, that is, excluding forestland permanently protected by government ownership or conservation easement, then the situation is even more dramatic. Fifteen towns have lost more than 10% of their unprotected forestland in the past seventeen years.[15]

New housing development is clearly a factor in the changing landscape. Many towns in the study area are expanding residential development at a scale of 2 to 3 new houses per square mile each year (see appendix D).

Total Acres in Area of Analysis	2002	1,195,138
Acres Included in Analysis (land not permanently protected from development)	2002	993,183
Acres in Water	2002	45,943
Acres in Conservation Lands	2002	156,001
% Area in Water	2002	4%
% Area in Conservation Land	2002	13%
Total Acres of Forest	1985	940,702
	2002	887,973
% Forested	1985	79%
	2002	74%
Forest Cover (Excluding Conservation Lands)		
Actual (acres)	1985	738,747
Actual (acres)	2002	683,970
Projected (acres)	2008	665,747
	2013	650,561
	2018	635,375
	2023	620,189
% Loss 1985 - 2002		7%
% of 2002 Unprotected forest at risk	by 2013	5%
	by 2023	9%

Table 9: Thames Watershed 2002 land cover and projected changes through 2023.

Median housing prices, after declining in the mid-1990s, are on the rise again. Employment in the area, on the other hand, has remained relatively flat since 1990, indicating that new residents are likely commuting to urban areas for employment. Overall population has also remained fairly flat, so the expansion in housing means smaller households, in line with national trends. The population dynamics of the area are not easy to interpret, however, as many towns are losing population and many others gaining. For the most part, the smaller towns (under 15,000) are growing, while the larger towns (over 15,000) are losing people (figure 19). The town of Eastford, for example, with a population of 1,350 in 1990, gained 280 residents in the following ten years, a 21% increase. Three hundred or so new people in a small town can be a big drain on local resources.

We plotted the decline in forest cover since 1985 and fit two trend curves to the data set (figure 20). The best projection of loss of forestland over the next 20 years is probably somewhere between the conservative third order polynomial trend line that predicts a leveling off at around 680,000 acres, a loss of only 6,000 acres, and the more aggressive linear trend that predicts a loss of 60,000 plus acres. Nevertheless, for our projections we used the higher quantity of forest loss predicted by the linear trend since polynomial curves, given their inherent nature, are often reliable for only a small portion of a data set, and less reliable over a longer period of time.

Our analysis revealed that the highest loss of forest cover occurred in three Massachusetts towns, Webster, Oxford and Spencer, and the Connecticut towns of Vernon and Norwich (table 10). Interestingly, six of the ten towns with the highest rates of forest loss are also among the top ten towns with the least forest cover. This apparent relationship between total area developed and the on-going rate of forest loss coincides with our findings that the lands most vulnerable to deforestation are those neighboring already developed lands (see below). In contrast, five of ten towns experiencing the least forest loss since 1985 are among the ten towns with the highest percent forest cover.

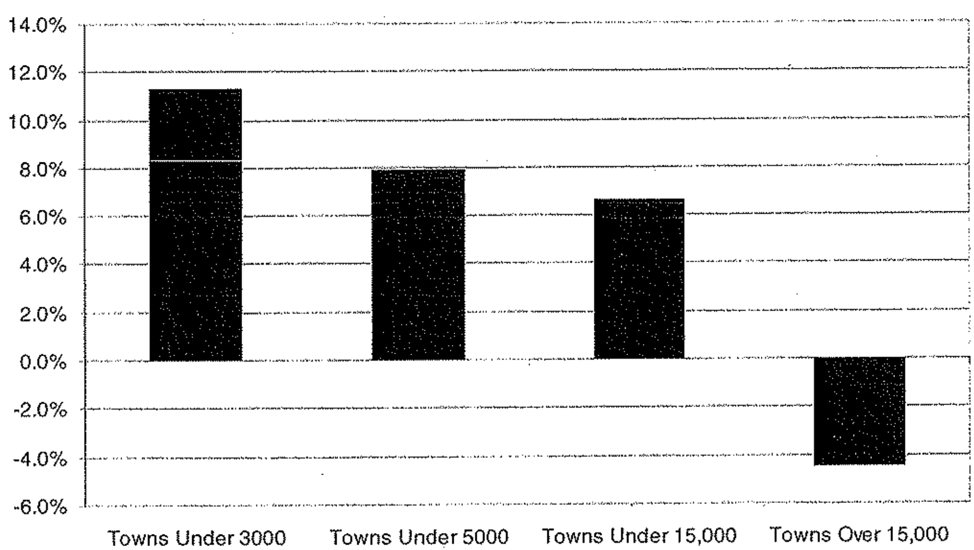


Figure 19. Population changes 1990–2000 for 59 towns in Thames Watershed study area.

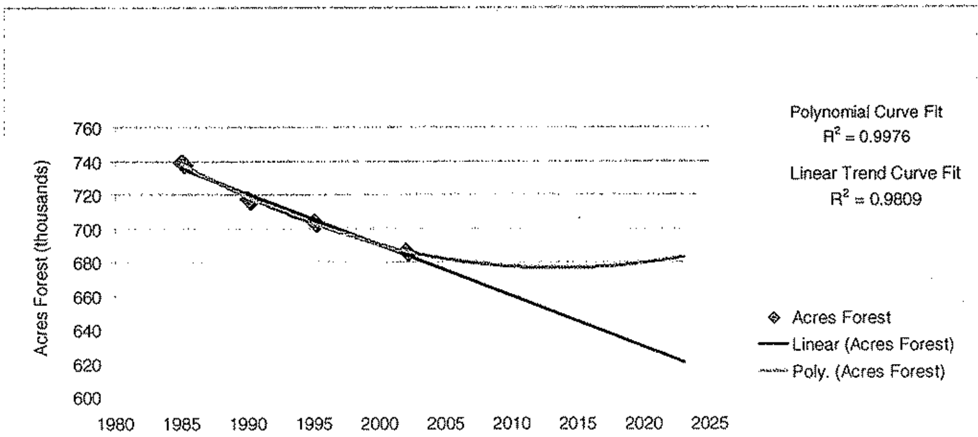


Figure 20. Analysis of 1985–2002 Thames Watershed forest cover and projection of trends to 2023.

Towns with top rate of forest loss 1985-2002	State	% loss of unprotected forest 1985 - 2002	Towns with least rate of forest loss 1985-2002	State	% loss of unprotected forest 1985 - 2002
Webster	MA	17	Union	CT	2
Oxford	MA	15	Holland	MA	3
Spencer	MA	13	Ashford	CT	3
Vernon	CT	13	Eastford	CT	4
Norwich	CT	13	Woodstock	CT	4
Plainfield	CT	12	Hampton	CT	4
Putnam	CT	12	Wales	MA	5
Leicester	MA	12	Scotland	CT	5
Windham	CT	12	Pomfret	CT	5
Charlton	MA	12	East Haddam	CT	5

10 least forested towns in 2002		% Forest Cover 2002	10 most forested towns in 2002		% Forest Cover 2002
Vernon	CT	47	Union	CT	91
Somers	CT	51	Wales	MA	91
Ellington	CT	52	Voluntown	CT	89
Norwich	CT	53	Holland	MA	86
Windham	CT	60	Chaplin	CT	85
Webster	MA	64	Eastford	CT	84
Putnam	CT	65	Stafford	CT	84
Lebanon	CT	65	Sturbridge	MA	84
Plainfield	CT	65	Brookfield	MA	84
Bolton	CT	66	Ashford	CT	83

Table 10: Thames Watershed towns with highest and lowest rate of forest loss (as a % of unprotected forestland) and highest and lowest forest cover (as a % total land area).

Pattern of Forestland Loss, the Empirically-Important Factors and Their Ability to Predict the Future Location of Development

In the Thames Watershed study we analyzed 34 different factors (table 11). We compared the simulated 2002 results using the "vulnerability" map for each factor, to the actual 2002 land use map. The "goodness of fit" between the simulated map and the actual map is indicated by the kappa statistic, which measures how much better than chance alone the model is in predicting areas that will be converted from forest to non-forest (with "0" being no better than chance alone and "1" being a perfect predictor).

The highest kappa, hence the best prediction of the pattern of land use change, was obtained using the combination of three factors: distance to 1985 agricultural land; soils; and distance to 1985 developed land, with the region stratified by town (table 12). This last factor can be construed to match distance from "urban" areas in the New York study. We found that using all of the top eleven factors actually slightly reduced the model's ability to match the 2002 landscape. More information does not, therefore, necessarily aid in landscape unit (cell by cell) selection precision. The top three factors were used for future land use change projections post-2002, but were updated to reflect distance from 1990 agricultural and developed areas.

Nonetheless, the kappa statistics are quite close for all factors, indicating the interdependence of topography, roads, population, and urban development. Using these factors in combination in the GEOMOD process has given us great predictive power to project the pattern of future land development.

Validation Statistics for Connecticut Spatial Drivers; Time 1 = 1990, Time 2 = 2002

Rank	Factor	Kappa for location
1	Distance from 1985 Agricultural Lands	0.8928
2	Soil type	0.8881
3	Distance from 1985 Urban Areas	0.8859
3	Population Over Age 65 (1990)	0.8859
4	Density of Housing Units (1990)	0.8858
5	Population Density (1990 Census)	0.8855
5	Distance to Secondary Roads	0.8855
6	Owner Occupied Housing Units (1990)	0.8850
7	Population Under Age 18 (1990)	0.8849
7	Distance to Railroads	0.8849
8	Elevation	0.8846
9	Distance to Major Rivers	0.8843
10	Distance to Local Roads	0.8840
11	Distance to Primary Roads	0.8839
12	Number of Home Sales (1990)	0.8830
13	Unemployment Rate (1990)	0.8828
13	Distance to Local Roads	0.8828
14	Town polygons	0.8826
14	Single Family Housing Permits (1990)	0.8826
14	Labor Force - Construction	0.8826
14	# House Building Permits	0.8826
15	Labor Force - Service Industry	0.8823
16	Labor Force 1990	0.8821
17	Mean Value Owner Occupied Housing Units (1990)	0.8817
18	Median Home Sales Price (1990)	0.8816
19	Distance to Primary Roads	0.8815
20	Distance to Power Lines	0.8810
20	Distance to Pipe Line	0.8810
20	Slope	0.8810
21	Aspect	0.8807
22	Distance to Rivers/Lakes	0.8802
23	Distance to Casinos	0.8801

Table 11: Validation results for 34 spatially distributed factors tested in the Thames Watershed study.

Rank	Combination	Strata	% Correct	Klocation
1	Distance from '85 Agriculture, Soil Type, Distance from '85 Developed	By Town	94.94	0.8987
2	Distance from '85 Agriculture, Soil Type, Distance from '85 Developed	Entire Region	94.91	0.8987
3	Distance from '85 Agriculture, Soil Type, Distance from '85 Developed, Population over age 65, Density of housing units	By Town	94.87	0.8966
4	Distance from '85 Agriculture, Soil Type, Distance from '85 Developed, Population over age 65.	Entire Region	94.79	0.8958
5	Distance from '85 Agriculture, Soil Type	Entire Region	94.75	0.8949
6	11 top factors	Entire Region	94.46	0.8891

Table 12: Combined predictive power of 2002 land use using 1985 and 1990 information.

Future Projections

The forest fragmentation potentiality or "development risk" map for the Thames watershed, based on the three most highly predictive factors, is reclassed for visualization purposes to show those areas most likely to be developed in the next 10 to 30 years (Figure 21(a)). This map shows which areas in each town are most vulnerable to development, based on distance to 1990 agricultural land, soils, and distance to 1990 developed land. Weights were developed based on the amount of development that has already occurred within each county on land with similar characteristics relative to these three factors. The factors used are those that together yielded the best "goodness of fit" between the simulated and the real 2001 map for each town.

Figure 21(b), shown for comparison's sake, illustrates which towns or areas of the watershed are more at risk than others when the region is analyzed without stratification by towns. The weights are derived from the amount of land across the entire area already developed in 2001 with similar characteristics relative to the top three drivers. We projected the future scenario for changes in land cover in the Thames Watershed (figure 22), selecting for non-forest use those cells most vulnerable for change within each town. (figure 21a), since we had received a higher kappa using stratification by town.

The most dramatic changes will occur in the Massachusetts towns of Webster, Oxford and Spencer, which by year 2012 could lose an additional 10.5 %, 9.1 %, and 8.5 % respectively of their 2002 forest not currently protected from development, and twice that by 2022. These are followed by the Connecticut towns of Vernon, Norwich and Plainfield, already some of the least forested towns in the study area (tables 10 and Appendix D).

In the Thames Watershed, forest fragmentation has increased from 1985 to 2002. Using a simple measure over the entire study area of 'area of intact forest' vs. 'perimeter of forest patches,' the area:perimeter ratio was 421:1 in 1985, dropping to 381:1 in 2002. Forest patches are getting smaller, with more edge environment, which has implications for wildlife, invasive species, and water quality. However, our projections out to 2022 indicate that the future trend may result in a loss of the smaller forest fragments which results in a higher area:perimeter ratio. This ratio change could deceptively be interpreted to mean elimination of forest fragmentation, and consolidation of forest patches. Rather, inspection of the maps shows an infilling of developed areas by elimination of smaller forest fragments. This mathematically changes the area:perimeter ratio of the remaining forest, but does not mean there will be a consolidation of forest patches.

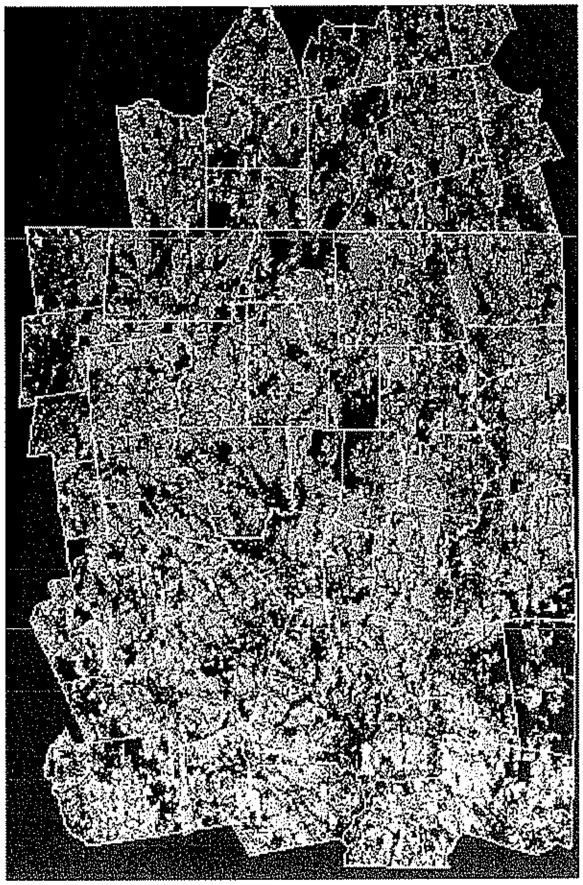


Figure 21a. Forest Fragmentation "Potentiality" or "Risk" Map calculated for each of the 59 towns in the Thames region of analysis. This map illustrates those areas within each town most and least likely to be developed based on which land within each town has been the most desirable for development in the past.

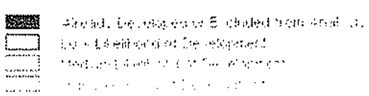


Figure 21b. Forest Fragmentation "Potentiality" or "Risk" Map for the Thames region. In this map forested areas are categorized from high to low risk of development based on past regional patterns. Areas in red are those under greatest pressure for future development compared to other areas across the entire region.

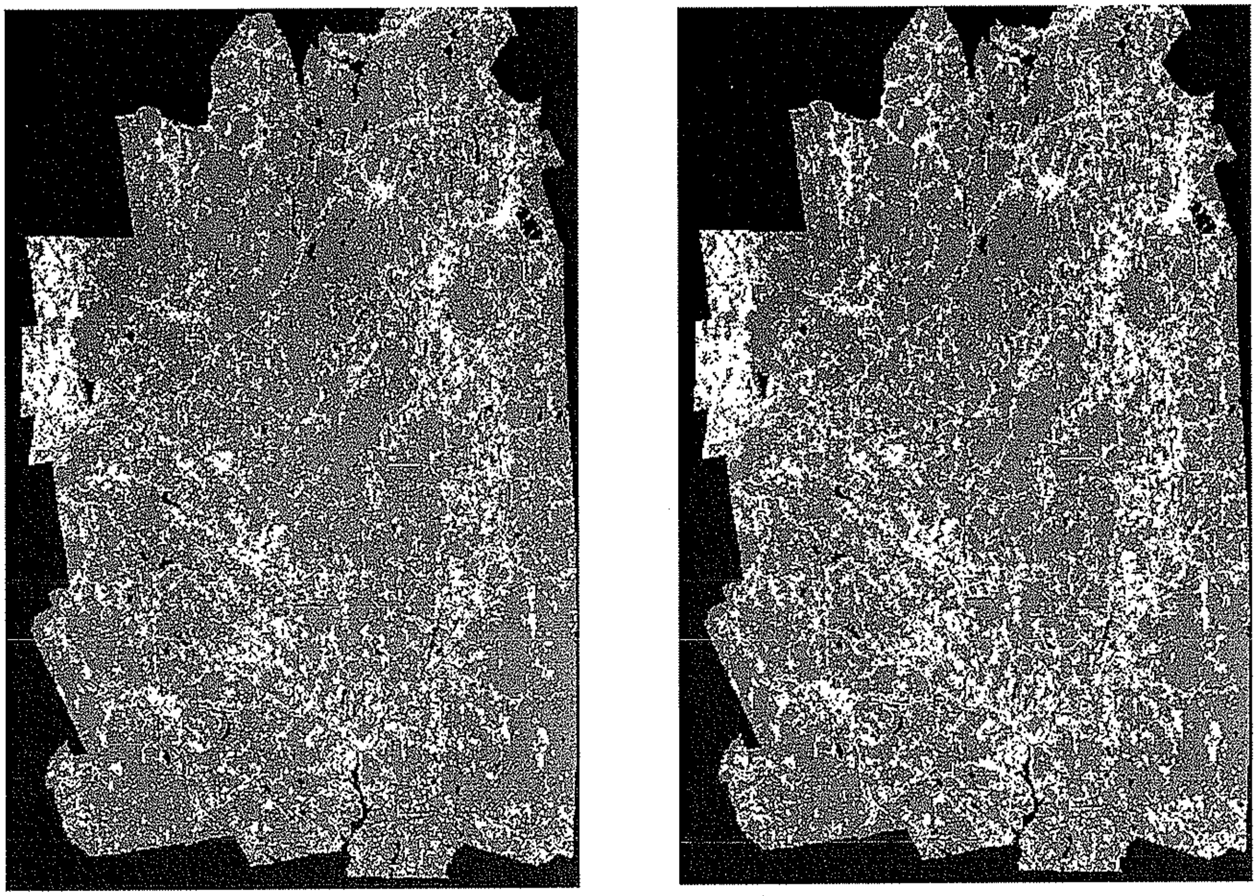


Figure 22. Thames Watershed forest fragmentation projections 2002 (existing) to 2022. Green represents forest (including conservation lands); yellow nonforest; and black water.

Conclusions

- The Catskill/Delaware region of New York and the Thames Watershed region of Connecticut and Massachusetts are losing forestland, and this trend will likely continue.

- Forests in the Catskill/Delaware region are increasingly fragmented, and this trend will likely continue. In the Thames Watershed, forest fragmentation has increased from 1985 to 2002, however, our projections out to 2022 indicate that the trend might be a loss of the smaller forest fragments which results in a higher area:perimeter ratio. This ratio change could deceptively be interpreted to mean elimination of forest fragmentation, and consolidation of forest patches. Rather, inspection of the maps shows an infilling of developed areas by elimination of smaller forest patches. This mathematically changes the area:perimeter ratio of the remaining forest, but does not mean there will be a consolidation of forest patches. The pattern of development in the Thames is less dispersed than that observed in the Catskills perhaps due to the fact that there is less private land available for development, or because of the type of development taking place.

- Ownerships are getting smaller (parcelization) in the Catskill/Delaware region and land that has been divided since 1984 is 1.5 times more likely to be fragmented than land that has not been parcelized during the past twenty years.

- As indicated by the discussions at the community workshops (Appendix A), local people know that their forests are becoming more fragmented and the rural character of their towns is changing, and they are asking for tools to help educate communities about the problems with growth and development in largely rural, forested areas.

- GEOMOD is a very useful tool for projecting future change in these areas and for helping communities visualize the impacts of seemingly innocuous, dispersed development in rural, forested areas.

- We are now able to identify where the highest risk seems to be of future forest fragmentation and loss within each area and within each county or town—a real benefit to conservation efforts.

- Already developed areas are nodes for expanded development. Towns with the least forest cover are losing the forest they have faster than towns that are mostly forested. Driving factors and indicators of development in the northeast are highly interdependent, thus no single one stands out as more highly predictive than others.

- Socio-economic data, although useful in understanding the demographic trends in an area, did not provide better predictive power than just bio-physical (topography) and socio-political (development and roads) factors alone. This is good news for broad application of GEOMOD in the northeast, because of all the factors we analyzed, the socio-economic data were the most time consuming to collect and format for the model.

- Based on the high kappa-for-location numbers that we achieved it appears that the predictive power of GEOMOD is much higher in the northeastern USA than in several of its applications in the tropics at the same scale, where it has been previously tested. This is probably due to the advanced state of GIS data availability in the USA, but perhaps more importantly due to the higher resolution (level of information) of the publicly-available map inputs we employed, rather than the types of mapped data we tested. In the end biophysical factors and infrastructure remained the most powerful indicators of future settlement pattern.

much as we and others, have found in the tropics.[18] Many of the other socio/demographic/economic factors we tested are probably co-dependent with these underlying factors. Even roads and towns are usually sited according to topographical factors, and historically navigable waterways. The imprint of the past is still very strong in both these regions. It follows that the population factors produced nearly equivalent kappas due to the fact that where there is development there are people, and where there is no "developed" landscape people are absent. This means that the model, having analyzed the percentage of cells in the map where, for example, the population density is high, will then look for those cells to "deforest," but in fact they are probably already in the non-forest class. Looking for flat land or western exposure is much easier, and there should be more variation in the selection and hence "goodness of fit" between factors. We would like to apply the model to one more northeastern location in order to make final recommendations about the best data sets for communities of the NE to use to project the business as usual landscape.

Recommendations

Ultimately, this research will be most widely applicable if the analytical tools and methods developed and tested in the study sites can be used by municipal, regional, county and conservation planners throughout the northeast. Our first job as researchers is to test the power of the tools. Having done that, our goal now is to put that power in the hands of the folks who are making the day-to-day decisions about land use planning. Once these local interest groups can analyze the land use change dynamics in their communities, they can project how these changes may affect the future of their landscape, their tax base and infrastructure demands, or critical areas of concern such as water quality, air quality, traffic, wildlife habitat, and recreation areas, and incorporate that knowledge into their policy and planning efforts.

Feedback from the community workshops indicates that this information would be extremely useful in the town, county and regional planning processes. We suggest, based on these discussions, that we create a CD in which the results of our research would be organized and presented in a way that would be easy for each town or county to "click" and see the local dynamics in their town and the surrounding area. This CD would be developed in collaboration with three or four "pilot" towns to fully utilize the information about forestland change and trends in socio-economic factors resulting from the analysis in a way that would be compelling and useful for the people and organizations whose every-day decisions affect land use change at the local scale.

To assure the predictive capability and overall usefulness of the model throughout the northeast, we recommend a third study site to increase our ability to test for commonalities of pattern and drivers of forestland change in the region. This will enhance our ability to indicate the broader implications about trends in land use change based on the trends detected in this study, and to guide communities in application of this model to their particular area. We found that in both the Catskill/Delaware and the Thames sites, the best predictors of the pattern of forest fragmentation were bio-physical and socio-political factors such as distance from previous development and roads. If this holds true in a third site, then it would be relatively simpler and less expensive to apply the model broadly in the northeast. Thus, in order to expand the potential for using GEOMOD as a land use planning tool, we recommend the following:

- Create a web-based workbook for using GEOMOD in the northeast including: types of data sets that are useful in predicting land use change and are widely available in standard formats; how to organize and format the data; how to run the model and interpret the results; and use of visualization tools for presentation of the model results.

- Adapt GEOMOD to run in ArcGIS. Currently GEOMOD is available in the IDRISI tool suite, however, ArcGIS is the most commonly used GIS tool by government and conservation organizations. Having an ArcGIS version of GEOMOD would make it much more likely that planning groups can use this tool.

- Create a web site for modeling and understanding land use change in the northeast featuring results of this research with emphasis on visualization tools and maps, annotated bibliographies of forest fragmentation literature, and resources for forest-focused land use planning tools for the northeast.

[1] Forest ownership numbers are extrapolated from the draft 2002 National Woodland Owner Survey (Butler and Leatherberry *forthcoming*).

[2] USDA Natural Resources Conservation Service 1997.

[3] Commonwealth Research Group 1995; Resource Systems Group 1999.

[4] Hall *et al* 1995a and 1995b.

[5] Hall *et al.* 2000.

[6] Pontius 2000.

[7] Hall *et al* 1995a and 1995b; Pontius *et al.* 2001; Hall and Dushku 2002.

[8] Pontius and Schneider 2001. Schneider and Pontius 2001.

[9] We wish to acknowledge the following agencies for much of the information found here: The Catskill.com website (www.catskillpark.com/catskills.html); The New York State Department of Environmental Conservation (www.dec.state.ny.us/website/dlf/publands/cats/); and The Catskill Center for Conservation and Development (www.catskillcenter.org).

[10] We wish to acknowledge the Connecticut Chapter of the Nature Conservancy (http://nature.org/wherewework/northamerica/states/connecticut/) and the Quinebaug-Shetucket Heritage Corridor, Inc. (http://www.thelastgreenvalley.org/) for much of the information found here.

[11] A description of the methods used for classification and post-classification assessment are found in Appendix B.

[12] For details on the accuracy assessment, refer to Appendix B

[13] More information about the Connecticut Statewide Temporal Land Cover and Land Cover Change Project is available at [illegible]

[14] [illegible] Thames [illegible]

[illegible]

[illegible] 2003

[illegible]

[illegible]

[illegible]

References Cited

Butler, B.J. and E.C. Leatherberry. Forthcoming. *USDA Forest Service 2002 National Woodland Owner Survey* (DRAFT). www.fs.fed.us/woodlandowners.

Chomitz, K. and D. Gray. 1996. Roads, land use, and deforestation: A spatial model applied to belize. *The World Bank Economic Review, Volume 16,* Number 3: 487-512.

Commonwealth Research Group. 1995. *Cost of Community Services in Southern New England.* Commissioned by Southern New England Forest Consortium, Inc.

Dushku, A., S. Brown and M.H.P. Hall. 2002. *Modeling the deforestation and carbon emissions baseline in the Rio Bravo Conservation and Management Area Climate Action Project 1993- 2035.* Web report. http://www.winrock.org/what/PDF/eco/Product%205%20GEOMOD%20to%20Rio%20Bravo%20CAP.pdf.

Eastman, J.R. 1999. *Idrisi32 Guide to GIS and Image Processing Volume 2.* ClarkLabs, Worcester, MA.

Hall, C.A S., C.J. Cleveland and R. Kaufmann, 1986. *Energy and resource quality: The Ecology of the Economic Process.* John Wiley and Sons, New York.

Hall, C.A.S., H. Tian, Y. Qi, G. Pontius, J. Cornell and J. Uhlig. 1995a. *Spatially Explicit Models of Land Use Change and Their Application to the Tropics.* DOE Research Summary, No. 31. (Ed. By CDIAC, Oak Ridge National Lab).

Hall, C.A.S., H. Tian, Y. Qi, G. Pontius, J. Cornell and J. Uhlig. 1995b. Modeling spatial and temporal patterns of tropical land use change. *Journal of Biogeography,* 22:753-757.

Hall, M.H.P. and A. Dushku. 2002. *Spatial Modeling of the Averted Deforestation Baseline for the Noel Kempff Mercado Climate Action Project, Bolivia.* Web report. http://www.winrock.org/general/Publications/EcoCoop.pdf.

Hall, M.H.P., C.A.S. Hall, and M.R. Taylor. 2000. Geographical modeling: The synthesis of GIS and simulation modeling, Chapter. 7, in C.A.S. Hall, (Ed.) *Quantifying Sustainable Development: the Future of Tropical Economies.* Academic Press, San Diego, CA. pp. 177-202.

Kaimowitz, David and Arild Angelsen. 1998. *Economic Models of Tropical Deforestation: A Review.* Bogor, Indonesia: Center for International Forestry Research.

Lambin, Eric F. 1997. Modeling and monitoring land-cover change processes in tropical regions. *Progress in Physical Geography* 21(3):375-393

LaPierre, S. and R.H. Germain. 2003. Parcelization of nonindustrial private forestlands in the New York City Watershed. Presented at *AWRA s International Congress on Watershed Management for Public Water Supplies.* New York City, NY July 1-2.

Pontius, Jr. R.G. and P. Pacheco. 2004. Calibration and validation of a model of forest disturbance in the Western Ghats, India 1920-1990. *GeoJournal.* In press.

Pontius, Jr. R.G., J. Cornell, and C. Hall. 2001. Modeling the spatial pattern of land-use change with GEO-MOD: application and validation for Costa Rica. *Agriculture, Ecosystems & Environment* 85(1-3):191-203.

Pontius, Jr. R.G. and L. Schneider. 2001. Land-use change model validation by a ROC method for the Ipswich watershed, Massachusetts, USA. *Agriculture, Ecosystems & Environment* 85(1-3):239-248.

Pontius, Jr. R.G. 2000. Quantification error versus location error in comparison of categorical maps. *Photogrammetric Engineering & Remote Sensing* 66(8):1011-1016.

Resource Systems Group. 1999. *The Economic Impact of Open Space in New Hampshire.* Prepared for The Society for the Protection of New Hampshire Forests.

Schneider, L. and R.G. Pontius Jr. 2001. Modeling land-use change in the Ipswich watershed, Massachusetts, USA. *Agriculture, Ecosystems & Environment* 85(1-3):83-94.

USDA Natural Resources Service. 1997 *National Resources Inventory* (Revised December 2000). Washington, DC.

Appendix A: Community Workshops

Participants at Thames Watershed Community Workshops

Michael Altshul	Green Valley Institute
Dick Booth	Wyndham Land Trust
Fred Borman	CT DEP - Division of Forestry
Steve Broderick	UCONN Extension Forestry
Mark Buccowich	USDA Forest Service State and Private, Cooperative Forestry
Dan Civco	UCONN Laboratory for Earth Resources Information Systems
Ruth Cutler	Green Valley Institute
Dan Donahue	Norcross Wildlife Foundation
Phillip Elliott	Eastern Connecticut State University
Doug Emmerthal	CT Division of Forestry
Delia Fey	Town of Killingly
John Filchak	NE CT Council of Governments
Carl Fontneau	Towns of Columbia and Scotland
Kristin Foord	Massachusetts Executive Office of Environmental Affairs
Ken Goldsmith	Woodstock Conservation Commission
Reanna Goodreau	Town of Ellington Planning Department
Scott Gravatt	Eastern CT Conservation District
Myrna Hall	SUNY College of Environmental Science and Forestry
Brian Holdt	UCONN NRME
James Hurd	UCONN Laboratory for Earth Resources Information Systems
Steve Klemchuk	
Sara Laughlin	Town of Thompson
Tom Luther	Northeastern Area, State & Private Forestry
Carrie Magee	Yale School of Forestry and Environmental Studies
Andy McLeod	The Trust for Public Land
Karen Mollander	Durham Field Office, NA State &Private Forestry
Roger Monthey	USDA Forest Service
Susan Nixson	SUNY College of Environmental Science and Forestry
Jim Parda	CT Division of Forestry
Elizabeth Petruska	Yale School of Forestry & Environmental Studies
Neil Sampson	Yale School of Forestry & Environmental Studies/The Sampson Group
Art Talmage	Conwood Foresters/Connecticut Tree Farm
Eric Thomas	Department of Environmental Protection
Bill Toomey	The Nature Conservancy
Eric Trott	Coventry Town Planner
Mary Tyrrell	Yale School of Forestry & Environmental Studies
Edwin Vonderheide	Woodstock Conservation Commission
Susan Westa	Green Valley Institute
Paul Wilbur	Woodstock Conservation Commission
Emily Hoffhine Wilson	NEMO Project, Cooperative Extension, UCONN

Participants at Catskill/Delaware Watersheds Community Workshops

Anne Altshuler	Olive Natural Heritage Society
Aaron Bennett	The Catskill Center
Page Bertelsen	Yale School of Forestry & Environmental Studies
Tim Cox	Corporate Counsel Catskill Watershed Corporation
Michelle Decker	SUNY College of Environmental Science and Forestry
Steve Dettman	Yale School of Forestry & Environmental Studies
Brian Fisher	Watershed Agricultural Council
René Germain	SUNY College of Environmental Science and Forestry
Nat Gillespe	The Nature Conservancy
Myrna Hall	SUNY College of Environmental Science and Forestry
Henry Kernan	Forest Landowner
Maureen Krudner	U.S. Environmental Protection Agency
Jack McShane	Catskill Landowners Association
Jean Millar	Roxbury Planning Committee
Ken Neavey	Catskill Watershed Corporation
Christopher Olney	The Catskill Center for Conservation and Development
Jim Porter	New York City Department of Environmental Protection
John Potter	New York City Department of Environmental Protection
Neil Sampson	Yale School of Forestry & Environmental Studies/The Sampson Group
Matthew Schwab	New York City DEP
Michael Shaw	U.S. Environmental Protection Agency, NYC Watershed
Kate Schmidt	Cornell Cooperative Extension, Sullivan County
Mary Tyrrell	Yale School of Forestry & Environmental Studies
Rick Wyman	Edmund Niles Huyck Preserve and Biological Station

FOREST FRAGMENTATION/LAND USE CHANGE MODELING PROJECT

Yale School of Forestry and Environmental Studies, Global Institute of Sustainable Forestry
and State University of New York College of Environmental Science and Forestry

THAMES SITE WORKSHOP

Brooklyn, Connecticut
May 21, 2002

AGENDA

Welcome and Introduction — Mary Tyrrell and Steve Broderick

TNC Quinnebaug Highlands Project — Bill Toomey

Project Overview — Neil Sampson

Comments and Feedback

GEOMOD Demonstration — Myrna Hall

Comments and Feedback

Hypothesis Formulation

ATTENDEES

Myrna Hall, SUNY ESF
Neil Sampson, The Sampson Group and Yale FES
Mary Tyrrell, Yale FES
Carrie Magee, Yale FES
Susan Nixson, SUNY ESF

Steve Broderick, University of Connecticut Extension Forestry
Bill Toomey, The Nature Conservancy, Connecticut Chapter
Phillip Elliott, Eastern Connecticut State University
Dick Booth, Wyndham Land Trust
Art Talmadge, Conwood Foresters/ CT Tree Farm
Delia Putnam, Town of Killingly
Ruth Cutler, Green Valley Institute
Paul Wilbur, Woodstock Conservation Commission
Dan Donahue, Norcross Wildlife Foundation
Andy McLeod, Trust for Public Land
James Hurd, University of Connecticut

SUMMARY OF COMMENTS AND FEEDBACK

<u>Concerns, trends and perceived threats to the forests</u>

- Most of the land is still forested and population fairly low
- Fragmentation, habitat destruction and conversion are the biggest threats
- No longer much forestry work of any significance
- Timber markets are narrowing down
- Parcelization is obvious
- Cheapest land in Connecticut and less than one hour from four major cities

- Local planning and zoning people do not necessarily distinguish between rural character and working land
- Need for public education
- Collapse of the dairy industry leading to development on ag lands
- Paper subdivisions legacy from the 1980s development boom
- Perceived drivers of forest loss and fragmentation
- Population growth
- Zoning (towns without zoning regulations; towns with "10-acre lot" type of zoning)
- Forests are not able to generate revenue due to narrowing of timber market
- Parcelization
- Casino development (pressure from the south)
- Threat of new casino development in the Q/S area
- Pinching of suburban areas leading to migration from suburbs to rural areas
- Land prices
- New houses; large homesteads
- Distance from major cities (Providence, Hartford, Worcester, New London)
- DOT investment in road improvement and expansion

Hypotheses

Parcelization is occurring and will eventually lead to forest fragmentation and loss.

Forestland change is driven by population growth, zoning regulations, narrowing of timber markets, casino development, land prices, distance from major cities, and DOT investment in road improvements and new roads.

Final Notes

The general sense was that this project has a lot to contribute to the forest conservation efforts in the area. Attendees expressed a lot of interest and willingness to work with the project team on many aspects of the research. Feedback was that this can be a tremendous educational tool: this type of time series projection is needed and will be very useful.

It was strongly suggested (requested) that the team include the Massachusetts portion of the Quinnebaug/Shetucket Heritage Corridor in the analysis. Many groups are working throughout the entire corridor and have worked hard to go beyond the political boundaries. The team agreed to consider the request, depending on whether or not UCONN can include that portion of Massachusetts in their land cover classification work being done for the project.

There was some amount of discussion of a sub project to look at parcelization in the Corridor. This would be a very useful addition and some work has already been done to digitize tax maps in many towns. (Note: This would require additional funding.)

FOREST FRAGMENTATION/LAND USE CHANGE MODELING PROJECT

Yale School of Forestry and Environmental Studies, Global Institute of Sustainable Forestry
and State University of New York College of Environmental Science and Forestry

THAMES SITE RESULTS WORKSHOP

Brooklyn, Connecticut
November 24, 2003

AGENDA

Welcome and Introduction — Mary Tyrrell

Project Overview — Mary Tyrrell

Results: Land Use Changes in the Thames Watershed 1985 - 2002 — Myrna Hall

Next Steps: Phase II of Research Project — Mary Tyrrell

Questions, Comments, Feedback

Lunch Discussion: Putting land use change information and model results to good use

ATTENDEES

Myrna Hall	SUNY College of Environmental Science and Forestry
Mary Tyrrell	Yale School of Forestry and Environmental Studies
Elizabeth Petruska	Yale School of Forestry & Environmental Studies
Michael Altshul	Green Valley Institute
Fred Borman	CT DEP - Division of Forestry
Steve Broderick	UCONN Extension Forestry
Mark Buccowich	USDA Forest Service State and Private, Cooperative Forestry
Dan Civco	UCONN Laboratory for Earth Resources Information Systems
Ruth Cutler	Green Valley Institute
Doug Emmerthal	CT Division of Forestry
Delia Fey	Town of Killingly
John Filchak	NE CT Council of Governments
Carl Fontneau	Towns of Columbia and Scotland
Kristin Foord	Massachusetts Executive Office of Environmental Affairs
Ken Goldsmith	Woodstock Conservation Commission
Reanna Goodreau	Town of Ellington Planning Department
Scott Gravatt	Eastern CT Conservation District
Brian Holdt	UCONN NRME
James Hurd	UCONN Laboratory for Earth Resources Information Systems
Steve Klemchuk	
Sara Laughlin	Town of Thompson
Tom Luther	Northeastern Area, State & Private Forestry
Karen Mollander	Durham Field Office, NA State &Private Forestry
Roger Monthey	USDA Forest Service
Jim Parda	CT Division of Forestry
Eric Thomas	Department of Environmental Protection
Bill Toomey	The Nature Conservancy
Eric Trott	Coventry Town Planner
Edwin Vonderheide	Woodstock Conservation Commission
Susan Westa	Green Valley Institute
Emily Hoffhine Wilson	NEMO Project, Cooperative Extension, UCONN

Summary of Comments and Feedback

Map Accuracy

- The agricultural class includes a lot of non-forested grasslands that could be associated with urban development; some residential development could be classified as "agricultural."
- The 1985/1990/1995/2002 land cover time series developed by CLEAR at UCONN is a unique resource and technically very reliable.

Factors Driving Loss of Forest: What else could be considered?

- Transportation networks: the three Massachusetts towns with little development are "protected" because they are located where there is no exit on the Massachusetts Turnpike for 30 miles.
- Commuting patterns and job vs. home location are hugely important for showing where and why development is occurring.
- Age of landowners and parcel size. Parcelization is important in this area. There was a lot of "paper" subdivision in the 1990s—land that was subdivided, but not developed. Development could happen very rapidly in these places.
- Absentee landownership is a factor.
- Does the amount of land permanently protected from development in a town have any effect on the amount of other land that is developed?
- The number of households seems to be more important than population.

Potential Uses of Research Results

- Towns would like to run the model with more refined, localized data: tweak the model and add additional layers (such as digital parcel maps).
- Useful for identifying lands at risk, which can be incorporated into planning efforts, particularly in conjunction with identifying lands critical for natural resource values.
- Good way to visualize the phenomenon of development generally following roads—as more roads get built, there is more development.

Final Notes

Overall, feedback on the usefulness of the research was very enthusiastic, and there was a great deal of interest in getting the information and tools to the people who would bring it back to their communities. Eleven folks volunteered to meet with the project team to discuss and work on how to get this out to towns and into a regional planning process. There was some discussion about the need to make it easy for non technical folks to understand, which would be considered in the process.

FOREST FRAGMENTATION/LAND USE CHANGE MODELING PROJECT

Yale School of Forestry and Environmental Studies, Global Institute of Sustainable Forestry
and State University of New York College of Environmental Science and Forestry

CATSKILL/DELAWARE SITE WORKSHOP

Liberty, New York
March 19, 2002

AGENDA

Welcome and Introduction — Mary Tyrrell and Rene Germain

Project Overview — Neil Sampson

Comments and Feedback

GEOMOD Demonstration — Myrna Hall

Comments and Feedback

Hypothesis Formulation

ATTENDEES

Rene Germain, SUNY ESF
Myrna Hall, SUNY ESF
Neil Sampson, The Sampson Group and Yale FES
Mary Tyrrell, Yale FES
Steve Dettman, Yale FES
Michelle Decker, SUNY ESF

Henry Kernan, Forest Landowner
Maureen Krudner, U.S. EPA
Michael Shaw, U.S. EPA
Jack McShane, Catskill Landowners Association
Chris Olney, The Catskill Center
Aaron Bennett, The Catskill Center
Ken Neavey, Catskill Watershed Corporation
Brian Fisher, Watershed Agricultural Council
Anne Altshuler, Olive Natural Heritage Society
Matthew Schwab, New York City DEP

SUMMARY OF COMMENTS AND FEEDBACK

Concerns, trends and perceived threats to the forests

- Consideration of biodiversity and natural history in managing forests
- Need for consulting foresters to consider landscape scale
- High-graded forests
- Difficulty of reaching out to small landowners
- Lack of interest in timber (landowners); people own forestland for reasons other than growing and selling timber
- Affordability of the land over time
- A lot of land is not in the economic cycle

- Small, micro-land management is not financially feasible
- No market for lower quality materials
- Inability to manage the land, thus the forest is not a viable asset
- No system for NYC water consumers to pay for private landowners to maintain their forests
- NYC DEP has a priority land acquisition list
- A shift from commodity to non-commodity values
- Image of foresters
- Water quality problems—phosphorous and turbidity
- Degraded streams

<u>Perceived drivers of forest loss and fragmentation</u>

- Taxes
- Loss of pulpwood market
- Decline in number of timber processors; concentration towards bigger and bigger mills
- Large lot development
- Highest development along roads and water
- Second home development (Permanent vs. temporary residents)
- Parcelization
- Lack of education for homeowners, planning boards, zoning boards
- Lack of financial incentives for small landowners
- Lack of incentives for forest management
- Resort development (Bel Air) and consequent secondary development
- Regulation (NYC watershed)
- Distance to NYC and major thoroughfares (Thruway, Rt 17, Rt 28)
- Commuting distance
- Ski areas as growth nodes
- Topography
- Age of land owners
- Demand for new houses

Hypotheses

Parcelization is more of a current factor than fragmentation and will be hard to detect or predict.

Forestland change is driven by distance from NYC, distance from major roads, distance from growth nodes such as ski resorts and new resort development, watershed regulations, taxes, age of landowners, and the population of permanent residents vs. housing units (i.e. second home development)

Final Notes

The type of change that the area is experiencing may not be visible on satellite imagery, thus the feeling of some of the group was skepticism that this model will add much value to the work that is already being done in the area. The DEP is developing their own model to look at change in the watershed. The NYC watershed regulations are a complicating factor—they influence land use change, but will be difficult to account for in the model. The project team decided on a strategy to look at one township or county where parcelization data is available and determine if rural residential land use can be detected on satellite imagery.

FOREST FRAGMENTATION/LAND USE CHANGE MODELING PROJECT

Yale School of Forestry and Environmental Studies, Global Institute of Sustainable Forestry
and State University of New York College of Environmental Science and Forestry

CATSKILL/DELAWARE SITE RESULTS WORKSHOP

Liberty, New York
June 9, 2003

AGENDA

Welcome and Introduction — Mary Tyrrell

Project Overview — Mary Tyrrell

Results: Land Use Changes in the Catskill/Delaware Watersheds 1992 - 2001 — Myrna Hall

Next Steps: Phase II of Research Project — Mary Tyrrell

Questions, Comments, Feedback

Lunch Discussion: Putting land use change information and model results to good use

ATTENDEES

Page Bertelsen, Yale School of Forestry and Environmental Studies
Myrna Hall, SUNY College of Environmental Science and Forestry
Mary Tyrrell, Yale School of Forestry and Environmental Studies

Tim Cox, Corporate Counsel Catskill Watershed Corporation
Nat Gillepse, TNC Neversink Project
Henry Kernan, forest land owner
Jack McShane, forest land owner and Catskill Forest Association
Jean Millar, Roxbury Planning Board
Jim Porter, NYC DEP Watershed Hydrology Program
John Potter, NYC DEP Bureau of Water Supply
Kate Schmidt, Cornell Cooperative Extension, Natural Resource Educator
Mike Shaw, EPA NYC Watershed
Rick Wyman, Intl. Org. of Biological Field Stations

SUMMARY OF COMMENTS AND FEEDBACK

<u>Factors Driving Loss of Forest: What else could be considered?</u>

A few of the comments were about what folks see as driving change in their towns:

- Second homes and the associated development (tax records show that 80% of the forest parcels within the study area are owned by non-residents)
- Proposed casinos
- Trend of increased publicity about the rural towns in the area, resulting in increased second home development and urban migration
- High land taxes

Potential Uses of Research Results

- To inform local (town) discussions about the balance of conservation and development
- To tie in with water quality/quantity models to predict water impacts of future development
- Input to local planning tools, especially zoning, to help with the process of planning for development in areas that are best used for development and conservation of high value foreslands
- Help towns make the connection between the forest and the town in terms of water, economics, etc. Towns in the area tend to consider forest as "abandoned" or "unproductive" agricultural lands, especially with regard to tax policies
- Help with the discussion about the value of working forests to the local economy

Final Notes

Overall, feedback on the usefulness of the research was very enthusiastic, with several people indicating that they could have definitely used our results in their recent town planning efforts. The feeling was that the unique ability to visualize potential land use change and identify areas at high risk of development, would be very useful at the local and county level. The towns of Andes, Roxbury, Delhi, and Bel Air, and Sullivan County were volunteered as places that would be interested in working with the project team to integrate this project into the local planning process. The EPA was very interested in linking this project to water quality models for the NYC Watersheds.

Appendix B: Satellite Imagery Classification

Accuracy Assessment of Year 2001 satellite image classification for the New York study

This classification followed as close as possible the protocol and standards reported for the 1992 NLDC for New York. The imagery used came from the Multi-resolution Land Characterization (MRLC) Consortium. All image preparation including georeferencing was completed by the MRLC prior to this classification.

The initial Landsat TM mosaics, all ancillary data sets, and the land cover product are all map-registered to an Albers Conical Equal Area projection. The following represents projection information for the final land cover product for the state of New York.

Projection: Albers Conical Equal Area
Datum: NAD83
Spheroid: GRS80
Standard Parallels: 29.5 degrees North Latitude
45.5 degrees North Latitude
Central Meridian: 96 degrees West Longitude
Origin of the Projection: 23 degrees North Latitude
False Easting: 0 meters
False Northing: 0 meters

Number of Lines (rows): 17455
Number of Samples (columns): 23005
Number of Bands: 1 Pixel size: 30 X 30 meters
Projection Coordinates (center of pixel, projection meters)
Upper Left Corner: 1317210 meters(X),
2663820 meters(Y)
Lower Right Corner: 2007330 meters(X),
2140200 meters(Y)

NOTE: Each state data set was extracted from the larger regional data set. State boundaries from the USGS 1:100,000 Digital Line Graph (DLG) series were used as the basis for extracting the state data. In many instances, the precision of the boundaries in the 1:100,000 DLG data does not match the spatial precision of the Landsat TM data. This is most apparent where state boundaries follow small rivers. To overcome the possibility of data being lost in the extraction process, a 300 meter (10 pixel) buffer was added to the state boundary used to extract the state data.

Caveats and Concerns:

As with the previous classification from the NLDC, we believe that the approach taken has yielded a very good general land cover classification product for a very large region. However, it is important to indicate that there might be some potential problems. Problem areas are listed below:

1) Unlike the previous classification of this region only one image from May of 2000 was used. The image acquired from April was predominantly snow covered and so relatively unusable. Therefore there was no leaf off image to use that is necessary for accurately defining roads and the like that will often become obscured when the forest cover leafs out.

2) Like the USGS there were some issues with accurate definition of the transitional barren class. Because there were very few known positive examples available for this class to use as training sites this class was omitted. As a result, those true areas of transition were lumped in with row-crops and pasture-hay classes.

3) Due to the confusion between clear-cuts, regrowth in clear-cuts, forested areas, and shrublands, no attempts were made to populate the shrubland classes. Any shrubland areas that exist in this area are classed in their like forest class, i.e., deciduous shrubland is classed as deciduous forest, etc.

4) Pasture-hay and Row-crop classes were also quite difficult to distinguish between due in part to the time of year. These two classes may be somewhat interchangeable in reality.

5) There were also some issues separating low intensity residential and transportation. In the 1992 classification transportation is lumped with industrial but in this classification some roads show up as low intensity residential.

6) Again due to the time of year and lack of a leaf off image the residential classes may be somewhat less representative than reality. Relatively pure training sites were used for this class and so those regions where homes are scattered about the landscape with lots of forest cover may have been missed in this classification.

Accuracy Assessment:

In accordance with the accuracy assessment completed for the 1992 New York NLDC, 15 land cover and land use classes were assessed, using 1:40,000-scale Digital Ortho quads as reference data. See methodology section of New York NLDC for specific details. The overall Kappa statistic for agreement was .74112 with a confidence interval of +/- 0.0777 at %99. The classes having the highest errors were the woody-wetland and urban-grass/recreational.

Misclassification errors seem to be from a number of possible sources. The DOQQ's used for the assessment came from 1999 and different months. Some changes appear to have occurred in that time. Also the geo-referencing for the TM imagery seems to have some problems in the northeast and northwest corners. There may also be some disagreement due to georeferencing errors between the TM image and the DOQQ's. See problems listed in Caveats and Concerns.

A complete accuracy assessment for this classification may be obtained by contacting Stephen Ambagis at (508) 353-6430 or sambagis@clarku.edu or sambagis@yahoo.com

23-Class National Land Cover Data Key

NOTE - All Classes May NOT Be Represented in a specific state data set.
The class number represents the digital value of the class in the data set.

NLCD Land Cover Classification System Key - Rev. July 20, 1999

Water	New Classification
11 Open Water	1
12 Perennial Ice/Snow	2
Developed	
21 Low Intensity Residential	3
22 High Intensity Residential	4
23 Commercial/Industrial/Transportation	5
Barren	
31 Bare Rock/Sand/Clay	6
32 Quarries/Strip Mines/Gravel Pits	7
33 Transitional	8
Forested Upland	
41 Deciduous Forest	9

42 Evergreen Forest	10
43 Mixed Forest	11
Shrubland	
51 Shrubland	12
Non-natural Woody	
61 Orchards/Vineyards/Other	13
Herbaceous Upland	
71 Grasslands/Herbaceous	14
Herbaceous Planted/Cultivated	
81 Pasture/Hay	15
82 Row Crops	16
83 Small Grains	17
84 Fallow	18
85 Urban/Recreational Grasses	19
Wetlands	
91 Woody Wetlands	20
92 Emergent Herbaceous Wetlands	21

For a complete description of the classes see the NLCD Land Cover Classification System Land Cover Class Definitions.

Accuracy Assessment of Year 1992 NLCD satellite image classification for the New York study

1992 Accuracy Assessment Results

Test Point From 92samp2	DOQQ tile	Test Point X coord	Test Point Y coord	LU ID# 1992 Landsat	Land Use Class 1992 Landsat	Actual LU 1994 DOQQ	Same as 92 Landsat
1	hamd_sw_t3	502302	4665633	9	deciduous forest	9	1
2	hamd_sw_t2	504915	4665731	9	deciduous forest	9	1
3	ande_sw_t2	514182	4664699	9	deciduous forest	9	1
4	ande_se_t3	516636	4663856	11	mixed forest	11	1
5	marg_se_t3	526663	4664392	11	mixed forest	11	1
6	hamd_sw_t0	501194	4668833	11	mixed forest	14, 15, or 16	
7	hamd_se_t1	508944	4668803	11	mixed forest	11	1
8	ande_sw_t3	511629	4666403	15	pasture/hay	15	1
9	ande_sw_t1	514805	4667228	9	deciduous forest	9	1
10	marg_sw_t0	520707	4668990	9	deciduous forest	9	1
11	marg_se_t1	529767	4667960	9	deciduous forest	9	1
12	hamd_sw_t0	501313	4670154	11	mixed forest	10	
13	hamd_nw_t2	504770	4671203	9	deciduous forest	15	
14	hamd_ne_t3	507565	4670732	11	mixed forest	11	1
15	ande_nw_t2	514816	4670950	9	deciduous forest	9	1
16	ande_ne_t2	518149	4670814	3	low intensity residential	3	1
17	marg_nw_t2	523958	4670684	9	deciduous forest	9	1
18	marg_nw_t2	525271	4670947	9	deciduous forest	9	1
19	marg_se_t0	527014	4670562	15	pasture/hay	15	1
20	marg_se_t1	529915	4670194	9	deciduous forest	9	1
21	hamd_nw_t1	504890	4674218	11	mixed forest	11	1
22	ande_nw_t3	512735	4672232	9	deciduous forest	9	1
23	ande_ne_t3	515568	4673400	9	deciduous forest	9	1
24	ande_ne_t2	519293	4672959	9	deciduous forest	15	
25	marg_nw_t2	523972	4673454	9	deciduous forest	9	1
26	marg_nw_t2	524147	4673098	9	deciduous forest	9	1
27	hamd_nw_t0	502079	4676763	9	deciduous forest	9	1
28	hamd_ne_t1	509278	4677298	9	deciduous forest	9	1
29	ande_nw_t1	514169	4675077	9	deciduous forest	11	

Test Point From 92samp2	DOQQ tile	Test Point X coord	Test Point Y coord	LU ID# 1992 Landsat	Land Use Class 1992 Landsat	Actual LU 1994 DOQQ	Same as 92 Landsat
30	ande_ne_t0	516155	4677275	11	mixed forest	11	1
31	hoba_sw_t3	520842	4677590	9	deciduous forest	9	1
32	marg_nw_t1	524532	4675030	11	mixed forest	11	1
33	marg_ne_t1	528443	4676241	15	pasture/hay	15	1
34	marg_ne_t1	530329	4677434	11	mixed forest	11	1
35	marg_nw_t0	523227	4675186	11	mixed forest	11	1
36	delh_sw_t2	504721	4680355	9	deciduous forest	9	1
37	delh_se_t3	507051	4680415	9	deciduous forest	4	
38	delh_se_t2	509484	4677986	15	pasture/hay	15	1
39	bloo_sw_t3	512757	4680052	11	mixed forest	11	1
40	bloo_se_t3	516276	4678795	9	deciduous forest	15	
41	hoba_se_t2	528866	4680673	9	deciduous forest	9	1
42	delh_sw_t0	501993	4682219	9	deciduous forest	9	1
43	delh_sw_t2	504556	4680908	9	deciduous forest	9	1
44	delh_se_t1	508939	4681809	9	deciduous forest	9	1
45	bloo_sw_t1	513940	4682777	11	mixed forest	11	1
46	hoba_sw_t1	523643	4681992	11	mixed forest	11	1
47	hoba_se_t0	527029	4682860	9	deciduous forest	9	1
48	hoba_se_t1	530327	4682072	9	deciduous forest	9	1
49	delh_se_t0	505383	4684060	9	deciduous forest	9	1
50	delh_ne_t2	509354	4686441	11	mixed forest	11	1
51	bloo_nw_t3	510385	4685124	11	mixed forest	11	1
52	bloo_ne_t3	516739	4686390	15	pasture/hay	15	1
53	bloo_ne_t2	519449	4685991	11	mixed forest	11	1
54	hoba_se_t1	528884	4683697	11	mixed forest	11	1
55	hoba_ne_t2	530646	4686439	11	mixed forest	11	1
56	delh_nw_t2	502996	4687942	9	deciduous forest	9	1
57	delh_ne_t0	505889	4689196	15	pasture/hay	15	1
58	delh_ne_t1	509345	4688786	11	mixed forest	11	1
59	delh_ne_t1	510292	4687998	15	pasture/hay	15	1
60	bloo_ne_t2	519467	4687055	15	pasture/hay	15	1
61	hoba_nw_t3	522640	4687564	11	mixed forest	12	
62	delh_nw_t0	502107	4689928	11	mixed forest	11	1
63	wdav_se_t3	506046	4691568	15	pasture/hay	15	1

Test Point From 92samp2	DOQQ tile	Test Point X coord	Test Point Y coord	LU ID# 1992 Landsat	Land Use Class 1992 Landsat	Actual LU 1994 DOQQ	Same as 92 Landsat
64	dave_sw_t2	515121	4691970	11	mixed forest	11	1
65	bloo_ne_t0	517243	4691020	11	mixed forest	11	1
66	bloo_ne_t1	518889	4691390	15	pasture/hay	15	1
67	hoba_nw_t1	523250	4690738	15	pasture/hay	15	1
68	hoba_ne_t0	526335	4689761	9	deciduous forest	9	1
69	hoba_ne_t0	527462	4690753	3	low intensity residential	3	1
70	hoba_ne_t1	529983	4691341	11	mixed forest	11	1
71	wdav_sw_t2	503384	4694126	9	deciduous forest	9	1
72	wdav_se_t3	506173	4693173	9	deciduous forest	9	1
73	wdav_se_t1	508406	4695291	9	deciduous forest	9	1
74	dave_se_t2	519095	4692754	11	mixed forest	11	1
75	harp_sw_t3	521874	4692864	15	pasture/hay	15	1
76	harp_sw_t2	525174	4694411	15	pasture/hay	15	1
77	wdav_sw_t0	502016	4695604	11	mixed forest	11	1
78	wdav_sw_t1	504933	4696532	11	mixed forest	11	1
79	dave_sw_t0	511578	4695389	15	pasture/hay	15	1
80	dave_sw_t1	514031	4695949	15	pasture/hay	15	1
81	dave_se_t0	517372	4696613	15	pasture/hay	15	1
82	harp_sw_t0	520731	4695437	9	deciduous forest	9	1
83	harp_sw_t0	522610	4695627	11	mixed forest	11	1
84	harp_se_t1	530601	4697696	11	mixed forest	11	1
85	wdav_nw_t3	500767	4699884	11	mixed forest	11	1
86	wdav_nw_t2	503767	4698589	9	deciduous forest	9	1
87	wdav_se_t1	508211	4698283	15	pasture/hay	15	1
88	dave_nw_t2	514940	4698638	11	mixed forest	15	
89	dave_se_t0	516730	4698319	9	deciduous forest	9	1
90	dave_ne_t2	518509	4699401	9	deciduous forest	9	1
91	harp_nw_t2	524720	4698590	15	pasture/hay	15	1
92	harp_ne_t3	528268	4700747	9	deciduous forest	15	
93	wdav_ne_t0	505602	4702669	9	deciduous forest	9	1
94	wdav_ne_t0	506478	4703792	11	mixed forest	11	1
95	dave_nw_t1	513705	4703885	9	deciduous forest	9	1
96	dave_ne_t0	516996	4703602	9	deciduous forest	9	1
97	harp_nw_t3	520834	4701457	15	pasture/hay	15	1
98	harp_nw_t2	524883	4701503	10	evergreen forest	10	1
99	harp_ne_t1	530119	4702121	15	pasture/hay	15	1
100	dave_ne_t1	519611	4704466	15	pasture/hay	15	1

Total Correct = 90/100

Also see: http://landcover.usgs.gov/accuracy/table3.asp

Connecticut Statewide Temporal Land Cover and Land Cover Change Project

(for the years 1985, 1990, 1995, 2002)

A General Overview

James Hurd, Center for Land use Education And Research, University of Connecticut

Introduction

This latest attempt at Connecticut statewide land cover mapping was undertaken by the *Center for Land use Education And Research* **(CLEAR)** in the College of Agriculture and Natural Resources at the University of Connecticut to help gain a better understanding of the extent of land cover changes occurring in the Connecticut landscape. The premise was to develop a temporal series of basic land cover information for four years (1985, 1990, 1995, 2002) that would allow us, among other potential uses, to apply landscape characterization models developed under the NAUTILUS program; a NASA Regional Earth Science Applications Center (RESAC). These models consist of forest fragmentation, state of forest fragmentation, urban (development) growth, and impervious surface estimation. Each of these models utilizes land cover information, and land cover that is consistent between each date is necessary to produce reliable results over time. To achieve this, a base land cover image (1985) was generated with subsequent land cover (1990, 1995, 2002) derived from it using cross-correlation analysis, a change detection method developed by Earthsat, Inc. The analysis area consists of the entire State of Connecticut including local watersheds that intersect the state boundary, and a portion of south central Massachusetts. Nine towns from south central Massachusetts and 26 towns in northeast Connecticut comprise the Quinebaug and Shetucket Rivers Valley National Heritage Corridor.

Base Land Cover (1985)

The primary source of image data came from an April 26, 1985 Landsat Thematic Mapper (TM) scene (path 13/row 31) covering most of the analysis area. The Landsat Thematic Mapper sensor collects data in seven regions of the electromagnetic spectrum (blue, green, red, near-infrared, 2 middle-infrared, and thermal) at 30-meter spatial resolution (60 –meters for the thermal band) and is well suited for land cover classification at a regional level. The extreme southeastern portion of the State of Connecticut was covered by an August 9, 1985 Landsat TM scene (path 12/row 31). Cloud and cloud shadow regions covering some of the northwest portion of the state were extracted and substituted with a May 4, 1988 Landsat TM scene. Most of this area consisted of forested land cover and was not impacted by potential change in land cover between these two time periods. To derive land cover information, several classification techniques were used. These include sub-pixel classification, ISODATA unsupervised classification, supervised classification using the maximum likelihood classifier, and knowledge-based classification.

Road Network

Classification began with the April 26, 1985 image that was clipped to the analysis area. Classification of the road network was the first focus. Identification of major and local roads is critical to the successful application of the forest fragmentation and urban growth models and also proves useful for impervious surface estimation. In order to capture roads, vector road coverages were used to extract image data from the TM scene. All improved roads (paved) were selected from the vector road coverage and rasterized to the pixel size of the source imagery. This layer was then buffered 5 pixels to either side of the road to account for areas of mis-alignment between the road layer and Landsat image data. All image pixels contained within the 5 pixel buffer area were extracted for analysis (Figure 1a). The intent was to create an image data layer on which the classifications of roads could be focused by minimizing non-road pixels. ERDAS Imagine SubPixel Classifier™ (SPC) engineered by Applied Analysis Inc. (AAI) was used to classify road pixels. The SPC is a supervised classifier that enables the detection of materials of interest (MOIs) as whole or fractional pixel composition, with a minimum detectable threshold of 20 percent and in increments of 10 percent (*i.e.*, 20-30%, 30-40%, ..., 90-100%). Because of tonal variations in the built landscape, MOIs representing different brightness classes of road and paved surfaces (i.e. dark, medium, and bright surfaces) were selected to be mapped Any pixel identified by the SPC, regardless of its percent composition, was considered a developed pixel.

Final results of the SPC did not fully extract the road network. To enhance further the results of the SPC, knowledge-based (KB) classification was employed. Those pixels not identified as developed through the SPC technique were extracted for further evaluation. Bands 4 and 5 showed the most contrast between developed pixels and other pixels. In the ERDAS Imagine Knowledge Engineer, a rule was created that used the value ranges (129 and 143 for band 4; 128 and 193 for band 5) to identify developed pixels that met the criteria for both bands. In addition, a pixel also had to be contained within the actual rasterized road layer. The result of this procedure was the identification of additional developed pixels not identified using the sub-pixel classifier.

Figure 1b provides the results of the Sub-pixel Classifier and Knowledge-based classification applied to the road buffered image. The SPC and knowledge-based classification unfortunately did not extract the full extent of the road network. To correct for this problem, the rasterized road layer was embedded with the final classification. Onscreen digitizing was conducted to remove areas of mis-alignment. While this may appear to be a step backward, enough pixels were identified as developed to prove invaluable in determining the true road alignment that is critical to the success of the forest fragmentation and urban growth models. The same techniques were used on the August 9, 1985 image covering the southeast portion of the analysis area.

a b c

Figure 1. Example of the road network classification. (a) Extracted image pixels surrounding rasterized road network. (b) Classified road network pixels using the SBC and KB classifiers (yellow). (c) Embedded rasterized road network on final land cover.

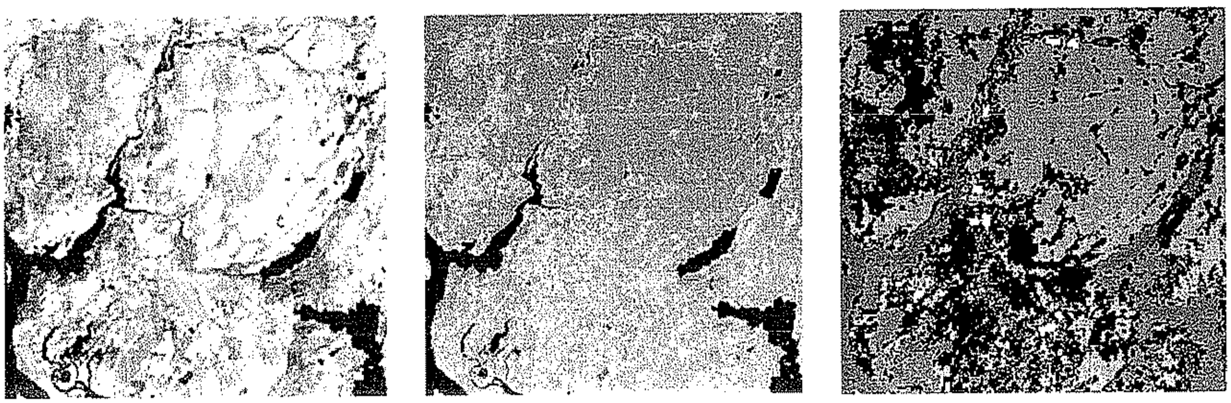
Complete Area Classification

The remaining image pixels were then classified. To begin, those pixels identified as developed in the previous step were eliminated from the TM image. An area of approximately 180 square miles along the central coast of Connecticut was then subset from the overall analysis area for use in deriving classification signature statistics. This area was selected because it contained a significant amount of those categories identified in the classification scheme (Table 1). ISODATA classification was performed generating 100 signature clusters. These clusters were then identified and labeled into the appropriate land cover category.

Table 1. Land cover classification scheme.

1. Developed	5. Coniferous Forest	9. Tidal Wetlands
2. Turf & Grass	6. Water	10. Barren Land
3. Agriculture & Other Grasses	7. Non-forested Wetlands	11. Utility Right-of-Ways
4. Deciduous Forest	8. Forest Wetlands	

Maximum likelihood classification was applied to the entire statewide area using selected signatures derived through the ISODATA process. Classification was done one class at a time specifying a distance image as the output. The distance file produces an image whose pixel values represent the spectral distance from the class signature. The lower the value, the more similar a pixel is to a specific class signature. This procedure was repeated for each class. Visual examination of the distance image with the TM image resulted in the identification of thresholds that were used with the Knowledge Engineer to derive a land cover image. Additionally, tidal wetlands were identified based on a previous land cover project for the State of Connecticut based on spring and summer 1995 Landsat TM imagery. This 1995 land cover image was also used to identify further non-vegetated agricultural areas that were misclassified as developed due to the bright spectral reflectance. Figure 2 provides an overview of this phase of the classification.



a b c

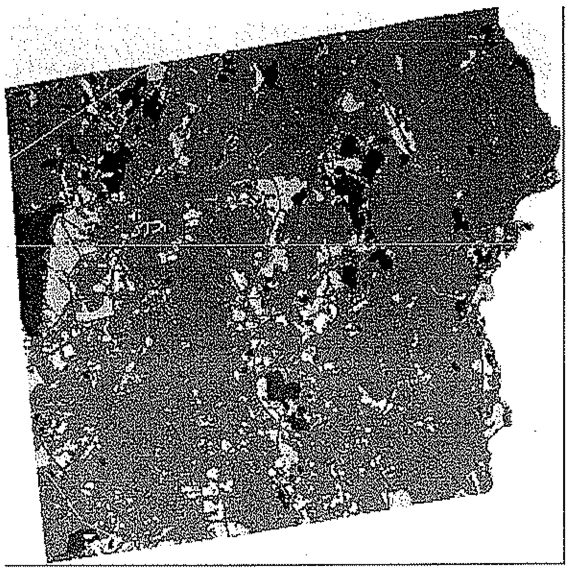
Figure 2. Example of knowledge-based classification using distance images. (a) April 26, 1985 Landsat TM image. (b) Distance image for the deciduous forest class (green = more likely deciduous). (c) Resulting KB classification.

Pixels remaining as unclassified were again extracted from the TM image. ISODATA classification was performed on these remaining pixels. The clusters were identified and labeled into the appropriate category. The resulting classification layers were then merged to create a single classified image with all pixels being identified as belonging to a single category. Several steps were taken to "clean-up" the classification. First, a digital elevation model was used to eliminate areas misclassified as wetlands due predominately to steep northwest facing slopes. Using the Knowledge Engineer, any pixel identified as non-forested or forested wetlands that fell on a slope of 12 degrees or more was reassigned to deciduous forest. Several majority filters were used to eliminate specific isolated pixels resulting in a more uniform classification. Lastly, extensive heads-up digitizing was used to remove any remaining apparent errors and to also include utility right-of-ways which can be considered significant fragmenting features to the forest landscape. Utility right-of-ways were digitized out of the deciduous and coniferous forest classes only. The overall intent in developing a land cover image using these various techniques was to continually eliminate those pixels that were easily classified and identify those pixels that were more problematic. Remaining errors would potentially be cleaned during the on-screen digitizing phase of the classification.

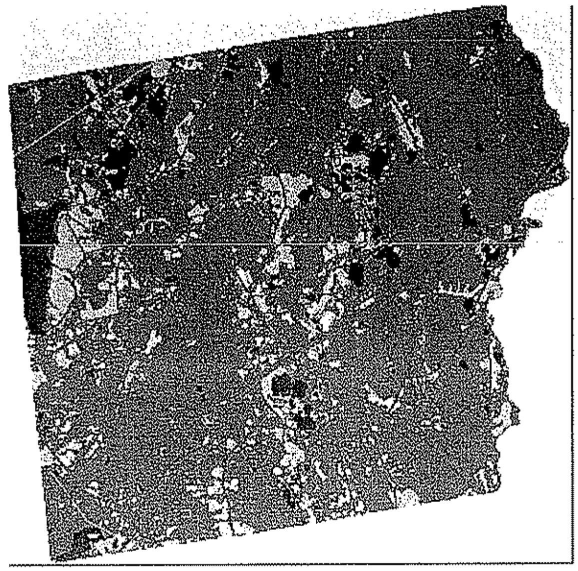
Subsequent Land Cover

Cross-correlation Analysis (CCA) was chosen as the method for determining subsequent land cover because it overcomes many of the limitations of conventional change detection methods and is able to produce a consistent set of land cover. Cross-correlation works by using the land cover categories identified in the base land cover image to derive an "expected" class average spectral response. This information is used to derive a Z-statistic for each pixel falling within a given land cover type. The Z-statistic describes how close a pixel's response is to the "expected" spectral response of its corresponding class value in the land cover image. Pixels that have undergone change between the date of the land cover image and the multispectral image will produce high Z-statistic values while pixels that have not changed will produce low Z-statistic values. The benefit of this technique is that it eliminates the problems associated with radiometric and phenological differences that are so readily experienced when performing change detection.

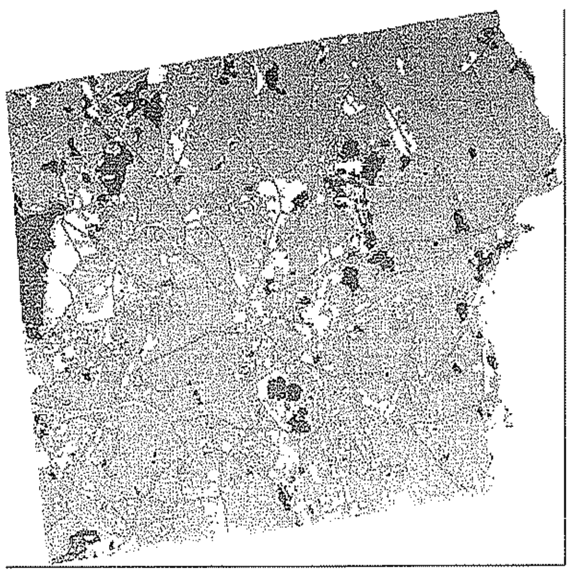
In the case of this work, CCA was applied to five groups of land cover categories. These groups include water; deciduous, coniferous and forested wetlands; turf & grass and agriculture; barren; and non-forested and tidal wetlands. Using the 1985 land cover, pixels belonging to each group were extracted from an August 30, 1990 TM image (*i.e.* for the deciduous, coniferous and forested wetlands group, pixels classified as these in 1985 were extracted from the August 30, 1990 TM image). The CCA procedure was applied to the extracted pixels and the results were visually examined with the recent image data to determine the threshold between probable change pixels and non-changed pixels. Those pixels identified as changed were extracted from the August 30, 1990 image. ISODATA unsupervised classification was performed to identify the category that each pixel now belonged. These steps were repeated for each class group. Figure 5 provides examples of CCA on the forest grouping between 1985 and 1990. Once completed, each group of classifications was combined into a single image and edited to remove apparent errors. These pixels were then fused with the previous land cover to produce an updated land cover image. This updated land cover was then used on an August 28, 1995 TM image and that updated land cover used on a September 8, 2002 TM image. Figure 3 provides examples of preliminary land cover for the town of Tolland, Connecticut.



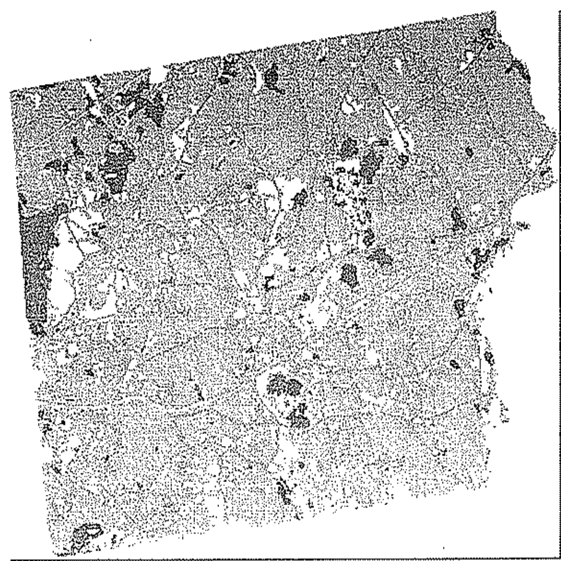
1985 land cover



1990 land cover



1995 land cover



2002 land cover

Figure 3. Preliminary results of land cover for the town of Tolland, Connecticut (developed is red, turf & grass is yellow, agriculture & other grasses is tan, deciduous forest is green, coniferous forest is dark green, water is blue, non-forested wetland is cyan, forested wetland is mint green, barren land is gray, and utility right-of-ways are orange).

Conclusion

The result of this work will provide CLEAR with a consistent set of land cover images on which to apply landscape characterization models. Together, the land cover information and results of the models will provide a suite of information that will be made available to community and state decision makers, and the general public, and provide a means for them to evaluate and quantify the results of past land use decisions, and to begin to grasp what type of future landscape current land use policies may produce.

Category Descriptions

Developed – includes high-density built-up areas which are typically associated with commercial, industrial and residential activities and transportation routes. These areas will contain a high percentage of land cover types such as concrete and asphalt surfaces, roofs, roads, and other impervious surfaces. Also includes some areas adjacent to highways and major roads. Most transportation routes identified by rasterizing statewide vector roads coverage.

Turf & Grass - a compound category of undifferentiated grasses associated mostly with developed areas. These areas will contain mostly cultivated lawns and cultivated lawns with a sparse tree over story such as is found in a typical residential neighborhood, turf farms, golf courses, and other maintained grassy areas. Also likely to include some agricultural fields due to similar spectral reflectance properties.

Agriculture & Other Grasses – includes mostly agricultural fields used for both crop production and pasture. Also includes grassy areas associated with development due to similar spectral reflectance properties and forest clear-cut areas.

Deciduous - includes typical southern New England mixed hardwood forests. Includes not only large expanses of forested land but inclusion of small patches of trees detectable by the Landsat sensor. Also likely to include scrub areas characterized by patches of small woody vegetation and undifferentiated grasses. Also some agricultural fields due to similar spectral characteristics.

Coniferous – includes typical southern New England mixed softwood forests. Includes not only large expanses of forested land but inclusion of small patches of trees detectable by the Landsat sensor.

Water - open water bodies and watercourses with relatively deep water and large enough to be resolved by the Landsat sensor.

Non-forested Wetland – includes areas depicted as being predominately wet throughout most of the year with a detectable vegetative cover. Also likely to include small river courses due to the similar spectral characteristics caused by the mix of water and vegetation land cover in a single Landsat pixel.

Forested Wetland - includes areas depicted as wetland, but with a more detectable vegetative cover. Also likely to include small river courses due to the similar spectral characteristics caused by the mix of water and vegetation land cover in a single Landsat pixel.

Tidal Wetland – includes emergent wetlands depicted as being predominately wet throughout most of the year with a detectable vegetative and located adjacent to the coastal region.

Barren - includes mostly non-agricultural areas relatively free from vegetation, such as sand, sand and gravel operations, bare exposed rock, mines, quarries, etc. Also likely to include some urban areas where the composition of construction materials spectrally resembles more natural materials, and bare soil agricultural fields.

Utility - includes identifiable utility right-of-ways. This category was manually digitized on-screen and was taken from the deciduous and coniferous categories only.

For information regarding this work, please contact:
James Hurd
Center for Land use Education And Research (CLEAR)
The University of Connecticut
jhurd@canr.uconn.edu
(860) 486-4610

Appendix C: Data Sources

MODEL INPUT DATA SOURCES

Data Type		Data Description	State	Scale
Biophysical Features	1	Digital Orthorectified Quarter Quadrangle Aerial Photography (1994 and 2001)	NY	1 meter and High resolution
	2	Elevation	CT/MA	30 meters
	3	Elevation	NY	USGS 1:24000
	4	Land Cover (1992)	NY	30 x 30 meter pixels
	5	Land Cover 2001Satellite Imagery	NY	30 x 30 meter pixels
	6	Land cover time series classifications for 1985, 1990, 1995, 2002	CT/MA	100 foot pixels
	7	Reservoir drainage basin boundaries	NY	USGS 1:24000
	8	Slope, aspect	CT/MA/NY	USGS 1:24000
	9	Soil types	MA	
	10	Soil types	CT	
	11	Water bodies	MA	USGS 1:24000
	12	Water courses by major watershed	MA	USGS 1:24000
	13	Water features; streams and water bodies	CT	USGS 1:24000
	14	Water features; streams and water bodies	NY	1:100,000
Political Features	15	Agricultural Districts	NY	county, 1:100,000
	16	Census Blocks	NY	county, 1:100,000
	17	County Boundaries	NY	county, 1:100,000
	18	Municipal Boundaries	NY	1:4,800
	19	Town Boundaries	CT	town
	20	Town Boundaries	MA	town
Socio-economic	21	Education	NY	census block
	22	Education, demographic data	CT	town
	23	Employment by sector	MA	town
	24	Employment in each major sector	CT	town
	25	Employment, commuting, poverty, income	CT	town
	26	Housing - median price	CT	town
	27	Housing - median price	MA	town
	28	Housing- number, year, value, tenure, size	CT	town
	29	Housing starts- total units, single family units	CT	town
	30	Housing starts- total units, single family units	MA	town
	31	Housing units (density); owner occupied units	CT/MA	census block
	32	Labor force; percent unemployed	CT	town
	33	Labor force; percent unemployed	MA	town
	34	Location of development nodes (casinos, ski resorts)	CT/NY	1:24,000
Socio-economic	35	Open Space/Protected Areas	CT	
	36	Open Space/Protected Areas	MA	
	37	Open Space/Protected Areas - Newly acquired lands	NY	1:4,800
	38	Open Space/Protected Areas - Pre-MOA NYC owned land	NY	1:4,800
	39	Open Space/Protected Areas - State owned lands	NY	1:4,800
	40	Population	CT/MA/NY	census block
	41	Property tax rates	MA	town
	42	Property tax rates	CT	town
	43	Railroads	NY	1:100,000
	44	Real estate conveyance tax revenues	CT	town
	45	Real estate conveyance tax revenues	MA	town
	46	Roads	NY	1:100,000
	47	Roads	CT	USGS 7.5 min
	48	Roads, utility transport lines, railroad lines	MA	USGS 7.5 min
	49	Tax Parcels (1985 parcel sample derived from above)	NY	town
	50	Tax parcels (2000)	NY	town
	51	Zoning	CT	
	52	Zoning areas for each MA town with universalized state zone definitions;	MA	town/zoning area

MODEL INPUT DATA SOURCES

	Source
[illegible]	[illegible]

MODEL INPUT DATA SOURCES

	Format and availability
1	Mr. Sid and GEOTIFF format, respectively
2	Digital Elevation Model in a grid format
3	The USGS 7.5-minute quadrangle DEM (10- by 10-m data spacing) is available in ASCII DEM format
4	Cornell University Geospatial Information Repository, in either Lat/Lon or UTM18 N, NAD83 GeoTiff format
5	Terrain and/or at-censor reflectance corrected raw satellite scenes, Path 14, Row 31
6	ERDAS Imagine file for CT/MA study area and for entire state of CT available from UCONN/CLEAR
7	Shape files, by arrangement only
8	Grid format, UTM Zone 18N, NAD83, all files were gridded to match
9	Soil polygon shape files on MassGIS except for Worcester County which is Pre-release data from Mass DFA
10	Soil polygon GIS shape files available at www.magic.lib.uconn.edu
11	for modified USGS standard map rectangles (10 areas); polygons available at http://www.state.ma.us/mgis/ftphd.htm
12	line file for each major watershed available at http://www.state.ma.us/mgis/ftpcl_.htm
13	GIS files available at www.magic.lib.uconn.edu
14	Cornell University Geospatial Information Repository, US Census Bureau 1998 Tiger Line Files
15	Cornell University Geospatial Information Repository, US Census Bureau 1998 Tiger Line Files
16	Census data for 1990 and 2000 in geospatial format from GeoLytics; http://www.geolytics.com/
17	Cornell University Geospatial Information Repository, US Census Bureau 1998 Tiger Line Files
18	
19	Town boundary GIS shape files available at www.magic.lib.uconn.edu
20	Town boundary GIS shape files available at http://www.state.ma.us/mgis/towns.htm
21	Census data for 1990 and 2000 in geospatial format from GeoLytics;
22	Tables available online at http://www.ct.gov/ecd/ under Research Data for most recent years; back data available hardcopy from DECD
23	http://www.detma.org/LMIHome.htm
24	
25	Tables available online at http://www.ct.gov/ecd/ under Research Data for most recent years; back data available hardcopy from DECD
26	Available at http://www.businessnewhaven.com:5002/businessnewhaven/realestateinfo.htm
27	
28	Tables available online at http://www.ct.gov/ecd/ under Research Data for most recent years; back data available hardcopy from DECD
29	Tables available online at http://www.ct.gov/ecd/ under Research Data for most recent years; back data available hardcopy from DECD
30	
31	Census data for 1990 and 2000 in geospatial format from GeoLytics; http://www.geolytics.com/
32	
33	http://www.detma.org/LMIHome.htm
34	GIS points created specifically for this project from street addresses
35	GIS shape files available from www.magic.lib.uconn.edu; updated open space layers for project area in CT provided by Green Valley Institute
36	GIS shape files from MassGIS and Norcross
37	Shape files, by arrangement only
38	Shape files, by arrangement only
39	Shape files, by arrangement only
40	Census data for 1990 and 2000 in geospatial format from GeoLytics;
41	http://www.dls.state.ma.us/allfiles.htm
42	Tables available online at http://www.ct.gov/ecd/ under Research Data for most recent years; back data available hardcopy from DECD
43	Cornell University Geospatial Information Repository, US Census Bureau 1998 Tiger Line Files
44	
45	
46	Cornell University Geospatial Information Repository, US Census Bureau 1998 Tiger Line Files
47	Census road categorization GIS files available at magic.lib.uconn.edu
48	Census 2000 tiger line files available at http://www.geographynetwork.com/data/tiger2000/index.html
49	Hand digitized from above by ESF graduate student Seth LaPierre
50	Tax parcel boundaries and ownership information made available by special arrangement
51	
52	GIS polygon files available at http://www.state.ma.us/mgis/ftpzn.htm

MODEL INPUT DATA SOURCES

Appendix D: Thames Watershed Town Data

THAMES STUDY AREA FOREST DATA

Town	Total Acres in town	Acres included in Analysis	Acres in Water	Acres in Conservation Lands	% Area in Water	% Area in Conservation Land	Total Acres of Forest		% Forested		Forest Cover (Excluding Conservation Lands) Actual (acres)	Actual (acres)	Projected (acres)				% Loss	% of 2002 Unprotected forest at risk	
							1985	2002	1985	2002	1985	2002	2008	2013	2018	2023	1985-2002	by 2013	by 2023
Connecticut																			
Andover	10057	8398	266	1394	3%	14%	8476	8125	84%	81%	6817	6463	6344	6244	6145	6045	5%	3%	6%
Ashford	25269	21598	907	2762	4%	11%	21416	20913	85%	83%	17744	17217	17047	16904	16762	16620	3%	2%	3%
Bolton	9432	8571	96	766	1%	8%	6533	6213	69%	66%	5672	5340	5230	5138	5046	4954	6%	3%	7%
Bozrah	12982	12205	272	506	2%	4%	10266	9727	79%	75%	9489	8923	8737	8582	8428	8273	6%	3%	7%
Brooklyn	18648	17598	595	454	3%	2%	13675	12754	73%	68%	12624	11682	11361	11094	10826	10559	7%	5%	9%
Canterbury	25758	23785	852	1124	3%	4%	20794	19773	81%	77%	18820	17770	17412	17114	16816	16518	6%	3%	7%
Chaplin	12570	8871	244	3451	2%	27%	11088	10701	88%	85%	7390	6972	6829	6709	6590	6471	6%	3%	7%
Colchester	31761	27572	774	3413	2%	11%	24582	22990	77%	72%	20393	18738	18190	17734	17278	16822	8%	5%	10%
Columbia	14040	12834	534	678	4%	5%	11060	10503	79%	75%	9854	9263	9071	8911	8751	8591	6%	3%	7%
Coventry	24488	22338	686	1462	3%	6%	18168	17185	74%	70%	16019	14968	14633	14354	14076	13797	7%	4%	7%
East Haddam	36230	27682	1403	7146	4%	20%	30499	29490	84%	81%	21950	20961	20612	20321	20031	19740	5%	3%	6%
Eastford	18776	12705	432	5646	2%	30%	16206	15853	86%	84%	10135	9776	9655	9554	9453	9352	4%	2%	4%
Ellington	22140	19743	540	1858	2%	8%	12611	11548	57%	52%	10214	9155	8789	8484	8178	7873	10%	7%	13%
Franklin	12590	11537	135	918	1%	7%	8893	8395	71%	67%	7839	7324	7153	7011	6869	6727	7%	4%	8%
Griswold	23651	17707	1062	4882	4%	21%	18339	16971	78%	72%	12394	10980	10504	10107	9711	9314	11%	7%	14%
Hampton	16276	12820	324	3131	2%	19%	13492	13084	83%	80%	10036	9607	9465	9346	9228	9110	4%	2%	5%
Hebron	23937	20122	584	3231	2%	13%	18484	17704	77%	74%	14669	13880	13607	13379	13151	12923	5%	3%	7%
Killingly	31968	28552	1862	1553	6%	5%	25076	23491	78%	73%	21660	19967	19418	18961	18504	18046	8%	5%	9%
Lebanon	35302	32298	1308	1695	4%	5%	24541	23094	70%	65%	21537	20021	19528	19117	18706	18296	7%	4%	8%
Ledyard	25543	21849	1532	2160	6%	8%	20851	19547	82%	77%	17157	15791	15329	14943	14558	14173	8%	5%	10%
Lisbon	10687	10075	485	127	5%	1%	8350	7750	78%	73%	7737	7109	6894	6715	6536	6357	8%	5%	10%
Mansfield	29177	24899	609	3660	2%	13%	21887	20576	75%	71%	17609	16203	15734	15343	14953	14562	8%	5%	10%
Marlborough	15032	12096	240	2696	2%	18%	12564	12104	84%	81%	9628	9165	9006	8874	8742	8611	5%	3%	6%
Montville	28316	25314	1708	1294	6%	5%	22194	20515	78%	72%	19192	17511	16923	16434	15944	15454	9%	6%	11%
North Stonington	35158	30445	893	3820	3%	11%	29421	27469	84%	78%	24707	22766	22073	21495	20918	20340	8%	5%	10%
Norwich	18776	16797	1121	857	6%	5%	11045	9963	59%	53%	9066	7923	7545	7231	6916	6602	13%	8%	16%
Plainfield	27561	24244	947	2370	3%	9%	19968	17992	72%	65%	16652	14573	13883	13307	12732	12157	12%	8%	16%
Pomfret	25972	22356	763	2856	3%	11%	19321	18608	74%	72%	15705	14969	14723	14519	14315	14110	5%	3%	5%
Preston	20317	18842	956	519	5%	3%	14889	13937	73%	69%	13414	12417	12092	11822	11551	11280	7%	4%	9%
Putnam	13040	11972	600	467	5%	4%	9467	8498	73%	65%	8399	7402	7065	6784	6504	6223	12%	8%	15%
Salem	19002	16477	454	2069	2%	11%	15804	14989	83%	79%	13280	12457	12181	11951	11722	11492	6%	4%	7%
Scotland	11997	9827	168	2002	1%	17%	9345	9020	78%	75%	7175	6838	6727	6635	6542	6449	5%	3%	5%
Somers	18318	17192	211	915	1%	5%	10438	9406	57%	51%	9311	8247	7894	7600	7306	7012	11%	7%	14%
Sprague	8839	8095	511	232	6%	3%	6834	6496	77%	73%	6090	5731	5609	5508	5406	5305	6%	4%	7%
Stafford	37567	27909	973	8677	3%	23%	32825	31699	87%	84%	23167	21986	21606	21290	20974	20658	5%	3%	6%
Sterling	17477	14733	240	2506	1%	14%	14659	13760	84%	79%	11916	10986	10669	10405	10141	9877	8%	5%	10%
Thompson	31137	27271	1533	2336	5%	8%	24995	23674	80%	76%	21129	19797	19346	18970	18594	18218	6%	4%	8%
Tolland	25739	23079	766	1893	3%	7%	20933	19579	81%	76%	18273	16918	16458	16075	15692	15309	7%	5%	9%
Union	19098	12177	836	6082	4%	32%	17609	17407	92%	91%	10689	10480	10412	10355	10299	10242	2%	1%	2%
Vernon	11601	10240	168	1192	1%	10%	6037	5459	52%	47%	4677	4057	3861	3697	3534	3370	13%	8%	16%
Voluntown	25457	9318	448	15693	2%	62%	23502	22711	92%	89%	7363	6597	6318	6086	5854	5622	10%	7%	14%
Willington	21466	19844	539	1098	3%	5%	17893	17132	83%	80%	16272	15464	15204	14987	14769	14552	5%	3%	6%
Windham	17771	15857	797	1114	4%	6%	11877	10743	67%	60%	9963	8767	8377	8052	7728	7403	12%	7%	15%
Woodstock	39485	36291	1623	1565	4%	4%	29243	28200	74%	71%	26049	24986	24630	24333	24036	23739	4%	2%	5%
Massachusetts																			
Brimfield	22586	18431	498	3654	2%	16%	19718	18555	87%	82%	15563	14296	13875	13523	13171	12820	8%	5%	10%
Brookfield	10613	5879	1153	3579	11%	34%	9340	8904	88%	84%	4605	4145	3998	3876	3754	3632	10%	6%	12%
Charlton	28176	23705	1820	2649	6%	9%	23121	21068	82%	75%	18650	16498	15808	15232	14657	14082	12%	7%	14%
Dudley	14037	11278	842	1915	6%	14%	10206	9470	73%	67%	7448	6688	6438	6231	6023	5815	10%	6%	12%
East Brookfield	6653	5259	983	412	15%	6%	5544	5192	83%	78%	4149	3781	3659	3558	3457	3355	9%	5%	11%
Holland	8375	6956	659	745	8%	9%	7392	7236	88%	86%	5972	5813	5761	5717	5673	5629	3%	2%	3%
Leicester	10460	8009	898	1553	9%	15%	8404	7723	80%	74%	5953	5243	5001	4800	4599	4398	12%	8%	15%
Monson	28673	24751	536	3405	2%	12%	24233	22887	85%	80%	20311	18854	18381	17987	17593	17199	7%	4%	8%
Oxford	17550	15443	1117	990	6%	6%	13091	11574	75%	66%	10984	9383	8871	8444	8017	7590	15%	9%	18%
Southbridge	13215	10025	586	2608	4%	20%	10496	9924	79%	75%	7306	6712	6520	6361	6201	6041	8%	5%	10%
Spencer	12218	7687	925	3605	8%	30%	10010	9317	82%	76%	5479	4744	4502	4300	4098	3897	13%	9%	17%
Sturbridge	24919	14157	1499	9278	6%	37%	21777	20940	87%	84%	11015	10139	9856	9620	9384	9148	8%	5%	9%
Wales	10234	5409	151	4660	1%	46%	9480	9279	93%	91%	4655	4444	4377	4321	4265	4209	5%	3%	5%
Warren	17685	14660	480	2544	3%	14%	15040	14196	85%	80%	12015	11111	10831	10598	10364	10131	8%	4%	8%
Webster	9334	7400	1798	134	19%	1%	6698	5956	72%	64%	4764	3972	3722	3514	3306	3097	17%	10%	21%
Total	1195138	993183	45943	156001	4%	13%	940702	887973	79%	74%	738747	683970	665747	650561	635375	620189	7%	5%	9%

THAMES STUDY AREA HOUSING DATA

	median home sale price			# home sales per square mile			residential building permits per square mile			
	1990	1995	2000	1990	1995	2000	1985	1990	1995	2000
Andover	$ 80,000	$115,500	$136,500	4.1	4.4	4.5	1.8	1.3	1.4	0.9
Ashford	$101,500	$ 68,750	$111,000	2.1	1.7	2.7	0.6	0.6	0.5	0.6
Bolton	$178,500	$110,000	$134,750	3.5	5.8	7.3	3.3	0.3	1.4	1.4
Bozrah	$107,000	$ 93,500	$114,450	1.2	1.7	1.9	0.7	0.5	0.6	0.5
Brimfield	$ 72,500	$ 60,000	$ 77,500	2.3	2.2	2.6		0.6	0.5	0.8
Brookfield	$ 89,900	$ 72,000	$ 98,900	2.5	3.3	6.0		0.0	0.2	0.5
Brooklyn	$100,000	$ 90,000	$112,000	5.0	3.9	5.3	1.4	1.0	0.8	0.9
Canterbury	$115,000	$ 94,000	$115,000	1.6	1.9	2.5		0.3	0.6	0.5
Chaplin	$124,900	$ 75,000	$ 99,750	1.2	2.5	2.6	0.6	0.6	0.0	0.7
Charlton	$105,000	$105,000	$153,500	3.8	4.5	6.7		0.0	1.1	1.9
Colchester	$138,825	$116,500	$135,950	5.1	7.3	6.8	3.5	0.0	2.3	1.9
Columbia	$144,000	$115,000	$137,750	3.0	3.7	6.1	5.9	0.7	1.2	1.1
Coventry	$122,700	$ 85,000	$120,000	5.5	6.3	8.0		1.8	1.3	2.1
Dudley	$100,000	$ 68,000	$125,000	6.2	6.1	10.9	2.0	1.6	2.0	3.6
East Brookfield	$108,000	$ 80,500	$115,500	4.8	4.2	3.8	0.8	0.3	0.1	0.3
East_Haddam	$106,000	$105,000	$137,510	2.8	3.1	5.2		1.1	0.8	1.3
Eastford	$ 75,500	$ 57,000	$ 90,000	0.7	1.2	1.4		0.5	0.3	0.2
Ellington	$140,000	$114,000	$149,900	5.1	5.6	8.9	9.0	1.2	1.4	3.7
Franklin	$147,750	$ 97,000	$129,000	1.4	1.6	1.9	0.8	0.3	0.2	0.5
Griswold	$105,000	$ 84,000	$111,250	4.7	5.1	6.2		1.5	1.4	1.1
Hampton	$ 99,500	$ 49,000	$111,500	1.0	1.6	1.8	0.3	0.4	0.6	0.7
Hebron	$152,000	$112,000	$148,900	3.3	5.4	5.1	3.2	0.5	1.4	1.1
Holland	$ 95,000	$ 77.500	$ 79.000	5.0	3.4	7.3		0.6	0.4	0.7
Killingly	$105.000	$ 80.000	$100.000	5.1	4.9	6.5	2.2	1.1	0.7	0.8
Lebanon	$110,000	$100,000	$110,000	2.4	2.2	2.6	1.3	0.7	0.4	0.8
Ledyard	$131.250	$112,250	$138.000	5.8	5.3	6.9	2.9	0.8	0.8	1.0
Leicester	$ 89.450	$ 89,950	$112.950	5.0	5.6	7.5	1.7	1.8	1.4	1.8
Lisbon	$125.000	$ 91.000	$119.750	2.8	4.6	4.3	2.1	0.8	1.3	1.1
Mansfield	$128.294	$108.000	$126.001	3.2	4.4	5.7	1.1	0.6	1.1	1.0
Marlborough	$157.000	$135.750	$165.000	2.9	4.5	6.3	2.0	0.3	0.9	1.5
Monson	$ 96.000	$ 92.250	$107.000	6.1	6.2	5.8	1.0	0.0	0.8	0.7
Montville	$120.000	$100.000	$119.500	4.6	5.2	8.2	1.8	0.7	1.3	1.8
North_Stoningto	$128.000	$122.000	$134.500	1.0	2.1	2.1		0.4	0.4	0.4
Norwich	$110.000	$ 75.000	$ 97,000	14.4	15.1	18.5	2.2	6.5	0.7	1.0
Oxford	$100.000	$ 88.750	$117.750	8.5	6.9	11.5	2.2		2.3	2.0
Plainfield	$100.000	$ 82.350	$ 97.000	4.6	4.8	7.8	1.6	1.2	1.1	2.0
Pomfret	$105.250	$103.870	$116.500	1.7	1.9	1.5	0.9	0.7	0.5	0.6
Preston	$105.000	$ 90,000	$125.000	1.7	2.5	2.9	1.0	0.4	0.7	0.6
Putnam	$100 000	$ 79 950	$ 91.750	7.4	7.1	7.8	1.7	0.5	0.8	0.6
Salem	$ 56.392	$143.000	$137.450	3.3	3.1	2.6	1.7	0.7	0.9	0.6
Scotland	$ 57.500	$ 38.500	$110.000	1.9	1.7	2.3	0.5	0.4	0.5	0.4
Somers	$178.000	$139.500	$140.000	4.3	4.2	6.9	1.6	0.7	0.6	2.0
Southbridge	$ 88.000	$ 76.900	$101.000	7.5	9.0	12.0	4.3	1.0	0.9	1.1
Spencer	$105.000	$ 83 000	$114 950	4.6	4.5	6.7		0.7	2.9	1.0
Sprague	$115.000	$ 71 000	$ 88 250	1.8	2.5	2.6	0.7	0.3	0.2	0.2
Stafford	$115 000	$ 85 000	$ 98.000	3.6	3.2	4.9	2.2	1.1	0.5	0.7
Sterling	$ 87 450	$ 63.700	$112.000	2.9	2.6	3.0	0.9	1.7	0.8	0.6
Sturbridge	$116.640	$105.000	$139 900	3.4	4.0	6.5	3.6	0.7	0.7	1.8
Thompson	$ 86.200	$ 75.000	$ 99 000	3.1	2.9	3.7	1.1	0.8	0.5	0.5
Tolland	$152,025	$122.200	$160.000	4.3	6.8	9.1	2.7	0.8	2.1	3.8
Union	$128.000	$ 35 000	$ 89.900	0.5	0.4	0.8	0.1	0.1	0.3	0.2
Vernon	$129 900	$106.250	$120.750	20.5	19.4	30.7	18.6	1.7	1.0	3.4
Voluntown	$106.500	$ 76.000	$114.950	1.1	1.4	1.5	0.5	0.5	0.5	0.4
Wales	$ 60.000	$ 65.302	$ 77.000	2.9	1.9	2.8			0.4	0.4
Warren	$ 75.000	$ 58.621	$ 88.750	3.2	3.1	3.4	1.3	1.8	0.5	0.0
Webster	$100 000	$ 84 500	$110.000	15.8	14.6	22.4	5.9	3.4	1.8	2.9
Willington	$136.000	$111 750	$124.250	2.2	2.4	3.1	1.8	0.6	0.4	0.5
Windham	$114.900	$ 77.000	$ 90.000	6.8	7.5	11.1	1.2	1.1	0.4	0.2
Woodstock	$ 89 900	$ 86.000	$108.000	3.2	2.7	3.3	1.2	0.8	0.4	0.8

THAMES STUDY AREA LABOR FORCE DATA

	Labor Force				Unemployment Rate (%)			
	1985	1990	1995	2000	1985	1990	1995	2000
Andover	1,410	1,577	1,511	1,650	3.6	4.4	4.9	1.6
Ashford	1,824	2,229	2,126	2,178	2.7	3.9	5.6	1.7
Bolton	2,458	2,857	2,650	2,747	3.5	3.2	4.5	1.5
Bozrah	1,350	1,419	1,451	1,464	4.5	6.6	5.2	2
Brimfield	1,115	1,462	1,615	1,541	4.2	5.7	6	3
Brookfield	1,249	1,508	1,416	1,412	4.3	6.6	4.7	2.7
Brooklyn	3,360	3,640	3,756	3,972	4.6	6.2	5.6	2
Canterbury	1,959	2,555	2,635	2,784	6.4	6.8	5.8	2.1
Chaplin	962	1,178	1,145	1,201	3.1	4.4	5.2	1.3
Charlton	3,314	5,208	5,310	5,462	4.8	5.8	5.8	2.7
Colchester	4,475	6,367	6,438	6,733	4.6	5.5	5.7	1.9
Columbia	2,095	2,705	2,581	2,691	4.2	3.6	4.6	1.4
Coventry	5,281	6,114	5,957	6,202	4.3	4.5	5.4	1.8
Dudley	4,645	5,201	5,068	4,898	3.1	6.2	4.8	2.9
East Brookfield	953	1,056	1,014	1,008	3.5	6.4	5.6	3.5
East Haddam	3,117	3,971	3,961	4,165	4	4.1	6.1	2.1
Eastford	583	760	821	898	3.8	4.2	5.1	1.7
Ellington	5,863	7,091	6,641	6,961	3.6	3.6	4.7	2.1
Franklin	1,077	1,080	1,101	1,102	5.2	4.6	4.5	1.5
Griswold	5,143	5,496	5,630	5,827	5.7	6.8	5.7	2.5
Hampton	781	1,011	1,033	1,133	4.5	4.1	4.5	2.1
Hebron	3,449	4,149	4,093	4,421	3.5	4	5	1.6
Holland	741	1,140	1,032	1,005	4	4.6	5.4	4.1
Killingly	8,167	8,889	8,891	8,644	8.5	9.6	7.9	4.2
Lebanon	2,646	3,552	3,389	3,364	3.5	4.9	6	2.1
Ledyard	7,070	7,884	7,960	8,092	3.4	3.8	3.9	1.6
Leicester	4,854	5,652	5,571	5,622	3.7	6	5.5	2.8
Lisbon	1,919	2,130	2,207	2,255	4	6.1	5.8	2.2
Mansfield	9,097	10,952	8,932	9,238	1.8	3.1	3.3	1.3
Marlborough	2,801	3,199	2,991	3,096	2.5	3.5	4.5	1.5
Monson	3,392	3,870	3,777	3,794	4.1	6	6.6	3
Montville	9,151	9,461	9,775	9,798	4.9	6.3	5.5	2.1
North Stonington	2,366	2,769	2,819	2,943	4.2	5.2	3.9	1.9
Norwich	20,401	19,356	18,975	18,876	6	7	6.2	2.9
Oxford	5,888	6,715	6,644	6,758	5	7	5.7	3
Plainfield	6,643	7,747	7,855	8,676	8.4	8.5	7.3	2.8
Pomfret	1,637	1,849	1,976	2,182	4.3	5.5	5.4	2
Preston	2,335	2,677	2,756	2,578	1.5	4.5	4.6	2
Putnam	4,522	4,658	4,557	4,822	7.7	9.3	7.4	3
Salem	1,508	1,936	2,066	2,055	4.3	6	6	1.8
Scotland	563	722	809	888	2.3	5.4	4.4	1.4
Somers	4,178	4,274	3,996	4,119	3.7	4	4.9	1.8
Southbridge	7,691	8,755	8,332	8,098	3.8	7.4	6.2	3.3
Spencer	5,314	6,093	6,069	6,197	3.4	6.2	5.4	2.6
Sprague	1,742	1,683	1,687	1,675	6.3	7.7	6.9	3.3
Stafford	5,276	6,100	5,761	5,896	5.9	5.4	6.4	2
Sterling	906	1,328	1,509	1,635	8.2	8.5	7.9	2.6
Sturbridge	2,945	4,242	4,151	4,218	5.6	5.4	4.3	2.3
Thompson	4,648	4,729	4,619	4,612	8.9	8.3	5.7	2.9
Tolland	5,929	6,778	6,657	7,201	3.4	3.2	4.4	1.3
Union	311	369	381	407	1	4.6	3.4	2.2
Vernon	16,404	18,440	16,604	16,592	4.4	4.8	5.5	1.8
Voluntown	892	1,265	1,308	1,380	8.9	8.7	8.4	3.2
Wales	523	852	894	833	8	6.9	5.3	3.8
Warren	1,556	2,281	2,462	2,368	3.4	6	5.1	3.3
Webster	7,068	8,401	8,037	8,110	4.9	7.8	6.1	3.4
Willington	2,815	3,823	3,524	3,484	3.2	3.8	4.6	1.5
Windham	11,139	11,322	10,341	10,115	6.6	5.8	7.6	3.1
Woodstock	2,962	3,400	3,630	4,001	4.4	5.2	4.3	1.9
Total	234,463	267,927	260,897	266,077				
Average					5%	6%	5%	2%

THAMES STUDY AREA POPULATION DATA

Town	Population 1990	Population 2000		Population change 1990 - 2000	% Population Change
Andover	2,612	3,066		455	17.4%
Ashford	3,816	4,073		258	6.8%
Bolton	4,685	5,031		346	7.4%
Bozrah	2,293	2,280		-13	-0.6%
Brimfield	3,027	3,343		316	10.4%
Brookfield	3,149	3,062		-87	-2.8%
Brooklyn	6,706	7,124		418	6.2%
Canterbury	4,518	4,724		206	4.6%
Chaplin	2,095	2,289		194	9.2%
Charlton	9,819	11,276		1457	14.8%
Colchester	11,145	14,537		3392	30.4%
Columbia	4,651	4,976		324	7.0%
Coventry	10,243	11,517		1273	12.4%
Dudley	9,878	9,969		91	0.9%
East Brookfield	2,166	2,096		-70	-3.2%
East Haddam	6,945	8,289		1344	19.4%
Eastford	1,352	1,630		278	20.6%
Ellington	11,347	12,848		1501	13 2%
Franklin	1,809	1,812		3	0.1%
Griswold	10,995	10,787		-208	-1.9%
Hampton	1,602	1,764		163	10.2%
Hebron	7,131	8,651		1520	21.3%
Holland	2,302	2,409		107	4.7%
Killingly	16,409	16,646		237	1.4%
Lebanon	6,132	6,923		791	12 9%
Ledyard	15,481	14,649		-833	-5.4%
Leicester	10,110	9,574		-536	-5.3%
Lisbon	3,905	4,096		191	4 9%
Mansfield	22,026	21,349		-677	-3 1%
Marlborough	5,553	5,733		180	3 2%
Monson	7,894	8,381		487	6 2%
Montville	17,567	18,544		977	5 6%
North Stonington	4,996	5,007		11	0 2%
Norwich	38,642	35,951		-2691	-7 0%
Oxford	13,015	13,378		363	2 8%
Plainfield	14,607	14,659		52	0.4%
Pomfret	3,132	3,782		649	20 7%
Preston	5,299	4,795		-504	-9 5%
Putnam	9,049	8,987		-61	-0 7%
Salem	3 380	3 817		437	12 9%
Scotland	1 263	1 574		311	24 6%
Somers	9 262	10 707		1445	15 6%
Southbridge	18 294	17 205		1089	-6 0%
Spencer	9 815	9 272		542	-5 5%
Sprague	3 161	2 985		-176	-5 6%
Stafford	11 229	11 312		83	0 7%
Sterling	2 394	3 079		685	28 6%
Sturbridge	8 074	7 842		232	2 9%
Thompson	9 213	9 076		137	-1 5%
Tolland	11 161	13 148		1987	17 8%
Union	655	716		61	9 3%
Vernon	30 584	28 269		-2316	-7 6%
Voluntown	2 128	2 533		405	19 0%
Wales	1 564	1 733		169	10 8%
Warren	4 411	4 816		405	9 2%
Webster	19 025	16 253		-2772	14 6%
Willington	6 075	6 004		-71	-1 2%
Windham	22 725	22 825		100	0 4%
Woodstock	6 085	7 171		1086	17 8%
Total	498 598	510 342		11744	2 4%

Dynamic Models of Land Use Change In Northeastern USA

Developing Tools, Techniques, and Talents for Effective Conservation Action

Mary L. Tyrrell
Program on Private Forests
Yale School of Forestry and Environmental Studies

Myrna H.P. Hall
College of Environmental Science and Forestry
State University of New York

R. Neil Sampson
Yale School of Forestry and Environmental Studies
and the Sampson Group

January 2004
GISF Research Paper 003
Program on Private Forests

Yale University
School of Forestry and Environmental Studies
Global Institute of Sustainable Forestry
360 Prospect Street, New Haven, Connecticut 06511 USA

This project was supported by a grant from the USDA Forest Service, Cooperative Forestry

Acknowledgements

This project was made possible through the contributions, ideas, and support of many people. We are grateful to Larry Payne, Ted Beauvais, and Rick Cooksey of the USDA Forest Service, Cooperative Forestry, who understood the potential and provided funding for the project. The Yale School of Forestry and Environmental Studies (FES), Global Institute of Sustainable Forestry, and the State University of New York College of Environmental Science and Forestry (SUNY ESF) provided additional resources to support the project.

We would like to acknowledge the work of graduate students Steve Dettman and David Hobson at Yale FES and Susan Nixson at SUNY ESF who worked on data collection and formatting. Tagan Blake, now at Georgetown University, spent a summer collecting, formatting and organizing the Connecticut and Massachusetts data into one Thames data set, a significant contribution to the project. Michelle Decker, undergraduate at SUNY ESF, also contributed to the New York data collection.

We are grateful to Dan Civco and James Hurd at the University of Connecticut Center for Land use Education And Research (CLEAR) for their contribution of a newly created set of temporal land cover maps, which was an enormous benefit to the project. We would also like to acknowledge the work of Stephen Ambagis, at Clark University graduate student, now at Winrock International, who created the 2001 land cover map for the Catskill/Delaware area. New York City Department of Environmental Protection's (NYC DEP) GIS unit provided other very important data, in particular the 2000 tax parcel information. Our sincere thanks to Terry Spies and Barbara Dibeler of the NYC DEP. The many folks in state, town and county offices, who answered questions and provided data, are too numerous to mention, however we sincerely appreciate their help. The U.S. Census data used in the analysis was obtained from GEOLYTICS, E. Brunswick, NJ.

And finally we would like to give special thanks to the following people for their support, particularly for connecting us to the local organizations and people in Connecticut, Massachusetts and New York, and for helping organize the community workshops: Steve Brodrick, Senior Extension Educator/Forester for Connecticut; Bill Toomey, Quinebaug Highlands Project Director at The Nature Conservancy; and René Germain, at SUNY ESF, Coordinator of the New York City Watershed Model Forest Program.

Table of Contents

Summary

America's productive private forests are at risk, under threat of being converted to malls, housing developments, and personal green space. Conservationists and officials in many localities are asking what they can do to help conserve their forests and maintain local forest-based economies. This study is designed to test the ability of a dynamic simulation modeling tool—GEOMOD—to illustrate local and regional land use changes, both in the recent past and in the near future. It stems from the idea that if people know how rapidly their forest resource is being lost, where it is being lost, and what forces seem to be driving the losses, they will be better equipped to take effective conservation action.

With this project, we have successfully demonstrated the utility of using GEOMOD as a land use planning tool in areas under pressure from unplanned development and sprawl. Working with two sites, the Thames River Watershed in Connecticut and Massachusetts and the Catskill/Delaware water supply watersheds and surrounding region in New York, we have demonstrated a scientifically rigorous method of projecting likely future scenarios of development based on analysis of past rate and patterns of land use change.

In the Catskill/Delaware region we found that private forests are being converted to non-forest uses at a rate of a little over 1% per year, in a fragmented pattern. Without strong conservation intervention, that rate is likely to proceed for the next decade, resulting in the loss of another 162,000 acres of private forestland, and a much more fragmented forest resource, by the year 2011. Through statistical analysis, we found that in this mountainous region, the fragmentation that has occurred since 1992 follows a pattern of sprawling up the valleys and is most influenced by the proximity of urban areas and roads, and topography, particularly elevation and slope.

Of the 740,000 acres of forest not permanently protected from development, the Thames Watershed region has lost 7.4 % since 1985. This may seem like a fairly low rate over 17 years, but it is the pattern that is most troubling. The forest is much more fragmented and parcelized, which impacts everything from wildlife habitat, deer and tick populations, the potential for timber harvesting, recreation, aesthetics, and local economies. If the same trends continue, we project that the Thames Watershed and surrounding towns will lose an additional 64,000 acres of forest, scattered across the landscape, in the next 17 years.

These numbers actually understate the amount of intact forest remaining. For example, a housing subdivision with large lots and trees would show up as partial forest in the satellite imagery. However, this is no longer the same forested habitat for wildlife as a large tract of unfragmented forest, nor is it a forest that can be managed for timber or other forest products.

Nonetheless, our results demonstrate that the rate and location of recent conversions of forest to non-forest cover, detected by modern interpretation of satellite imagery, can be used not only to study the past but to visualize possible future conditions. GEOMOD is able to take those past changes, compare them with a wide range of geophysical and socio-economic data, and derive a statistically robust correlation between past patterns of land use and land cover change and the most likely future continuation of those patterns.

The result is a visually powerful dynamic display of local land use change, coupled with a new understanding of the factors associated with that change. Using these tools, local leaders can bring new insight and energy to forest conservation and land use management programs. The local stakeholders in both areas have expressed tremendous interest in the results, which they believe would be particularly useful in local- and county- or regional-level planning efforts.

Introduction

There are some 10 million private forest ownerships in the United States, and that number has been estimated to be growing at the rate of around 150,000 a year.[1] At the same time, the area of privately-owned forest land—excluding Alaska, some two-thirds of all U.S. forests—has stayed roughly the same for decades. The obvious result is that America's forests are being divided into smaller and smaller ownerships. Nationwide, over 25 million acres of rural land were developed between 1982 and 1997, and over 10 million of those acres were forest before they were developed.[2] The clear implication is that forests are increasingly under threat from urban sprawl and other dispersed development.

These trends raise concerns in two general categories. The first is forest fragmentation—the breaking up of large contiguous forest areas into smaller, disconnected parcels separated by non-forest lands, roads, or other land use. The impacts of this fragmentation are often described in ecological terms. A landscape sprinkled with little patches of disconnected forest does not function in the same way as that landscape functioned when it was a single large forest. The impact on wildlife habitat can be severe, as many species cannot thrive or even survive in fragmented landscapes. Other impacts may be felt, for example, on water quality, as non-forest land uses often are associated with higher rates of water runoff, soil erosion, and other damaging factors.

The second category of change is parcelization, the dividing up of private land into smaller ownerships. The impacts here are more often economic. Small ownerships, particularly those of less than 50 acres, are seldom managed to produce sustainable yields of forest products. Increasingly, they become private "green space" for their owners. The trees remain, but opportunities for sustainable production are largely lost. That might not sound like much of a problem in a large country where there are ample supplies of forest products to meet consumer demand. But over half of the timber used to produce wood and paper products in the United States comes from the smaller private ownerships held by families, institutions, and companies. And those are the forest tracts that are being converted to smaller and smaller parcels. The long-term impact, if not the immediate effect, is an important national concern.

It can be an important local concern as well. As more of the local forest resource is withdrawn from timber production, local mills and forestry businesses suffer. At some point, they begin to go out of business or move elsewhere. Mill closings have been common in recent years, and in many areas, the lack of available timber is one of the reasons. When a local mill closes, the remaining forest owners have less access to markets, and the feasibility of keeping their forests in sustainable production may become questionable. Increasingly, they will look to sell the land, and often it will be most profitable to break it up into small pieces and sell it to potential developers or homeowners. In this way, the processes of parcelization and fragmentation take on a cascading effect, where each forest sale strengthens and hastens the rate of local forest conversion.

As people buy small forest tracts and build homes, the scattered patterns of rural housing become a local economic issue. Rural homes impose significant costs on local services. Their owners need roads, schools, transportation infrastructure, waste disposal, law enforcement and other local services, and the fact that they are dispersed thinly across the region makes the cost of providing each service higher than where people live in more compact arrangements. Seldom do the property taxes paid by scattered rural houses cover the increased burden placed on local services.[3]

Despite these and other concerns in many communities over forest changes, there often seems to be little that can be done to address the situation. By the time the problem is recognized, it's a *fait accompli*. Once the forest is fragmented, it can possibly be restored by intentional management actions, but that process may take decades, and will be highly unlikely where the non-forest land uses are long-lasting. A landscape with a thousand small landowners can be re-assembled, theoretically, back into a few ownerships, but only with great difficulty. So the general situation is that once these forests become fragmented or parcelized, it is nearly impossible to restore their integrity.

It is hard to evaluate how rapidly these processes are taking place. Change often comes in the form of one small, seemingly insignificant event at a time, and the full effect of the cumulative change may not be evident for years. By the time the impacts are known, it is too late to do anything to alter them. Before the parcelization or fragmentation occurs, however, there are effective preventative measures for a community to consider. Depending on the local situation, it may be possible to use local planning and zoning to guide development into more desirable patterns. Improving local incentives for sustainable forest management sometimes take the form of special tax programs for producing forest lands, or other ways to make sustainable forestry an attractive reason to hold land in production. Sometimes land with high conservation values can be placed under a conservation easement that limits development while providing compensation for lost land sale values.

This leads to the idea that communities could, if they knew where forest parcelization and fragmentation were most likely to occur in the future, design locally adapted conservation measures that would slow these changes or reduce their undesirable impacts. The question becomes: How does one see such phenomena in advance of their actual occurrence?

This project is an attempt to harness modern scientific tools to that task. We begin by studying the trends in land change over the recent past, using satellite imagery to identify where forests have been altered through fragmentation or parcelization. Once those areas have been identified, we seek to understand what underlying factors or drivers might have been the most important contributors to the change. If that can be understood, perhaps we can assume that similar conditions or driving factors may continue to be important in future land use changes. If that assumption holds, then conservation program efforts can be prioritized to those forests most at risk, with some hope that success will be improved.

Since fragmentation and parcelization are very difficult to quantify, especially over a large land area, we have used change in forest cover as a surrogate measure of the extent to which the forest has become fragmented and parcelized. This is a reasonable approach in the northeastern United States, where the situation with change in forest cover is not so much large extensive clearing of forestland, but a patch–by-patch clearing for development.

But even when looking at forest cover, seeing the extent of past changes is a technical challenge, as the processes differ considerably in their visible effects. Forest fragmentation—conversion of a large, continuous forest into a scattering of small patches— can be readily seen in satellite imagery. It may not, however, be visible from the local roads and thus remain hidden from public view and consciousness. Parcelization is even less obvious, particularly where one relies on aerial imagery to detect it. Property lines don't show on the land, and unless the new owners build roads and houses, the change in the appearance of the forest, particularly from the air, may be difficult to discern.

In spite of those difficulties, this project demonstrates that past trends in parcelization and fragmentation, at least in the northern and central hardwood forests where the methods were tested, are possible to document. This is due, in large part, to the increasing skills in image processing and interpretation that we were able to attract to the effort. Those people are recognized elsewhere in the report, and their contributions were essential to success. Without an accurate means of comparing the current condition to past conditions, the chance of understanding the most likely future is greatly reduced.

This project demonstrates what many land use and forestry specialists have felt to be the case. Further development and land use change is almost certain in these areas, at least into the foreseeable future. That change will not, however, affect all lands equally. Some areas are far more likely to experience it than others. Where a community can focus its conservation efforts on limiting forest parcelization and fragmentation in the most at-risk areas, the chances of retaining a productive and sustainable forest while accommodating local growth trends are significantly enhanced.

GEOMOD, A Dynamic Land Use Change Modeling Tool

With this project, we have successfully demonstrated the utility of using a modeling tool, GEOMOD, as a land use planning tool in areas under severe pressure from unplanned development and sprawl. Working with two sites, the Thames River Watershed in Connecticut and Massachusetts and the Catskill/Delaware water supply watersheds in New York (figure 1), we have demonstrated a scientifically rigorous method of projecting likely future scenarios of development based on analysis of past rate and patterns of land use change.

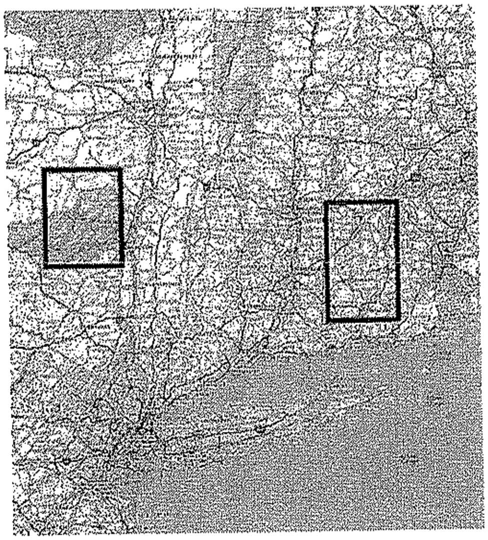


Figure 1. Research site locations, indicated by red boxes. Catskill/Delaware is on the left; Thames on the right. Source: DeLorme Topo USA.

GEOMOD, developed by researchers at the State University of New York College of Environmental Science and Forestry (SUNY ESF) predicts the rate and spatial pattern of land conversion based on past land use change.[4] Although there are many tools now being used by the conservation and land use planning communities, dynamic simulation, with its ability to visually portray the importance of cumulative effects, change over time, and driving forces, is an enormous enhancement to static GIS mapping or build-out analyses. GEOMOD is extraordinarily effective in helping people understand the dynamics of land use change, see where forests are most at risk of fragmentation and conversion to development, visualize future conditions, and plan strategic approaches to the mitigation of harmful trends. Knowing how, where, and why those changes are likely to occur can be a powerful tool for conservation organizations, community leaders, and citizens.

The Spatio-Temporal Modeling Approach

Spatial modeling, as we define it,[5] is the application of a numerical model that uses spatially distributed data to simulate landscape dynamics. In the case of land use change modeling it implies that the spatial distribution of various factors, such as topography, plays an important role in determining where humans exploit the landscape. There sometimes exists confusion about the terms land *use* and land *cover*, and they are often mistakenly used interchangeably. In this study we analyze the conversion of forest *cover* to non- or partial-forest *cover* for which the new *use* is presumed to be some type of human activity, such as residential housing. Thus we are in some ways working with both land *cover* and land *use*, the combination of which we refer to as LULC.

Spatial models of future LULC require two types of parameters—those that project how rapidly land is converted to other uses and those that indicate where the change will take place, i.e. rate and location. GEOMOD, a spatially explicit land use change model, identifies through a rigorous calibration/validation process those spatially distributed bio-physical, and/or socio-economic variables that explain past and current development patterns, and projects them into the future assuming 'business as usual.' It can be used to analyze any kind of LULC conversion, for example, forest to pasture or pasture to suburban residential development, if such changes can be detected through remote sensing.

The factors that often influence where people settle can include biophysical determinants such as topographic position (elevation and steepness of slope), distance from rivers, soil type, and/or socio-economic factors such as infrastructure, already-established settlements, distance to roads and markets, and density of population engaged in agriculture and forestry. Demographic factors such as those available via population census may also explain why certain land is attractive to developers, or simply available for sale, for example, an aging population.

The model allows for regional stratification in order to capture, for example, the effect of different government policies in different political units on the pattern and rate of landscape development. The basis for analysis is a time series of land cover maps derived from satellite imagery or aerial photographs. At least two time periods are necessary (time 1 and time 2), with sufficient time between the two for change in forest cover to have occurred.

A model is a simplification of a complex system. An architect's model of a building to be constructed is an example. A computerized ecosystem model tries to capture and represent how the system works. We like to think of it as a formalization of our assumptions about that system. Building a model that can be relied upon requires a circular process of *calibration* and *validation* until the model gets as close to reality as is possible given the information we have at the current time. A good model thus begins by using historical, or what we call empirical data—meaning it has been measured and recorded—to calibrate the model. Some of this data must be held in reserve to validate the model's projections, in other words to see if the model is predicting correctly.

An example would be a model that predicts the growth of trees based on the type of soil they are planted in, and the amount of sunlight and precipitation they receive. To *calibrate* the model the researcher first needs data that shows how much trees actually have grown in different soil, sun and moisture conditions. Then he/she writes the model to grow trees across the landscape based on the conditions found at each location. Finally, to determine how well the model is doing, the modeler checks his/her predictions against the growth information for other trees distributed across the landscape that were not used in the calibration process, and determines statistically how well the model has matched the real growth (volume or biomass) of this validation set of trees. The model's mathematical equations that express the relation between tree growth response and environmental conditions continues to be adjusted until the predictions match as closely as possible the real world.

An analysis of landscape change with GEOMOD is performed in the same way, testing the importance of different variables like 'distance from roads' or 'slope' of the terrain to determine where people settled at one point in time. Then, taking this information, the model projects where they are likely to settle in the future and then checks against a map of the 'real' landscape at that point in time. The closer we are able to match the second time period, the more confidence we have that those are the important factors that will affect the future distribution of settlement activity in a region.

How well one factor, or a combination of factors, allows GEOMOD to predict the future time is measured by the 'kappa-for-location' ($K_{location}$) statistic. The kappa statistic tells us how much better than chance alone the model is in predicting areas that will be converted from forest to non-forest (with "0" being no better than chance alone and "1" being a perfect predictor), i.e. the higher the kappa statistic the higher the factor's ability to identify correctly those forested areas that will be converted to non-forest in the future based on their attractiveness for development. Percent cells correctly simulated can be deceiving especially when little change has occurred in the landscape. The kappa adjusts for this. One could also test whether a predicted quantity of change is accurate using the 'kappa-for-quantity' measure.[6]

Objective

Our objective in this study was to test whether the land use change model GEOMOD, heretofore applied principally in tropical forested landscapes of the less developed world,[7] could reveal important insights into how quickly, where, and in what pattern the working forested landscape of the highly developed northeastern United States is being lost to other forms of landscape development. In its application in the developing tropics the model's inputs have been limited to maps of primarily bio-physical properties, but seldom included spatially distributed socio-economic or demographic information. In the United States we wanted to test whether the addition of such information in the form of, for example, US census data, county tax parcel maps, and real estate and labor statistics, might enhance the model's predictive power. The model has previously been applied to one other area of the northeast, the Ipswich Watershed in Massachusetts, but primarily examined the influence of topography.[8]

Study Sites

After considering several possible sites in the northeast, the final selection was narrowed to two places, based on criteria developed by the project team in the early planning stages (see box on this page): a portion of the New York City Catskill/Delaware Watersheds in New York; and the Thames River Watershed in Connecticut, later expanded to also include the Massachusetts portion of the watershed.

These largely forested places are under tremendous pressure from local development and the sprawling metropolitan areas of New York City, Boston, Hartford and Providence (figure 2). As the largest unfiltered surface water supply in the country, the New York City Watershed is extremely vulnerable to potential changes in land use. Protecting the remaining forested landscape is a high priority for both the local communities and the urban population of New York City. The Thames River Watershed, in northeastern Connecticut and south-central Massachusetts, known as the "Last Green Valley" between New York and Boston, is home to the Quinebaug-Shetucket National Heritage Corridor, honoring both its present rural character and its past industrial history. Development pressures are typical of those being experienced throughout the northeast, and there are active forest conservation efforts in both places.

Criteria for Choosing Research Sites

- Local or regional interest and willingness to partner in the project on the part of conservation organizations, local governments, and citizens' groups.
- A reasonably-scaled study area that makes political sense to the local partners, which is large enough to allow landscape inferences (such as watershed impacts), and yet fit within the technical constraints of GEOMOD for data analysis.
- Adequate existing data sets on physical, economic, and social conditions so that the analysis can be readily constructed without the need for gathering a significant amount of new data.
- Land cover maps derived from remote sensing imagery enabling construction of past land cover history extending back 10-20 years.
- Contains large tracts of intact, privately-owned forest as well as areas that are already developed and considered to be at risk of losing forest to development and of further forest fragmentation.
- Located within a region of conservation focus in order to maximize the project's contribution to the larger forest conservation agenda.
- At least one member of the research team familiar with the area to aid in background, contacts and reality-checking.

Figure 2. Night lights over northeastern North America. The Catskill/Delaware (left) and Thames (right) watersheds are in the areas circled in red. Image from NASA Lights of the Earth web site.

The Catskill Mountains of New York[9]

Our New York study site lies in the Catskill Mountains about 100 miles northwest of New York City. Encompassing more than six counties and over 6,000 square miles of mountains, forests, rivers, and farmland, the Catskills are often referred to as America's First Wilderness because scholars trace the beginnings of the environmental conservation movement to this beautiful area. With almost three dozen mountain peaks over 3,500 feet in elevation and six major river systems that annually attract the world's most devoted fly fishermen, the Catskills are an ecological resource of significant importance. The region's rugged terrain has contributed over the years to a sense of the area as remote wilderness, in spite of its nearness to the country's largest population center.

The two most prominent features of the Catskill region today are the nearly 300,000 acres of public Forest Preserve land located largely within the Catskill Park, and the 1,584 square miles of catchment known as the Catskill/Delaware Watersheds that provide 90 percent of the New York City water supply. This unfiltered water supply has been made possible largely because in 1885 the New York State Legislature established the Catskill Forest Preserve to be set aside as 'Forever Wild.' In 1904 the Catskill Park was created to establish an imaginary boundary, called the 'blue line,' around the Forest Preserve, and surrounding private land. Together the Preserve and the Park have grown over the years to approximately 700,000 acres, of which about 60% is private land.

But this is also a working landscape, and the coexistence of the two—wilderness and human society—side by side is considered a grand and visionary landscape experiment in the Catskills. Farms and forests of the region have provided livelihood to families for centuries. Catskill tanneries supplied most of the saddles used in the Civil War. Hides were shipped from South America for processing into leather. High-tannin bark was stripped from hemlock trees and used to 'tan' hides. The furniture making industry followed, using the trees left behind. Cleared land was often sold for 50 cents an acre to mountain farmers. Furniture makers, lumberjacks, charcoal producers, hoopmakers (hoops were used to hold barrels together), and wood acid manufacturers all exploited the Catskill forest. Today, the cleared valleys and hillsides have returned to forest and forestry remains important on private lands, primarily as a source of lumber. But little by little that landscape is being carved into ever smaller parcels of land, and the effects of New York City weekend sprawl and development may have significant impact on the long term viability of forestry in this region.

The Thames River Watershed of Massachusetts and Connecticut[10]

The New England study area covers most of the Thames River Watershed and adjacent towns, almost 1900 square miles of rural and forested land in northeastern Connecticut and south-central Massachusetts. An estimated thirteen percent of this land is permanently protected from development, either in the form of public land or conservation easements. Known as the "Last Green Valley," it is one of the last large rural areas remaining in the highly-developed section of the east coast between Boston and Washington, D.C. It is home to the Quinebaug Highlands, a 269 square mile region of mostly privately owned forestland in Connecticut and Massachusetts, identified as one of Connecticut's Last Great Places by The Nature Conservancy; the privately-owned 4,000 acre Norcross Wildlife Sanctuary in Massachusetts; the Yale Myers Forest, a 7,000 acre research and teaching forest; several state forests; and the Pawcatuck Borderlands, a 200 square mile area of largely contiguous forests along the Connecticut-Rhode Island border. The Quinebaug-Shetucket Rivers Valley was declared a National Heritage Corridor in 1994, to help with efforts to protect the unique history and rural character of this New England valley.

The region is rich with wildlife and healthy hardwood and coniferous forests, and encompasses all or part of seven New England watersheds. Now this relatively unspoiled land is under pressure from the intense development of surrounding urban and suburban areas. Bordered by Worcester, Massachusetts to the north, New London, Connecticut to the south, Providence, Rhode Island to the east, and Hartford, Connecticut to the west, the area has undergone significant land use changes over the past fifty years as housing and industrial development has encroached upon formerly rural and forested land. Because so much of the forestland is privately owned, there is no guarantee that unique natural areas like the Quinebaug Highlands will remain intact or immune to development pressures, and therefore a number of conservation organizations have mobilized an effort to protect this region from development.

Community Input

Local input was considered vital to ensure both that assumptions could be tested against local knowledge and that the results would be meaningful and useful to the local communities who are working to conserve their forested landscapes and rural character. Two community workshops were held, one in New York on March 19, 2002, the other in Connecticut on May 21, 2002. Attendees included representatives of various local and regional conservation organizations and government agencies; local citizens; and forest landowners. (See appendix A for workshop summaries and lists of attendees). Follow-up workshops were held in each location to present the results and discuss ways to get this information into the local planning processes.

A working hypothesis about what is driving land use change in each area was developed from the first community sessions. Input and feedback from the participants was incorporated into the project plan, wherever feasible.

Working Hypotheses

New York Catskill/Delaware Watersheds

Parcelization is more of a current factor than fragmentation and will be hard to detect or predict.

Forest fragmentation and conversion is being driven primarily by distance from New York City, distance from major roads, distance from ski resorts/new resorts (growth nodes); New York City water supply watershed regulations; taxes; age of landowner; and population of permanent residents vs. housing units (second home development).

Thames River Watershed

Threats to forests are from parcelization, fragmentation, habitat destruction, and conversion.

Forest fragmentation and conversion are being driven mainly by population growth; zoning regulations; changes in timber markets; casino development; economic growth in nearby major cities; land prices; distance from major cities; upgrade and expansion of roads; and the collapse of the dairy industry.

Data Creation and Collection

Two data sets are required in this method of modeling land use change over time: land cover, which is the dependent variable; and the so-called potential driving factors, or independent variables. The assumption is that land use change (using land cover as a surrogate for land use) is a function of one or more biophysical and socio-economic factors, such as land prices, population growth, and proximity to natural amenities.

Dependent Variable—Land Cover[11]

Land cover maps for each region were the primary source of information for both the rate and location of change in forest cover in the two regions over time. For the New York study we relied on the USGS 1992 National Land Cover Data (NLCD) with 21 categories (figure 3) as our time 1 baseline (model calibration). Classifying satellite imagery into land cover/land use classes is as much an art as a science, as totally different land uses can sometimes have the same reflectance values. Thus a critical step in classifying satellite imagery is to perform an accuracy assessment, by either ground-truthing or comparing with aerial photographs[12]. For the region of our analysis (figure 4), we compared the 1992 land cover values to 1994 aerial photos and found 90.0% accuracy (Appendix B). For a second time period we classified a May 2001 satellite scene to use for model validation (also visible in figure 4). Our post-classification assessment yielded 99% accuracy at the pixel level when compared to year 2001 digital orthorectified quarter quadrangle (DOQQ) aerial photographs. The methods employed are outlined in Appendix B.

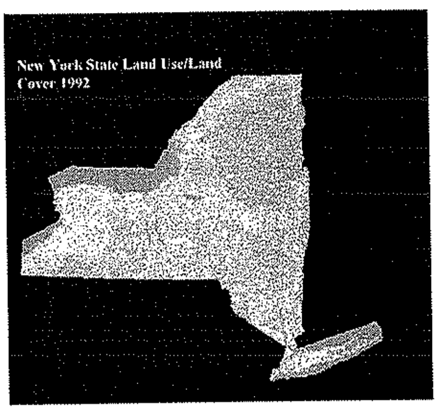
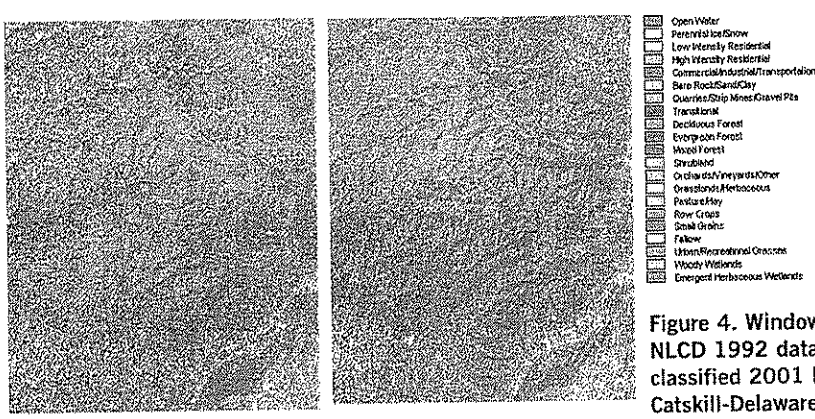


Figure 3.Baseline Map for Catskill-Delaware Study.Source: USGS National Land Cover Data Set



1992 *2001*

Figure 4. Window of analysis showing NLCD 1992 data juxtaposed with classified 2001 land cover for the Catskill-Delaware Region of analysis.

In the case of the Thames study, the Center for Land use Education And Research (CLEAR) at the University of Connecticut provided us with a four-year (1985, 1990, 1995, and 2002) land cover time series derived from satellite imagery[13] (figure 5). Eleven categories are delineated. "Agriculture" includes both cropland and pasture. As in other studies we have undertaken, agricultural lands are easily confused in the classification process with grasslands such as parks, and/ or with other grass and shrub-covered lands such as large lawns, fields, or meadows associated with residential or municipal property.[14]

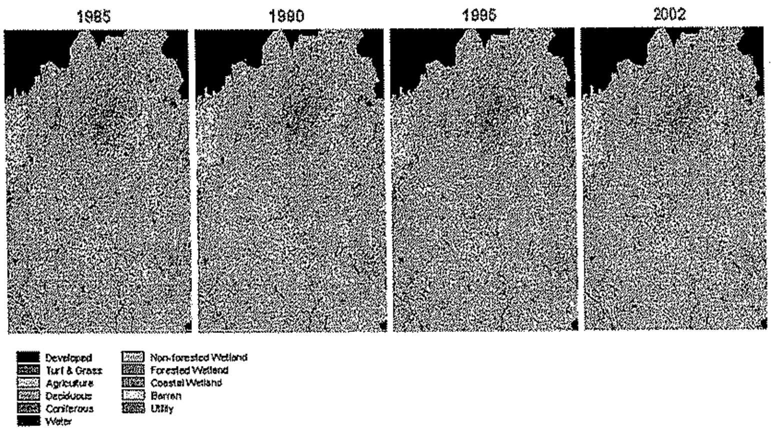


Figure 5. Land Cover history for the Thames Watershed and surrounding towns, 1985 to 2002. Source: Center for Land use Education And Research (CLEAR) at the University of Connecticut.

We used 1990 as time one (model calibration), and 2002 for time two (model validation). The 1985 map allowed us to look at the relation of lands newly developed in 1990 with respect to lands already developed in 1985. It should be noted that, as we did not have more than two time series land cover maps for New York, it was not possible to use this change from a previous time period in the New York anaylsis. Our results, therefore, cannot be fully compared across both regions.

We stratified each region by political units. The New York region included parts of five counties centered on the New York City water supply catchments (figure 6). The Thames site included 59 individual towns in Connecticut and Massachusetts lying within the Thames watershed or immediately adjacent (figure 7). Both public and private lands that are currently under conservation protection in the Thames, as well as public lands in New York acquired by both New York City and State to protect city drinking water quality, were excluded from analysis, as these lands are assumed to be unavailable for future development or other land use change (figures 8 and 9). Eighteen percent of the New York study area and thirteen percent in the Thames area is in this category.

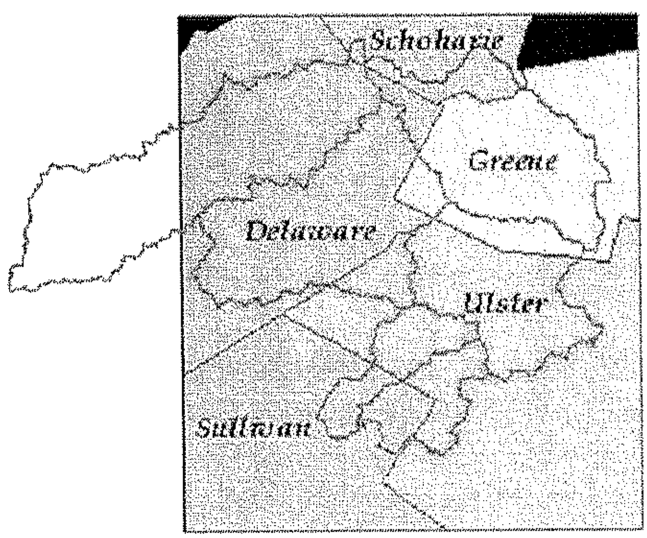


Figure 6. Study area boundary. Portions of counties and New York City water supply watersheds included in study area.

Figure 7. Towns of Massachusetts and Connecticut included in Thames Watershed Study.

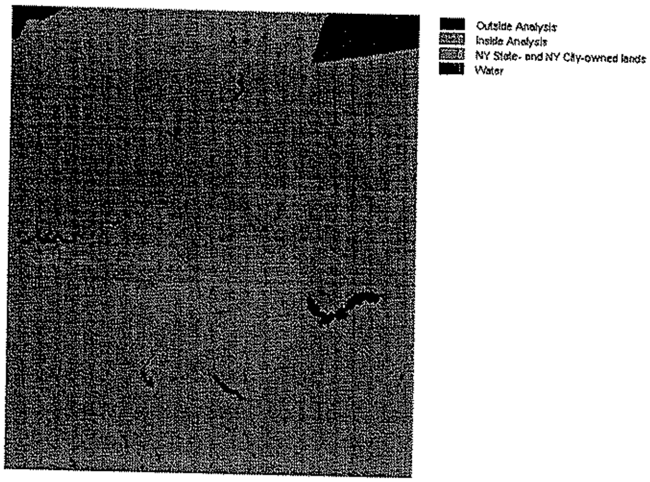


Figure 8. Public Land Excluded from New York Study.

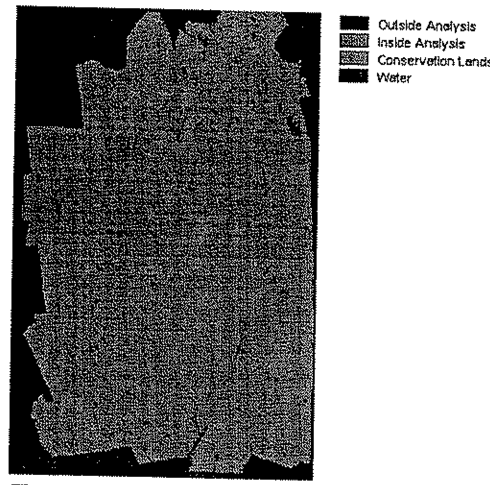


Figure 9. Thames Watershed Public and Private Conservation Areas excluded from analysis.

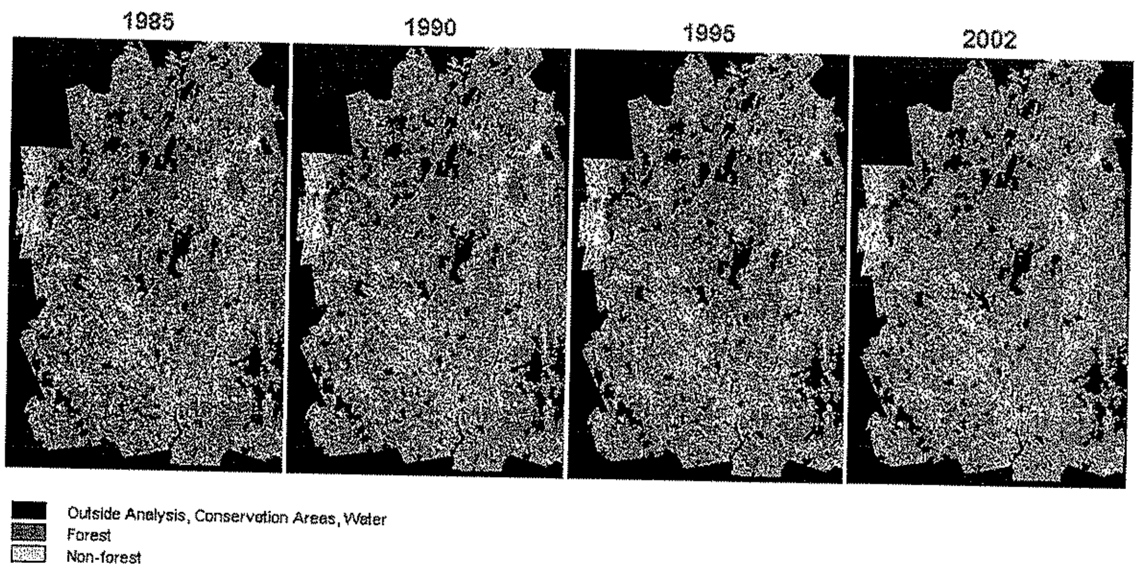


Figure 10. Thames Watershed 1985 – 2002 land cover reclassed to represent cells that are candidates for change and those that are not. Black areas indicate lands excluded from analysis—conservation lands and water.

Finally, all maps were reduced to two main categories. Those classified with the value '1' represent all forested land. A value of '2' indicates land that is in other uses such as agriculture, residential, industrial, commercial properties, etc. In the Thames the 'Forest' class includes deciduous and coniferous forests and forested wetlands, while 'Non-forest' represents the developed, turf and grass, agriculture, barren and utility classifications (Figure 10).

In the Catskill-Delaware Region (figure 11) 'Forest' includes deciduous, evergreen and mixed forest, and woody wetlands while 'Non-forest' includes low and high intensity residential, commercial, industrial, transportation, hay, pasture, row crops, urban, recreational grasses, quarries, strip mines, and gravel pits. There is much debate about whether lands classified as "agricultural" in 1992 are in fact clear cuts reforesting or pasture lands reverting to forest, and whether the NLCD map overstates or understates the amount of land actually 'deforested' as of 1992. The New York City Department of Environmental Protection map for the same time period shows (within the NYC water supply watershed only – Figure 12) a much larger area in agriculture in 1992, particularly in the Cannonsville Watershed in Delaware County. Our accuracy assessment of this area of discrepancy on the 1992 map , using a non-stratified random sample, yielded 90% accuracy (using 1994 aerial photos as the reference criteria).

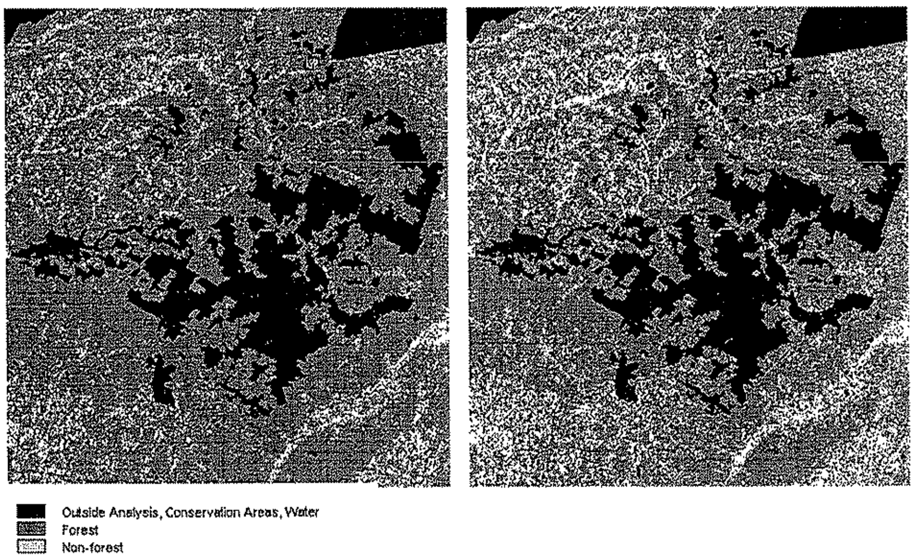


Figure 11. Catskill-Delaware reclassified 1992 and 2001 land cover. Black areas represent areas of water, wetlands, reforestation and NYC DEP and NY State lands masked out, i.e. not candidates for change from forest to non-forest.

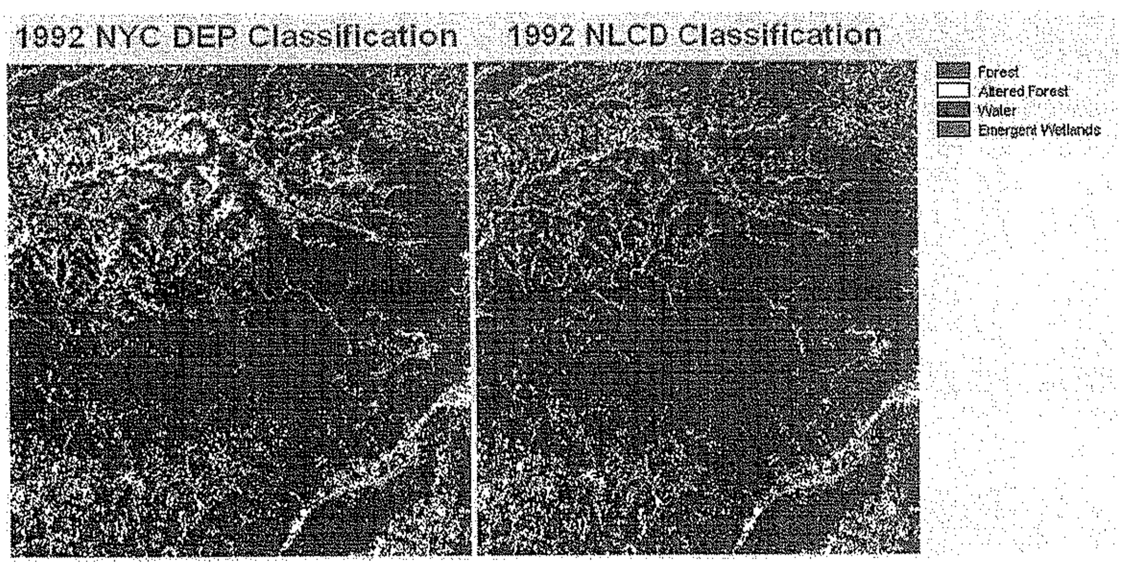


Figure 12. For comparison, the NYC DEP classification of Forest/Non-Forest in the watersheds is shown next to the NLCD '92 land cover map.

Independent Variables—Factors Affecting Location of New Developed Areas

An initial list of many possible drivers of land use change in the northeastern United States was derived from a combination of literature search, team experience/knowledge, and community input. The resulting list was then used to determine availability and usability of various data sets for incorporation into the modeling process (table 1).

		Included in Analysis	
		NY	CT/MA
Available for all three states in geospatial format at scale useful for analysis			
	Demographics: Population	x	x
	Distance from metropolitan growth nodes	x	x
	Housing density and type	x	x
	Hydrography	x	x
	Protected open space	x	x
	Railroads, utility lines		x
	Roads	x	x
	Second homes and non-resident owners	x	x
	Topography (elevation, slope, aspect)	x	x
Available, not in geospatial format; easily converted			
	Building permits		x
	Employment in the service economy		x
	Housing prices; housing sales		x
	Labor force by sector		x
	Unemployment rate		x
Available, not in geospatial format; not easily converted			
	Development nodes (casinos, ski resorts)	x	x
	Zoning regulations		
Available but at too course a scale for useful analysis			
	Economic cycles		
	Federal spending programs: Education, Transportation, Sewer & Water; Infrastructure		
	State spending programs: Education, Transportation, Sewer & Water; Infrastructure		
	Tax policies		
	Timber prices		
Not readily available for all three states, or not in useable format			
	Education demographics		
	Local economy - relative importance of farming, forestry, ranching, mining		
	Malls, big box stores		
	Property taxes - rates and structure		
	Ratio of land sale prices to timber stumpage prices		
	Real estate conveyance taxes		
	Rural Industry		
	Soils		x
	Timber markets		
	Transportation		
Did not investigate due to project resource constraints			
	Commuting distance from employment base		
	County business patterns		
	Emergence of "edge cities"		
	Employment in surrounding areas		
	Farm income		
	High amenity value natural features		
	Income		
	Land pricing		
	Land tenure patterns		
	Level at which land use planning takes place (municipal, county, region, state)		
	Level of regional cooperation and coordination		
	New jobs created by sector		
	Office and industrial parks		
	Population in surrounding areas		
	Schools data by school district		
	State of the planning process: how long in existence; age of plan; volunteer or paid staff		
	Tax rates in surrounding areas		
	Vitality of older cities and suburbs		

Table 1: Potential Factors Influencing where Forest Fragmentation and Loss from Sprawl Occurs

The project encompassed three states, and many data were not available in all three. Socio-economic data have to cover the same time period as the land cover data to provide meaningful analysis of drivers. So that the broadest possible set of factors could be tested in at least one of the sites, data that were available only in Connecticut and Massachusetts were used in the Thames analysis, even though they were not available for the Catskill/Delaware analysis. Although this approach gives us more robust information about the availability and utility of socio-economic data and its relationship to forest fragmentation and parcelization dynamics, the disadvantage is that it limits our ability to draw conclusions about commonalities across the two sites.

Thus, with the exception of the US Census data that we purchased for 1990 and 2000, these data sets are not equivalent across both regions. In the Thames study we had state labor department employment information by town, including the number of employees in each labor sector, such as construction, which we thought might be an indicator of growth. For the Thames we also had information on housing, such as the number of home starts, building permits and sales, and median sales price. And finally we had a soil map for the Thames that we did not have for the New York study.

On the other hand, in the New York region we had tax parcel data for 2000 made available by the New York City Department of Environmental Protection. This allowed us to analyze who owns how much forestland in the region and whether or not these owners are local residents. Finally, in New York, the elevation data were higher resolution, although of the same scale (1:24,000) as the Connecticut/Massachusetts data. In both instances the hydrography (water features) data were not of the same scale as the hypsometric (elevation) data.

Data Collection

Collecting, organizing, formatting and managing geospatial data is time consuming; thus we limited our efforts to those data that were either readily available in geospatial format, or easily converted. The exception was the location of "growth nodes", such as ski resorts and casinos. There is no geospatial data base of major developments (which would also include malls, and commercial and industrial parks), however, as input was strong at both community workshops that these growth nodes were important drivers of secondary development, we used a manual process to locate and geo-reference ski resorts and casinos in the study areas.

Data and sources included in the analysis are shown in appendix C. All three states have web sites where certain GIS (Geographic Information System) data layers (georeferenced, spatially explicit maps containing features such as rivers, roads, etc.) of mostly bio-physical data and political boundaries can be downloaded. The United States Census Bureau is the original source of all population and housing data. The raw census data, available at the US Census Bureau web page, are very difficult to use, especially because the geo-referencing is not automatic, but must be interpreted and managed by a technically proficient user. To avoid this resource-intensive work on data preparation, we chose to purchase data in an easy-to-use GIS format from Geolytics, a commercial company, which produces CDs of census data to the census block level in ArcView shape files and tables.

If data were not accessible on the state GIS web site, then a more intensive search was conducted by contacting various government offices. The socio-economic data obtained this way were then converted from either spreadsheets or hard copies to GIS files.

Combining data from two states, Connecticut and Massachusetts, was a major undertaking. Even the state boundaries in each state's GIS system do not exactly line up. Other GIS data, such as roads, based on census TIGER files, and hydrological features matched up very well. Socio-economic data (other than census) layers were created from individual files and documents and geo-referenced to town boundaries, which was a relatively easy task once the town boundary maps were corrected for the state line problem.

The soils data were the most problematic. Although both Connecticut and Massachusetts have GIS files of county soil maps, they use different nomenclature for what are obviously the same soil types (most apparent at the state border). To derive one soils map for the entire Thames study area, the soil series in each state were classified into general categories (e.g. "Agawam fine sandy loam" was reclassified to "fine sandy loam"), and obvious discrepancies at the state border were corrected.

Forest Products Industry Data

Loss of forestland inevitably leads to loss of the local forest products industry, hence feeding a vicious economic cycle where landowners have no ability to sell forest products to support the cost of owning the land. Consequently, we wanted to include in the analysis some indicator of the size of the forest products industry over time in each of the study sites. An extensive effort was made to find some applicable data for the Thames study area, to no avail.

Town- and county-level data on the value of the Connecticut and Massachusetts wood and forest products industries were not readily available. Federal and state government offices and databases did not have the desired information. For instance, the County Business Patterns database had economic data at the county resolution, but it was limited to employment and payroll information, with no data available on the actual value of the industries. Conversely, the Bureau of Economic Analysis had data on the value of wood and forest product industries, but only at the state level, and they were unable to provide the county- and metro-level data from which their state reports were presumably assembled. Queries with the New England Agricultural Statistics Service and the Massachusetts and Connecticut Departments of Economic and Community Development yielded no information.

Industry and trade groups such as the American Forest and Paper Association, the Massachusetts Forestry Association, the New England Forestry Foundation, the Massachusetts Maple Producers Association, and academic institutions such as the University of Connecticut had state-level data, but nothing at finer resolutions.

The best source of data was the 1997 Economic Census, which had data at the county- and metro-level for the shipment values of manufactured goods, in addition to the sales values for wholesale and retail trade. Industries covered included lumber, paper, and wood products. Unfortunately, industry data were often listed as, "withheld to avoid disclosure," and therefore unavailable. Additionally, the Economic Census is only held every five years, and 1997 is the first year in which specific wood products information is available; prior to 1997, the lumber, paper, and wood products data are grouped nonspecifically under "wholesale," and "manufacturing," with no way to separate them into industry-specific information. The 2002 Economic Census is currently underway, but until those data are compiled, 1997 is the only year for which the desired data are available.

After a similar search of government and industry sources for the Catskill/Delaware region, it was determined that the forest industry data available for the region were generally not of a spatial or temporal resolution that would allow comparisons between the recent history of the timber industry in this region and land use/land cover changes.

Results—Catskill-Delaware Region

Empirical Rate of Forestland Loss, Apparent Causes

With the exception of nearby Albany County and Ulster County with prime Hudson Valley real estate, population growth in the counties included in our study area has been fairly flat going back as far as 1890 (figure 13). What these data do not reveal, however, is the flux in weekend and seasonal inhabitants, which promotes development of the facilities and services they require. The average parcel size in the region has gone from 21 acres in 1985 to 17 acres in 2000,[15] clearly indicating increased parcelization of forestland since 1985. An analysis of a portion of our study region, encompassing 40 towns, shows there are 68,400 parcels of private land covering 927,000 acres. As evidence of the ownership dynamics in this area, 36,400 of these parcels covering 445,000 acres are owned locally, while 32,000 parcels covering 482,000 acres belong to people whose home address is outside the region. Thus resident population, as measured by the 10-year census, cannot be used in this region to predict a future rate of forest fragmentation.

Towns Included in Tax Parcel Ownership Analysis

Andes	Deposit	Hunter	Masonville	Shandaken
Ashland	Fallsburg	Hurley	Meredith	Sidney
Bovina	Franklin	Jefferson	Middletown	Stamford
Broome	Gilboa	Jewett	Neversink	Tompkins
Colchester	Halcott	Kortright	Olive	Walton
Conesville	Hamden	Lexington	Prattsville	Wawarsing
Delhi	Hardenburg	Liberty	Rochester	Windham
Denning	Harpersfield	Marbletown	Roxbury	Woodstock

Within the entire study area of 1.8 million acres, 376,000 acres are owned by the city and the state to protect NYC drinking water. Assuming that this land will be protected in perpetuity, we excluded it from our analysis, hence our results are focused on changes in the 1.4 million acres of private forestland in the region. Our findings indicate that private forests are disappearing at a rate of 16,187 acres (1.3 %) each year, for a total of 145,685 acres in the nine years between 1992 and 2001, in a pattern that is clearly evident of increased fragmentation of the forest resource. If that same trend continues, the region will lose another 162,000 acres of private forests by 2011. To arrive at this number, we derived the rate of forest conversion from the classified satellite imagery (1992 – 2001) and extrapolated that same rate into the future. This rate of forest loss may or may not remain the same in future years, and will likely have some relationship with economic activity, however, we were not able to find an economic database for the last 10 years at a scale that would allow us to look for correlations between economic activity and land use change.

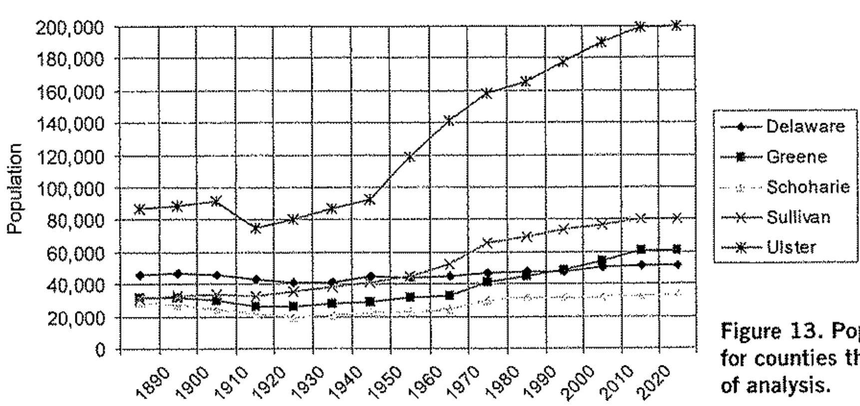


Figure 13. Population statistics for counties that are in the area of analysis.

	Forest 1992	Non-forest 1992	Forest 2001	Non-forest 2001	% Forested in 1992	% Forested in 2001	Acres of 1992 Forest Lost	Acres 1992 Non-forest Reforesting	Net Acres 'Forest' Lost
Delaware	366425	64820	322781	108464	83%	75%	49844	6200	43645
Greene	174780	18871	161274	32376	88%	84%	17048	3543	13506
Schoharie	83071	11188	76825	17434	86%	82%	8000	1754	6247
Sullivan	262040	38350	236681	63709	86%	79%	30846	5487	25359
Ulster	360527	48002	326569	81960	87%	80%	39946	5988	33958
Total	1246843	181230	1124129	303944	86%	79%	145685	17484	122714

Table 2: Catskill/Delaware Forest History (acres). All numbers include only privately-owned lands.

Some counties, namely Delaware, Ulster and Sullivan, are losing forest faster than Greene and Schoharie (table 2). In 1992 privately-owned lands were 86% forested. By 2001, they were 79% forested.

At the same time that private forests were being converted to other uses, some land was apparently "reforesting," i.e. land that was not classified as forest in 1992 was by 2001 showing up as forest on the satellite imagery. Some of this land may be working forest, i.e., regrowth after silvicultural treatment; some may be former agricultural land acquired by the NYC DEP. This merits further investigation. Considering the "reforesting" areas, the net change was 93,144 fewer acres in private land classified as "forest." In spite of the regrowth, the overall loss of 12% of the private forestland over the nine-year period far exceeds the amount that is "reforesting," which is 1.5% of the private forestland in 2001.

Including the publicly-owned forest, the entire region analyzed went from 87% to 81% forested over this nine-year period (table 3), and we project this to drop to 76% by 2011. This projection includes 'reforestation.' If 'reforesting' land is not developed in the meantime, it will take more than the time period of our projections to grow back into a full closed-canopy forest. Therefore these projections are likely to be on the high side, with actual forest cover somewhat lower.

	% Forest Including Public Land	
	1992	2001
Delaware	83%	76%
Greene	90%	87%
Schoharie	85%	81%
Sullivan	85%	78%
Ulster	90%	85%
Total	87%	81%

Table 3: Percent forested, including all lands, by county 1992 and 2001

Pattern of Forestland Fragmentation, the Empirically-Important Factors and Their Ability to Predict the Future Location of Development

In the Catskill-Delaware study we tested the ability of 18 factors to accurately predict where development (defined as change from forest to non-forest) occurred between 1992 and 2001. The results of our analysis show that development in the Catskill-Delaware region is driven primarily by the increasing number of non-local land owners desiring a piece of rural forested America, and the establishment of the facilities and services to support that weekend/vacation time population. In the five counties that surround the heart of this region the most important biophysical factors influencing what land is selected for development are elevation and slope, which is not surprising in a mountainous region. The socio-economic factors are distance to "urban" areas, population density, and the economic "infrastructure" of local and secondary roads (table 4).

Individual Drivers - Unconstrained				Individual Drivers - Constrained Neighborhood			
Driver	Rank	Kappa	%Correct	Driver	Rank	Kappa	%Correct
Population Density	1	0.5370	84.31	Distance from Urban Areas	1	0.7285	90.80
Distance from Urban	2	0.5176	83.65	Elevation	2	0.7271	90.75
Elevation	3	0.5255	83.92	Slope	3	0.7263	90.72
Population over age 65	4	0.5239	83.86	Distance from Local Roads	4	0.7260	90.71
Distance from State Owned Lands	5	0.5176	83.65	Distance from Secondary Roads	5	0.7255	90.69
Distance from Local Roads	6	0.5035	83.17	Population Density	6	0.7253	90.69
Distance from Agricultural Lands	7	0.5021	83.12	Distance from State Owned Lands	7	0.7250	90.68
Distance from Ski Resorts	8	0.4970	82.95	Distance from Primary Roads	8	0.7248	90.67
Slope	9	0.4983	83.00	Distance from Hydrological Features	9	0.7241	90.65
Distance from Secondary Roads	10	0.4979	82.98	Aspect	10	0.7241	90.65
Owner Occupied Housing	11	0.4939	82.85	Distance from Water	11	0.7241	90.65
Distance from Primary Roads	12	0.4901	82.72	Basins	12	0.7236	90.63
Distance from Water	13	0.4885	82.66	Distance from Route 28	13	0.7235	90.63
Distance from Route 28	14	0.4854	82.56	Population over age 65	14	0.7235	90.63
Distance from NYC	15	0.4848	82.54	Distance from NYC	15	0.7232	90.61
Aspect	16	0.4813	82.42	Distance from Ski Resorts	16	.07229	90.61
Distance from Hydrological Features	17	0.4812	82.42	Owner Occupied Housing	17	0.7227	90.60
Basins	18	0.4787	82.33	Distance from Agricultural Lands	18	0.7224	90.59
Top 5 Drivers		0.5633	85.27	Top 5 Drivers		0.7319	90.91

Table 4: Comparison of ability of individual drivers to re-create the 2001 landscape under an unconstrained simulatio (left) and one restriced only to those cells falling within 30 meters of previously developed cells (right).

To test the importance of each factor, and various combinations of factors, we compared the simulated 2001 reulsts using the "vulnerability" map for that factor, to the actual 2001 land use map. In the calibration year, some of these factors exhibit robust patterns indicating human preference for development, whereas others do not. The goodness of fit between the simulated map and the actual map is measured by the kappa statistic. The kappa statistic measures how much better than chance alone the model is in predicting areas that will be converted from forest to non-forest (with "0" being no better than chance alone and "1" being a perfect predictor). Thus, a high kappa statistic indicates a factor's ability to identify correctly those forested areas that will be converted to non-forest in the future based on their attractiveness for development.

Another possible measure of the predictive power of the model is the % of cells that are modeled correctly in the calibration/validation process. A high percent correct, however, can be misleading due to the persistence of both the forest class and the non-forest class, particularly in the case of the latter where we did not model the dynamic of change from non-forest to forest. Since percent correct is influenced by how many cells did not change between the two time periods (those cells that do not change will automatically be correct), we prefer the kappa as a better statistical measure of model success since it captures the statistical property of random cell selection. However, percent correct can be useful for comparison between drivers, especially since it is more intuitive than the "kappa-for-location" statistic. In this case, with our best driver set we achieved overall a 90.9% agreement between the simulated and the real map.

Zooming in to get a better view in figure 14, we illustrate the goodness of fit between the simulated 2001 and the actual 2001 map. Working with 30 x 30 meter square cells, the four classes represent 1) cells left in forest by the model that were in fact still forested in 2001 (correct), 2) cells simulated as converted from forest that were in actuality still forested in 2001 (incorrect), 3) cells left in forest by the model that were actually non-forest in 2001 (incorrect), and 4) cells simulated as non-forest that either remained as non-forest or were in fact converted to non-forest use (correct). This is perhaps the most intuitive way to visualize how well the model can predict the actual pattern of development over the nine year period.

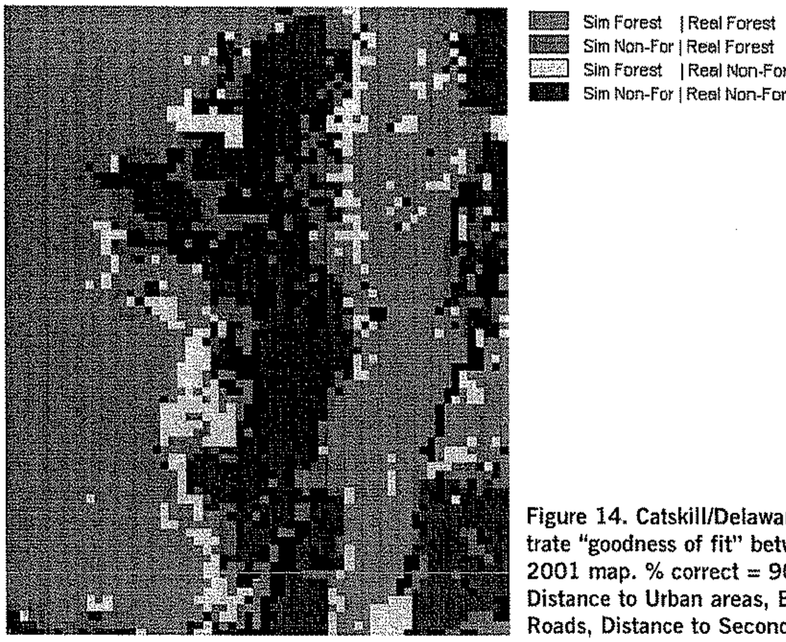


Figure 14. Catskill/Delaware validation map zoomed in to illustrate "goodness of fit" between simulated 2001 map and real 2001 map. % correct = 90.91; Kappa = 0.7319; Drivers = Distance to Urban areas, Elevation, Slope, Distance to Local Roads, Distance to Secondary Roads.

As stated above, the factors yielding the best fit between the simulated 2001 map and the real 2001 map were distance to "urban" areas, elevation, slope, and distance to local and secondary roads (table 4) with a kappa statistic of (0.7319). It is interesting to note that while population density returned the same kappa as distance to secondary roads, including it with the top five drivers adding it reduced the kappa, and hence the predictive power of the first five combined. Each additional driver tested in the model reduced the 'goodness of fit' even more.

The model can be allowed to select all of the highest weighted cells across the region, or be constrained to a neighborhood. Under the unconstrained simulation the kappa was considerably less than that achieved when the model was constrained to select within a distance of 30 meters of already developed land. This suggests a strong clustering of development as opposed to dispersal of settlement (table 4).

Furthermore, these top six factors are not the most significant in all counties (table 5), highlighting the differences in the underlying topography, and we assume, the different socio-economic forces at play, as well as the land that is available for sale. For instance, areas of high development preference are distance from water in Delaware and Greene Counties, but distance from publicly-owned lands is more important in Schoharie and Sullivan Counties. Also, in the three counties with the greatest topographic variation—Schoharie, Sullivan and Greene, aspect is one of the top five factors. This illustrates a preference for both flat land, which lessens development costs, and aspect, an indicator of sunlight in a region of dark valleys. Elevation is one of the most predictive factors in 3 of the 5 counties.

Nonetheless, the kappa statistics are quite close for all factors, indicating the interdependence of topography, roads, population, and urban development. Using these factors in combination in the GEOMOD process has given us great predictive power to project the pattern of future land development. We believe such information can be very useful to communities, planners and developers.

	TOTAL	DELAWARE	GREENE	SCHOHARIE	SULLIVAN	ULSTER
Distance from Urban Areas	[redacted]	[illegible]	[redacted]	91.64	90.55	[redacted]
Elevation	[illegible]	90.68	90.79	[redacted]	90.50	[illegible]
Slope	90.72	[redacted]	90.77	91.53	90.48	90.72
Distance from Local Roads	90.71	90.64	90.78	91.53	90.49	90.73
Distance from Secondary Roads	90.69	90.58	[illegible]	[illegible]	90.48	90.68
Population Density	90.69	90.61	90.80	91.48	90.42	90.73
Distance from State Owned Lands	90.68	90.49	90.72	91.64	[illegible]	90.71
Distance from Primary Roads	90.67	90.50	90.72	91.38	90.56	90.75
Distance from Hydrological Features	90.65	90.62	90.77	91.56	90.37	90.62
Aspect	90.65	90.43	90.80	91.59	90.50	90.69
Distance from Water	90.65	90.50	90.88	91.48	90.43	90.68
Basins	90.63	90.55	90.75	91.37	90.39	90.67
Distance from Route 28	90.63	90.43	90.70	91.54	[redacted]	90.62
Population over age 65	90.65	90.53	90.76	91.45	90.45	90.69
Distance from NYC	90.61	90.61	90.64	91.43	90.35	90.62
Distance from Ski Resorts	90.61	90.49	90.65	91.45	90.46	90.62
Owner Occupied Housing	90.60	90.43	90.70	91.46	90.43	90.66
Distance from Agricultural Lands	90.59	90.40	90.70	91.46	90.40	90.68
[redacted]						
2ND						
3RD						
4TH						
5TH						

Table 5: Although the first five drivers on the left provided the highest predictive power for the region as a whole, this table illustrates how different factors are important in different counties. For ease of interpretation the simple % correct is used here.

Future Projections

Simulation of the future landscape was performed at the county level using the best set of drivers for each county (table 5). The simulated maps for each time period were combined to give a view of GEOMOD's projections region-wide. For each county, we assumed the same rate and pattern of change that we have seen for the 1992 – 2001 period. Sites for future development were selected from the areas of highest weighting in the forest-fragmentation potentiality map (figure 15). Weights were based on those spatially distributed factors that together yielded the best "goodness of fit" between the simulated and the real 2001 map. This map, when summarized in four or five categories from high to low potential for development, allows communities to identify quickly those areas most at risk. The areas of highest vulnerability exhibit a linear pattern that appears to follow roads, which follow streams up the narrow valleys, as has been the case in the past. The rate of forest loss used for projecting the future is a linear extrapolation of the empirical rate of change in each county as derived from satellite imagery analysis, as explained earlier. The time period selected for the projections was based on how far back we were able to analyze the rate of change, so that in the Catskills where we had land use data for only 1992 and 2001, we project forward only 10 years.

Figure 15a. Forest Fragmentation 'Potentiality' or 'Risk' Map for the Catskill-Delaware Counties. In this map each county is analyzed separately, with areas of high to low risk calculated within each county.

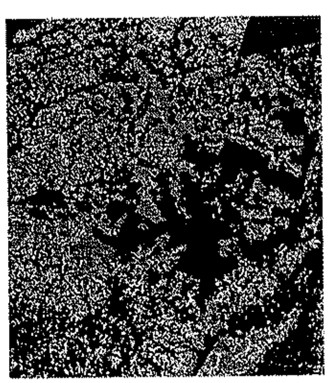


Figure 15b. Forest Fragmentation 'Potentiality' or 'Risk' Map for the Catskill-Delaware Region. In this map the region is analyzed as a whole, with areas of high to low risk calculated within the entire region.

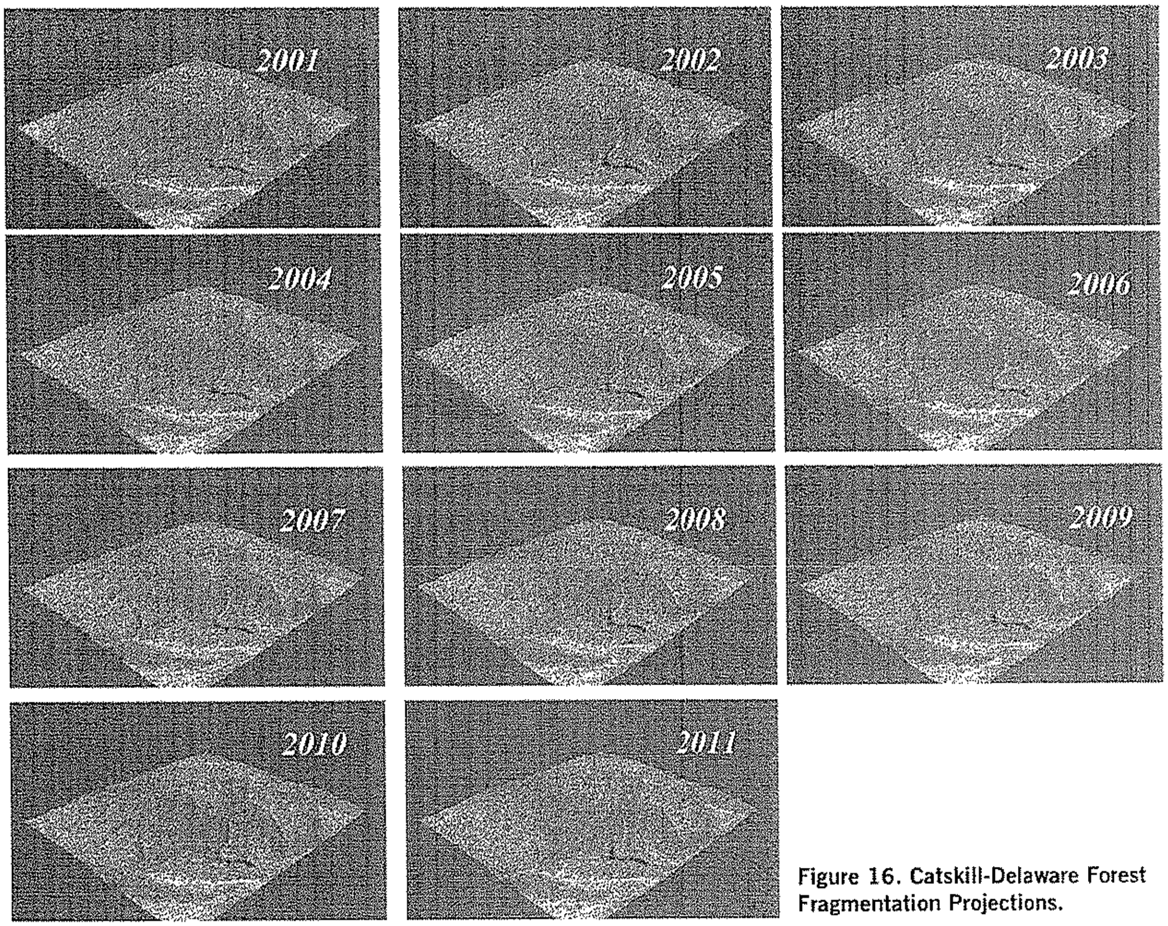


Figure 16. Catskill-Delaware Forest Fragmentation Projections.

Using GEOMOD, we simulated the rate and pattern of forest fragmentation out into the future from 2001 to 2011 (figure 16). The results show Delaware and Ulster County respectively losing 55,000 and 44,000 more acres of their 2001 forest cover (figure 17). This is a reduction of 17% and 14% of each county's remaining privately-owned forest (table 6). For the entire region of analysis, using the 1992-2001 rates, we estimate that another 162,000 acres of privately owned forestland will be lost to development, leaving the area 76% forested (including public and reforesting lands) by 2011, down from 81% in 2001 (table 7). Not only does this imply loss of the working forested landscape but these results could have significant impact on New York City water quality as well. Of all the NYC water supply watersheds in the analysis, we project the greatest loss of forest cover in the Cannonsville Watershed—approximately 30,000 acres, amounting to 18% of its private forests by year 2011, followed by the Pepacton, which will lose 11% (figure 18).

Acres Fores (Private Lands)t	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Delaware	316581	311043	305504	299966	294428	288889	283351	277813	272275	266736	261198
Greene	157731	155837	153943	152048	150154	148260	146365	144471	142577	140683	138788
Schoharie	75071	74182	73293	72404	71515	70626	69737	68849	67960	67071	66182
Sullivan	231194	227767	224339	220912	217485	214057	210630	207203	203775	200348	196920
Ulster	320581	316143	311704	307266	302828	298389	293951	289512	285074	280636	276197
Total Acres	1101158	1084971	1068784	1052596	1036409	1020222	1004035	987848	971660	955473	939286
Net (adjusted for reforestation)	1078187	1059448	1040708	1021968	1003229	984489	965750	947010	928270	909531	890791
% Private Lands Forested											
Delaware	73%	72%	71%	70%	68%	67%	66%	64%	63%	62%	61%
Greene	81%	80%	79%	79%	78%	77%	76%	75%	74%	73%	72%
Schoharie	80%	79%	78%	77%	76%	75%	74%	73%	72%	71%	70%
Sullivan	77%	76%	75%	74%	72%	71%	70%	69%	68%	67%	66%
Ulster	78%	77%	76%	75%	74%	73%	72%	71%	70%	69%	68%
Total Acres	77%	76%	75%	74%	73%	71%	70%	69%	68%	67%	66%

Table 6: Catskill/Delaware Forest Fragmentation Projections 2001-2011 by county. All numbers include only privately owned lands.

% County Area in Forest	Total Acres in County	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Delaware	492860	83%	82%	81%	80%	80%	79%	78%	77%	77%	76%	75%	75%	74%	73%	72%	72%	71%	70%	69%	69%
Greene	288915	90%	90%	90%	89%	89%	89%	88%	88%	88%	87%	87%	87%	86%	86%	85%	85%	85%	84%	84%	84%
Schoharie	106681	85%	84%	84%	84%	83%	83%	82%	82%	82%	81%	81%	80%	80%	80%	79%	79%	78%	78%	78%	77%
Sullivan	326570	85%	84%	83%	82%	82%	81%	80%	80%	79%	78%	78%	77%	76%	76%	75%	74%	74%	73%	72%	72%
Ulster	590023	90%	89%	89%	88%	87%	87%	86%	86%	85%	85%	84%	84%	83%	83%	82%	82%	81%	81%	80%	79%
Total	1805050	87%	86%	85%	85%	84%	84%	83%	83%	82%	81%	81%	80%	80%	79%	79%	78%	77%	77%	76%	76%

Table 7: total Forest Area Historic and Predicted by County (includes public and private land, and reforesting land).

Conclusions

- The forests in the Catskill/Delaware region of New York and the Thames Watershed region of Connecticut and Massachusetts are increasingly being fragmented, and this trend will likely continue.

- Local people know that their forests are becoming more fragmented and the rural character of their towns is changing, and they are asking for tools to help educate communities about the problems with dispersed growth and development in largely rural, forested areas.

- GEOMOD is a very useful tool for projecting future change in these areas and for helping communities visualize the impacts of seemingly innocuous, dispersed development in a rural, forested areas.

- We are now able to identify where the highest risk seems to be of future forest fragmentation and loss within each area and within each county or town—a real benefit to conservation efforts.

- Already developed areas are nodes for expanded development. Towns with the least forest cover are losing the forest they have faster than towns that are mostly forested. Driving factors and indicators of development in the northeast are highly interdependent, thus no single one stands out as more highly predictive than others.

- Socio-economic data, although useful in understanding the demographic trends in an area, did not provide better predictive power than just bio-physical (topography) and socio-political (development and roads) factors alone. This is good news for broad application of GEOMOD in the northeast, because of all the factors we analyzed, the socio-economic data were the most time consuming to collect and format for the model.

- Based on the high kappa-for-location numbers that we achieved it appears that the predictive power of GEOMOD is much higher in the northeastern USA than in several of its applications in the tropics at the same scale, where it has been previously tested.[17] This is probably due to the advanced state of GIS data availability in the US, but perhaps more importantly due to the higher resolution (level of information) of the publicly-available map inputs we employed, rather than the types of mapped data we tested. In the end biophysical factors and infrastructure remained the most powerful indicators of future settlement pattern, much as we and others, have found in the tropics.[18] Many of the other socio/demographic/economic factors we tested are probably co-dependent with these underlying factors. Even roads and towns are usually sited according to topographical factors, and historically navigable waterways. It follows that the population factors produced nearly equivalent kappas due to the fact that where you have development you have people, and where there is no "developed" landscape people are absent. This means that the model, having analyzed the percentage of cells in the map where, for example, the population density is high, will then look for those cells to 'deforest', but in fact they are probably already in the non-forest class. Looking for flat land or western exposure is much easier, and there should be more variation in the selection and hence 'goodness of fit' between factors. We would like to apply the model to one more northeastern location in order to make final recommendations about the best data sets for communities of the NE to use to project the 'business as usual' landscape.

Recommendations

Ultimately, this research will be most widely applicable if the analytical tools and methods developed and tested in the study sites can be used by municipal, regional, county and conservation planners throughout the northeast. Our first job as researchers is to prove the power of the tools. Having done that, our goal now is to put that power in the hands of the folks who are making the day-to-day decisions about land use planning. Once these local interest groups can themselves analyze the land use change dynamics in their communities, they can project how these changes may affect the future of their landscape, and incorporate that knowledge into their policy and planning efforts.

Feedback from the community workshops indicates that this information would be extremely useful in the town, county and regional planning processes. We suggest, based on these discussions, that we create a CD in which the results of our research would be organized and presented in a way that would be easy for each town or county to "click" and see the local dynamics in their town and the surrounding area. This CD would be developed in collaboration with three or four "pilot" towns to fully develop the information about forestland change and trends in socio-economic factors resulting from the analysis in a way that would be compelling and useful for the people and organizations whose every-day decisions affect land use change at the local scale.

To assure the predictive capability and overall usefulness of the model throughout the northeast, we recommend a third study site to increase our ability to test for commonalities of pattern and drivers of forestland change in the northeast, hence our ability to indicate the broader implications about trends in land use change based on the trends detected in this study, and to guide communities in application of this model to their particular area. We found that in both the Catskill/Delaware and the Thames sites, the best predictors of the pattern of forest fragmentation were bio-physical and socio-political factors such as distance from previous development and roads. If this holds true in a third site, then it would be relatively simpler and less expensive to apply the model broadly in the northeast. Then, in order to expand the potential for using GEOMOD as a land use planning tool, we recommend the following:

- Create a web-based workbook for using GEOMOD in the northeast including: types of data sets that have usefulness in predicting land use change and are widely available in standard formats; how to organize and format the data; how to run the model and interpret the results; and use of visualization tools for presentation of the model results.

- Adapt GEOMOD to run in ArcGIS. Currently GEOMOD is available in the IDRISI tool suite, however, ArcGIS is by far the most commonly used GIS tool.

- Create a web site for modeling and understanding land use change in the northeast featuring results of this research with emphasis on visualization tools and maps; annotated bibliographies of forest fragmentation literature; and resources for forest-focused land use planning tools for the northeast.

[1] Forest ownership numbers are extrapolated from the draft 2002 National Woodland Owner Survey (Butler and Leatherberry *forthcoming*).

[2] USDA Natural Resources Conservation Service 1997

[3] Commonwealth Research Group 1995; Resource Systems Group 1999

[4] Hall *et al* 1995a and 1995b

[5] Hall *et al.* 2000

[6] Pontius 2000

[7] Hall *et al* 1995a and 1995b; Pontius *et al.* 2001; Hall and Dushku 2002

[8] Pontius and Schneider 2001, Schneider and Pontius 2001

[9] We wish to acknowledge the following agencies for much of the information found here: The Catskill.com website (www.catskillpark.com/catskills.html); The New York State Department of Environmental Conservation (www.dec.state.ny.us/website/dlf/publands/cats/); and The Catskill Center for Conservation and Development (www.catskillcenter.org)

[10] We wish to acknowledge the Connecticut Chapter of the Nature Conservancy (http://nature.org/wherewework/northamerica/states/connecticut/) and the Quinebaug-Shetucket Heritage Corridor, Inc. (http://www.thelastgreenvalley.org/) for much of the information found here.

[11] A description of the methods used for classification and post-classification assessment are found in Appendix B.

[12] For details on the accuracy assessment, refer to Appendix B.

[13] More information about the Connecticut Statewide Temporal Land Cover and Land Cover Change Project is available at www.clear.uconn.edu

[14] Accuracy assessment for the Thames area is being done as part of the Connecticut state-wide land cover analysis project, and was not yet completed at the time of publication of this report.

[15] LaPierre and Germain 2003

[16] See Appendix D for details on forest cover and forest loss by town.

[17] Hall and Dushku 2002; Dushku, Brown and Hall 2002.

[18] For a review see Chomitz and Gray 1996; Lambin 1997; and Kaimowitz and Angelsen 1998.

References Cited

Butler, B.J. and E.C. Leatherberry. Forthcoming. *USDA Forest Service 2002 National Woodland Owner Survey* (DRAFT). www.fs.fed.us/woodlandowners

Chomitz, K. and D. Gray. 1996. Roads, Land Use, and Deforestation: A Spatial Model Applied to Belize. *The World Bank Economic Review, Volume 16,* Number 3: 487-512.

Commonwealth Research Group. 1995. *Cost of Community Services in Southern New England.* Commissioned by Southern New England Forest Consortium, Inc.

Dushku, A., S. Brown and M. H. P. Hall. 2002. *Modeling the deforestation and carbon emissions baseline in the Rio Bravo Conservation and Management Area Climate Action Project 1993- 2035.* web report. http://www.winrock.org/what/PDF/eco/Product%205%20GEOMOD%20to%20Rio%20Bravo%20CAP.pdf

Eastman, J.R. 1999. *Idrisi32 Guide to GIS and Image Processing Volume 2.* ClarkLabs, Worcester, MA.

Hall, C. A. S., C. J. Cleveland and R. Kaufmann, 1986. *Energy and Resource Quality: The Ecology of the Economic Process.* John Wiley and Sons, New York.

Hall, C. A. S., H. Tian, Y. Qi, G. Pontius, J. Cornell and J. Uhlig. 1995a. *Spatially Explicit Models of Land Use Change and Their Application to the Tropics.* DOE Research Summary, No. 31. (Ed. By CDIAC, Oak Ridge National Lab).

Hall, C. A. S., H. Tian, Y. Qi, G. Pontius, J. Cornell and J. Uhlig. 1995b. Modeling spatial and temporal patterns of tropical land use change. *Journal of Biogeography,* 22, 753-757.

Hall, M. H. P. and A. Dushku. 2002. *Spatial Modeling of the Averted Deforestation Baseline for the Noel Kempff Mercado Climate Action Project, Bolivia.* web report. http://www.winrock.org/general/Publications/EcoCoop.pdf

Hall, M. H. P., C. A. S. Hall, and M. R. Taylor. 2000. Geographical Modeling: The Synthesis of GIS and Simulation Modeling, Chapter. 7, in C. A. S. Hall, (Ed.) *Quantifying Sustainable Development: the Future of Tropical Economies.* Academic Press, San Diego, CA.

Kaimowitz, David and Arild Angelsen. 1998. *Economic Models of Tropical Deforestation: A Review.* Bogor, Indonesia: Center for International Forestry Research.

Lambin, Eric F. 1997. Modeling and monitoring land-cover change processes in tropical regions. *Progress in Physical Geography* 21, 3 pp. 375-393

LaPierre, S. & R.H. Germain. 2003. Parcelization of nonindustrial private forestlands in the New York City Watershed. *AWRA s International Congress on Watershed Management for Public Water Supplies.* New York City, NY July 1-2.

Pontius, R. G. Jr and P Pacheco. 2004. Calibration and validation of a model of forest disturbance in the Western Ghats, India 1920 - 1990. *GeoJournal.* in press.

Pontius, R.G. Jr., J. Cornell, C. Hall. 2001. Modeling the spatial pattern of land-use change with GEOMOD: application and validation for Costa Rica. *Agriculture, Ecosystems & Environment* 85(1-3) p. 191-203

Pontius, R. G. Jr. and L Schneider. 2001. Land-use change model validation by a ROC method for the Ipswich watershed, Massachusetts, USA. *Agriculture, Ecosystems & Environment* 85(1-3) p. 239-248.

Pontius, R. G. Jr. 2000. Quantification error versus location error in comparison of categorical maps. *Photogrammetric Engineering & Remote Sensing* 66(8) pp. 1011-1016.

Resource Systems Group. 1999. *The Economic Impact of Open Space in New Hampshire.* Prepared for The Society for the Protection of New Hampshire Forests.

Schneider, L. and R. G. Pontius Jr. 2001. Modeling land-use change in the Ipswich watershed, Massachusetts, USA. *Agriculture, Ecosystems & Environment* 85(1-3) p. 83-94

USDA Natural Resources Service. 19*97 National Resources Inventory* (Revised December 2000). Washington, DC

Forest Fragmentation in the Catskill/Delaware Region

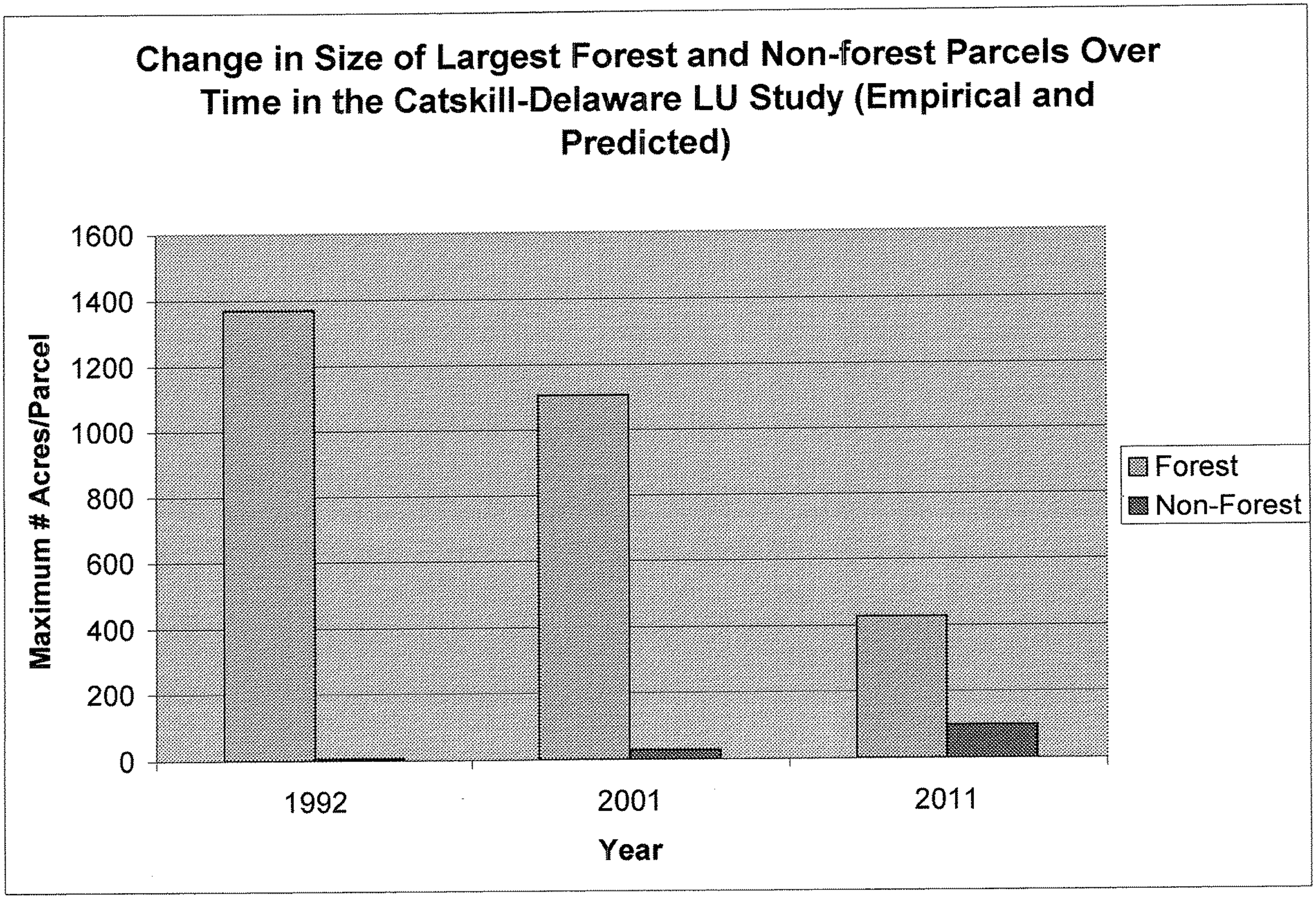
Computed as orthogonal

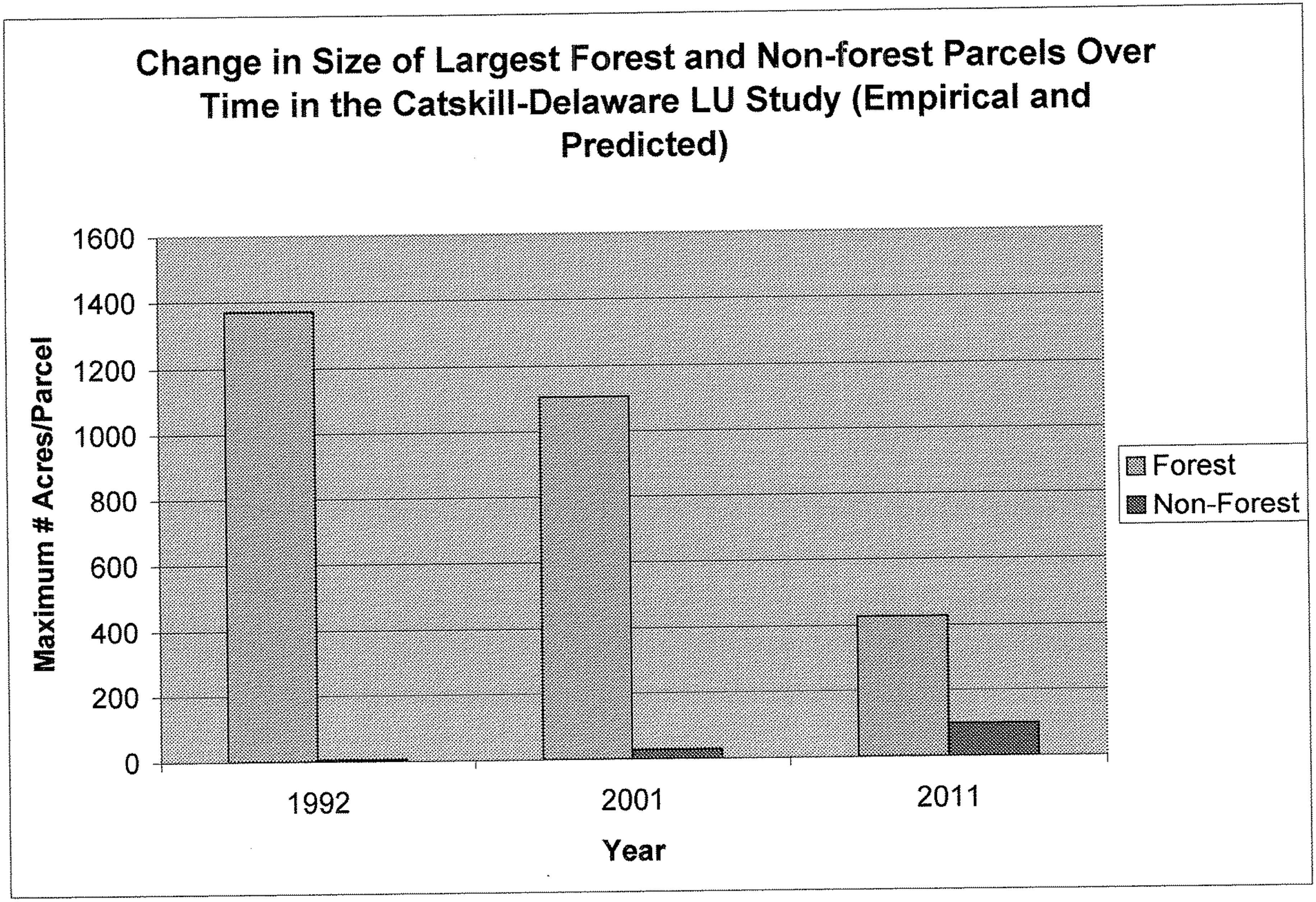
Year	LUC Type	Cell Count	# of Contiguous Parcels	Mean # Cells/Parcel	Max # Cells/Parcel	Year	LUC Type	Acres	# of Contiguous Parcels	Mean # Acres/Parcel	Max # Acres/Parcel
1992	Forest	5717517	13789	415	5611486	1992	Forest	1271541	13789	0.103	1387
	Non-Forest	962435	34082	28	27503		Non-Forest	214039.7	34082	0.007	7
2001	Forest	5313064	15002	354	5104273	2001	Forest	1181593	15002	0.087	1261
	Non-Forest	1366888	36401	38	174392		Non-Forest	303987.6	36401	0.009	43
2011	Forest	4601363	31007	148	3641171	2011	Forest	1023315	31007	0.037	900
	Non-Forest	2094554	11207	187	474989		Non-Forest	465816.1	11207	0.046	117

Computed as diagonal

Year	**LUC Type**	**Cell Count**	**# of Contiguous Parcels**	**Mean # Cells/Parcel**	**Max # Cells/Parcel**	**Year**	**LUC Type**	**Acres**	**# of Contiguous Parcels**	**Mean # Acres/Parcel**	**Max # Acres/Parcel**
1992	Forest	5717517	32860	174	5542163	1992	Forest	1271541	32860	0.043	1369
	Non-Forest	962435	59086	16	24937		Non-Forest	214039.7	59086	0.004	6
2001	Forest	5313064	32983	161	4470127	2001	Forest	1181593	32983	0.040	1105
	Non-Forest	1366888	60986	22	111817		Non-Forest	303987.6	60986	0.005	28
2011	Forest	4601363	83250	55	1729074	2011	Forest	1023315	83250	0.014	427
	Non-Forest	2094554	73046	29	398641		Non-Forest	465816.1	73046	0.007	99

	Forest	Non-Forest	Forest	Non-Forest
1992	32860	59086	1369	6
2001	32983	60986	1105	28
2011	83250	73046	427	99


Change in Size of Largest Forest and Non-forest Parcels Over Time in the Catskill-Delaware LU Study (Empirical and Predicted)
Maximum # Acres/Parcel
1600
1400
1200
1000
800
600
400
200
0
1992
2001
2011
Year
Forest
Non-Forest


Change in Size of Largest Forest and Non-forest Parcels Over Time in the Catskill-Delaware LU Study (Empirical and Predicted)
Maximum # Acres/Parcel
1600
1400
1200
1000
800
600
400
200
0
1992
2001
2011
Year
Forest
Non-Forest

MEMORANDUM

TO: **RIVERKEEPER**
Attention: Marc Yaggi, Esq., Senior Project Attorney

FROM: **CASHIN ASSOCIATES, P.C.**
John M. Ellsworth, Manager of Environmental Programs

John M. Ellsworth

SUBJECT: **BELLEAYRE RESORT AT CATSKILL PARK**
Draft Environmental Impact Statement (DEIS),
dated September 2003 – Discussion of Alternatives

DATE: **APRIL 21, 2004**

This report presents the analysis, findings and conclusions of Cashin Associates, P.C. (CA) regarding the above referenced document, which has been prepared by the applicant for the proposed project and has been circulated for public review by the lead agency, the New York State Department of Environmental Conservation. The public comment period currently is scheduled to expire on April 23, 2004.

CA has undertaken a technical review of the subject DEIS on behalf of Riverkeeper. As requested by Riverkeeper, CA's effort was directed primarily at evaluating the adequacy of the *Alternatives* portion of the DEIS, which comprises Section 5 of Volume 1 of the September 2003 report. However, CA also has reviewed other relevant components of the DEIS documentation, including appendices, in order to gain a more comprehensive understanding of the proposed action and its implications.

The following are CA's comments regarding the September 2003 DEIS for Belleayre Resort at Catskill Park, which should be addressed by detailed substantive responses in the Final Environmental Impact Statement (FEIS) which is anticipated to be prepared following the close of the public comment period for the DEIS, assuming that the lead agency allows the review process to proceed to an FEIS, or in a supplemental EIS if that is determined to be the appropriate next step.

A. Overview

Ultimately, each and every agency that has discretionary decision-making authority with regard to the proposed action will be required to adopt a statement of environmental findings prior to issuing any approval for the project. The specific requirements for this so-called findings statement are set forth in 6 NYCRR § 617.11(d)(5) of the implementing regulations of the State Environmental Quality Review Act (SEQRA), which states that the involved agencies must "certify that consistent with social, economic and other essential considerations **from among the reasonable alternatives available**, the action is one that avoids or minimizes adverse environmental impacts to the maximum extent practicable, and that adverse environmental impacts will be avoided or minimized to the maximum extent practicable by incorporating as conditions to the decision those mitigative measures that were identified as practicable [emphasis added]." Thus, one of the most critical considerations in the SEQRA decision for any action that has been through a full EIS process is that a range of reasonable alternatives must be described and analyzed in sufficient detail so as to allow the involved agencies to undertake a meaningful comparison between these alternatives and the proposed action. Furthermore, in order to ensure that the basis of this comparison is fair and accurate, SEQRA requires that the environmental impacts of the proposed action be adequately disclosed and addressed. In regard to the subject DEIS, CA's review reveals that neither of these conditions has been met, as discussed in detail below.

B. General Examination of the DEIS's Discussion of Alternatives

Even an initial glance at Section 5 of the DEIS, *Alternatives*, hints at critical shortcomings in the information that has been presented by the applicant. Of the 59 pages of text in this section, fully 41 pages are devoted to a discussion of alternatives for water supply, wastewater disposal, site access, golf course management practices, stormwater management practices, and construction phasing. Although it is acknowledged that these items were specifically listed in the scoping document for the DEIS, they all start with the premise that the proposed action would entail the general scale of development currently being advanced by the applicant (in terms of categories and quantities of uses). For the most part, these alternatives relate to engineering design issues, which, while important to the ultimate success of virtually any project at the subject location, should be considered as secondary to the more elemental question of defining the type and magnitude of development that is appropriate for this site.

Section 5 of the DEIS devotes only 18 pages to addressing alternative development scenarios. Most of this text (about 13 pages) comprises a summary of the findings and conclusions of an almost 700-page appendix (#27) which is directed at an effort by the applicant to show why less intense alternatives for the proposed project (called "alternative layouts" in Section 5 of the DEIS) are financially infeasible. Based on the applicant's conclusion that none of the alternative layouts are economically practicable, the DEIS provides no analysis of the environmental implications of these alternatives. The remaining five pages of Section 5 cover three different subjects – alternative locations, alternative uses of the site, and the requisite no-action alternative – in a manner that is equally as dismissive as the DEIS's discussion of alternative layouts. None of these are discussed in a way that provides a meaningful basis to evaluate the environmental impacts of the proposed action, both because of the utter lack of detail in the respective portions of Section 5 and because of critical deficiencies in the analysis of impacts for the applicant's preferred plan (Sections 3 and 4).

In the end, Section 5 of the DEIS leaves the reader with the applicant's foregone and self-serving conclusion that no development is feasible or reasonable other than the one being proposed (Subsections 5.1 through 5.3, and 5.10), and that the various engineering issues can be resolved in a manner that allows the proposed project to be constructed in a profitable manner (Subsections 5.4 through 5.9). The entire DEIS is written in a way that funnels into a black-and-white choice between the proposed project or nothing at all, with the alleged benefits of the applicant's plan highlighted at every opportunity and the myriad of impacts associated with this action either muted or overlooked completely.

Even in the absence of specific regulatory requirements governing the evaluation of alternatives in a DEIS, the subject DEIS's shortcomings in this regard would be objectionable to any impartial reviewer. However, these deficiencies become a fatal flaw when considering the explicit provisions of the SEQRA regarding alternatives.

The following commentary: identifies a number of substantive deficiencies in the DEIS's analysis of the impacts of the proposed action, particularly as this information relates to the comparative evaluation of alternatives; discusses deficiencies in the individual subsections of the *Alternatives* portion of the DEIS; and presents the findings and conclusions of CA's analysis of the DEIS regarding the manner in which alternatives have been addressed.

C. <u>Deficiencies in the Analysis of Impacts for the Proposed Action</u>

CA was retained by Riverkeeper to perform a critical review of the *Alternatives* section of the DEIS (Section 5). In order to establish the proper frame of reference for evaluating the various alternatives, CA undertook review of essentially the entire DEIS at varying levels of detail, with the greatest attention paid to Sections 1 (*Introduction*), 2 (*Description of Proposed Action*), 3 (*Environmental Setting, Potential Impacts and Mitigation Measures*), and 4 (*Unavoidable Adverse Environmental Impacts*), in addition to Section 5. In many cases, CA found the DEIS to be insufficiently detailed to serve as a meaningful basis for assessing the relative impacts of the proposed action versus the alternatives, which would prevent the involved agencies from making informed decisions regarding the balancing of these environmental impacts with socio-economic benefits for the proposed project and the various alternatives.

The following are CA's comments regarding sections of the DEIS other than Section 5. This should not be interpreted as representing a comprehensive compilation of comments, since CA's assignment was limited. However, all of these comments, when considered cumulatively, demonstrate that the DEIS does not contain a sufficient level of detail to adequately and accurately disclose project-related impacts. Unless these comments are addressed in a detailed and meaningful way, CA believes that the record would be deficient to a degree that would not support positive environmental findings with respect to the proposed action.

1. It is indicated on page 3-4 (¶ 2) that 374,600 cubic yards of rock would be removed by proposed blasting, which appears to pertain only to the Wildacres parcel. The quantity of blasting that would occur on the Big Indian parcel also should be specified.

2. The discussion of impacts due to blasting in Subsection 3.1.2.A is limited to potential effects on groundwater resources. The potential for blasting to destabilize adjacent areas of steep slopes also should be analyzed.

3. The discussion of topographic impacts in Subsection 3.1.2.B is limited to summary information regarding overall cut and fill volumes. In CA's experience, a DEIS for development in areas of extensive steep slopes typically would include a quantitative analysis of the spatial extent of steep slopes that would be disturbed. Given the size of the proposed development and the extent of steep slope areas that are present on the subject property, such an analysis should be provided in this instance. The recommended slope analysis should be broken down by category (e.g., 0-15 percent, 15-25 percent, and greater than 25 percent), with impact areas quantified in tabular format and depicted on a readable map.

4. Item #2 on page 3-9 asserts that: "The proposed grading will not result in any drastic cuts and fills along any ridgelines that would alter the overall silhouette of the landform." This conclusion is not supported by any quantitative analysis in the DEIS, such as a map showing areas and depths of cut and fill.

5. It is indicated on page 3-10 (¶ 1 in Subsection 3.2.1) that the proposed action involves development of "0.2 % of the Ashokan Reservoir's watershed, 96 % of which is currently forested or water." These data appear to be directed at minimizing the apparent impacts of the proposed project. If it is assumed that development presently comprises the four percent of the reservoir's watershed which is not covered by forest or surface waters, then the proposed project (i.e., the portion on the eastern parcel on Big Indian Plateau), by itself, would entail fully a five percent increase in the area of development with the entire watershed of Ashokan Reservoir (i.e., 0.2 ÷ 4.0).

6. The discussion of surface water resources does not include sufficient information to adequately assess impacts. Although the various surface water bodies on and in the vicinity of the subject property are described, not all of the paragraphs specify the extent of development that is proposed within the respective watershed areas of these streams. Furthermore, the watershed boundaries and the extent and type of proposed development in these watersheds are not illustrated. Many of the streams in the project area are designated as supporting trout, or are even designated or proposed for trout spawning, and a fairly small deterioration in water quality conditions could imperil these designations. Therefore, more detailed information and analysis regarding the proposed project's effect on the sub-watersheds is needed in order to assess the potential for localized water quality impacts.

7. The DEIS's analysis of wetland impacts is cursory, at best. It appears that the applicant has equated the issuance of a Nationwide Permit by the U.S. Army Corps of Engineers with a conclusion that the proposed project would not cause a significant impact to on-site wetlands. However, nowhere in the SEQRA regulations is it stated that impact analysis should be limited to considering the regulatory thresholds of any given agency. Such an approach would be illogical, since it would presume that the wetlands in a municipality that has enacted a local wetland ordinance establishing more stringent standards than are provided under federal law would somehow be more significant than similar wetlands in an adjoining municipality which, for whatever reasons, lacks such legislation. In fact, the subject DEIS undertakes analysis at varying levels of detail to assess anticipated impacts relative to a number of environmental parameters for which there are no specific regulatory standards (e.g., ecological communities and visual/aesthetic resources). Furthermore, it is the role of the involved agencies, not the applicant, to determine what constitutes a "significant" impact under SEQRA.

   On the basis of the foregoing, CA respectfully submits that the EIS should provide suitable maps illustrating the locations of the wetlands on the subject property and the specific areas that are proposed for disturbance (unless this information is contained on the sheets in the rear pocket of Appendix 17, copies of which were not available to CA within the time frame of our review). Furthermore, analysis should be provided with respect to the quality of the individual wetland areas on the site and the functional value of the wetlands that are proposed for disturbance. This information is critical to determining whether alternative layout plans would minimize impacts to wetlands.

8. The DEIS analysis of wetlands virtually ignores impacts that would be posed by inadequate buffering around these sensitive features. Notwithstanding that the federal regulations do not provide for buffer protection, the importance of providing sufficient buffers around wetlands is scientifically well established.

Preserving areas around freshwater wetlands creates a physical separation between development and the resources of the wetlands, thereby minimizing the impacts that typically result from such development. Buffers also provide for the effective filtering of stormwater discharges, a function which is particularly important in cases where development is placed in close proximity to wetlands, and especially during project construction.

In at least one instance, the DEIS appears to acknowledge the importance of wetland buffers to ensure that development-related impacts are mitigated. In item #1 on page 3-94, the proposed program of "Mitigation Measures" specifies that "[a] 25-foot protective buffer zone will be established on both sides of wetland 32, that contains the stream in Giggle Hollow." However, there is no explanation as to why the applicant believes that such buffering is necessary for only this one wetland area, out of all the wetlands on the subject property.

9. The DEIS summarily discards from consideration all wetland areas which, although exhibiting the characteristics of wetlands, do not conform to the current federal definition of regulated wetlands because they lack surface connections to other wetland areas. Again, this assumes that the lack of coverage under the existing regulatory framework is equivalent to a determination of non-significance, which as discussed above is a logically flawed conclusion. Furthermore, CA is unaware of any authoritative study or document which demonstrates that isolated wetlands are insignificant to the point of not meriting identification and analysis. In fact, even isolated wetlands can have important ecological values that are similar to jurisdictional wetlands.

   Based on the foregoing, CA respectfully submits that the subject EIS should be required to identify non-jurisdictional wetland areas on the project site, delineate the extent of disturbance that is proposed for each such wetland, and discuss associated impacts in terms of lost wetland functions and values.

10. Item #2 on page 3-94 specifies that all wetland areas that are to be retained on the site would be protected by deed restrictions and/or conservation easements. It should be verified whether this measure would apply equally to the two proposed golf courses. In CA's experience, it is common practice for golf course configurations to be modified periodically over time, and restrictions preventing the disturbance of wetlands could make such changes problematic.

11. Pages 3-95 and 3-96 outline a protocol for the selective removal of wetland trees. Additional details should be provided regarding the anticipated number, sizes and types of trees that are expected to be removed. Even if the exact count is not available, a reasonable estimate should be possible at this time.

12. The DEIS's assessment of the potential impacts of the proposed development with respect to watercourses in the project area, on page 3-25, is largely based on considering the linear distances between proposed areas of disturbance and the water courses. However, there is no discussion as to whether drainage patterns in the areas leading down to the subject water courses may result in concentrated flow in defined drainage ways, which would accelerate the delivery of surface flow (and associated contaminants) to the water courses, thereby diminishing the buffering capabilities of the intervening woodlands.

13. The discussion of anticipated impacts to wildlife resources in Subsection 3.5.3.B appears to greatly overplay the alleged benefit of the proposed action with respect to "habitat diversity". This discussion is very general, and does not identify the species that the applicant believes would benefit from the project, nor is there any meaningful attempt to quantify the trade-off between the habitat that would be lost versus the new habitat to be created.

14. Item #3 on page 3-108 specifies that 4,000 new trees are proposed to be planted as part of the new project. In order to assess the mitigative value of this measure, a comparison should be provided as to the number, type and size of trees that would be removed by the proposed action versus the number, type and size of trees to be planted.

15. The second bullet on page 3-27 indicates that the temporary sediment basins proposed as part of the project's erosion and sediment control plan would be designed to accommodate flow from the ten-year storm. Given the total time frame of construction that would be required to complete this project, it appears probable that an overflow event would occur. Therefore, an analysis should be provided regarding the impacts that would be expected if a temporary sediment basin overflows. This analysis should take into account the increased potential for overflow if residual water is left in the basin between closely spaced storms, considering the amount of time that would be required to treat the retained water with flocculant and drain the treated water from the basin.

16. The DEIS's water quality impact assessment appears to be focused on the drinking water reservoirs. However, due consideration also should be given to potential water quality impacts to nearby streams. In particular, page 3-38 indicates the proposed effluent from the Big Indian wastewater treatment plant would be discharged to Birch Creek. The potential for the proposed outfall to impact this water body, which is designated as a trout spawning stream, should be addressed by quantitative analysis.

17. The description of the construction phase erosion and sediment plan, on page 3-38, indicates that the developer would hire certified professional erosion control specialists (CPECSs) with the authority to stop the work of all contractors and

subcontractors. In order to avoid a potential conflict of interest which would be inherent in the developer hiring and paying individuals who are supposed to oversee the developer's activities, consideration could be given to an alternative arrangement, whereby the developer would establish a trust account that would be used by an appropriate regulatory agency to hire and oversee the CPECSs.

18. Item #7 on page 3-45 indicates that hydro-seeding would be applied in any areas on the construction site that would not be worked on for 14 days. The amount of time that would be required for treated areas to become effectively stabilized after seeding should be specified.

19. With regard to the implementation of Integrated Pest Management techniques at the proposed golf courses, page 3-74 (¶ 3) states that "[i]t is envisioned that Town personnel, such as the Code Enforcement Officer, would perform annual or semi-annual reviews for compliance." A determination should be made as to whether Town staff has the necessary technical expertise to perform this duty.

20. The applicant is proposing that groundwater monitoring would extend for five years after starting operations on the developed project site. Appropriate analysis should be presented to confirm that this is a sufficient time span to detect any project-related impacts, given the amount of time that would be required for water infiltrating into the project site to reach well intakes. Furthermore, elaboration should be provided regarding the meaning of the term "after starting operations", since it is proposed that the project would come on-line in phases, with several years scheduled to elapse between initial startup and completion of the final phase.

21. Subsection 3.3.3.G.2.e indicates that the golf course superintendent would be responsible for preparing reports on the results of laboratory testing of groundwater samples. Verification should be provided as to this individual's technical expertise to satisfactorily undertake this responsibility.

22. The DEIS's assessment of air quality impacts of construction activities (Appendix 22A) is based strictly on an evaluation of regulatory standards for airborne particulates. The DEIS concludes that adjacent residences would not be significantly impacted, using modeling results indicating that all of these residences are situated outside the area in which compliance would be achieved with respect to airborne particulates around the proposed on-site rock crushing and concrete manufacturing equipment. However, this analysis does not show the degree to which airborne particulate concentrations during project construction would be increased on residential properties in closest proximity to the subject facilities, compared to current levels.

CA is aware of more than a few instances of analogous industrial-type facilities, including aggregate crushing operations that are very similar to what is being proposed on the subject property, that reportedly are in compliance with applicable regulatory standards, but which are a persistent source of complaints from nearby residents. These circumstances indicate that real impacts can occur even in cases when regulatory compliance is achieved, suggesting that a broader impact assessment should be undertaken for the proposed facilities to calculate the anticipated magnitude of increase in airborne particulate levels at nearby sensitive receptors.

23. The DEIS does not discuss whether the proposal to site rock crushing and concrete manufacturing facilities at this location during construction are permitted uses in the applicable zoning districts, or whether any special approvals are required to erect and operate these plants. It appears from Table 5-1 that such uses are not permitted, at least in the portion of the subject property in the Town of Shandaken.

    The subject property is zoned for residential use, and the facilities in question are industrial uses (the DEIS admits as much in the heading of Subsection 3.2.3.D). Developed residential properties are located in close proximity to both of the proposed plant sites. During the 18 to 24 months of anticipated operation for these plants, people in the neighboring homes would be living next to an intense industrial operation, with continuous (i.e., 24-hour per day) activity occurring when large concrete pours are undertaken. Even the most basic tenets of planning practice would indicate that juxtaposing divergent land uses in this manner entails a high potential for conflicts (i.e., impacts) which are not sufficiently addressed in the DEIS.

24. Subsection 3.5 of the DEIS describes the ecological communities found on the subject property, as illustrated in Figures 3-17 and 3-18. However, there is very little location-specific information regarding the maturity of the woodlands in various locations on the site (including, but not limited to typical and maximum tree sizes, and specific types of trees and other vegetation present in various portions of the site). Given that statements are made in a number of locations in the DEIS to the effect that lands on the project site "have been comprehensively and repeatedly logged over the last century, including in recent years", there is reason to believe that there may be significant variability in the quality of the forest communities across the site. This information would be essential to evaluating whether the proposed plan is one that adequately avoids areas of greater ecological importance.

    The data contained in Table 3-21 suggest that little consideration may have been given to avoiding areas containing higher quality ecological communities and concentrating development in areas that are less ecologically important. In general, the proposed project would result in the disturbance of a higher percentage of the total on-site area in the most valuable habitats (e.g., BM, HS, HH, RS, and HD, with the area that would be cleared ranging from 22 percent to 51 percent of the total acreage of these communities on the site) and would disturb a lower percentage of the area in less valuable ecological communities (e.g., PP and SS, at 16 percent and 0 percent, respectively).

25. Bullet #3 on page 3-86 indicates that tree clearing would be strictly controlled outside the area currently proposed for development. A discussion should be provided regarding the mechanism that would be used to enforce this restriction.

26. The discussion of potential impacts to community character, in Subsection 3.8.2.B, states that the proposed action would "re-introduce resort development uses into an area that historically supported such development locally and on a large scale" and "consolidates recreation oriented land use in the same general location within the community." This conclusion ignores the fact that the project area has had a more rural community character for many years. Furthermore, the supporting analysis – in terms of the locations, types, sizes, and year closed for prior resort facilities in the project area – has not been provided.

27. The second paragraph in Subsection C.2.a claims that "previous blasting has been conducted on Belleayre Mountain by New York State without noise impact on the community". Although a reference is given (Crossroads, 2001), the DEIS's list of references does not contain this citation. More specific information should be provided regarding the blasting that reportedly occurred at Belleayre Mountain, in terms of volume of rock removed, distances to nearest sensitive uses, blasting methods used, and other relevant factors. This information is needed in order to verify that the prior blasting activities were analogous to what is being proposed by the present applicant.

28. The Sound Impact Study (Appendix 22) appears to understate the likely impacts that construction of the proposed development would cause at nearby sensitive uses. Section 5.4 assumes that temporary increases in noise levels of 9 dBA or less are "insignificant" and do not require mitigation. However, the table on page 4-2 characterizes a 0-to-5 dB increase in noise level as "unnoticeable to tolerable" and a 5-to-10 dB increase as "intrusive". This terminology implies that a noise increase of as little as 5 dB may be taken to constitute a significant impact. In light of this apparent inconsistency, an explanation should be provided regarding the basis of the applicant's conclusion that any increase in construction noise that is less than 9 dBA is not significant.

29. A large measure of the "mitigation" for construction noise proposed by the applicant is attributed to a 50 percent decrease in equipment usage in sensitive areas. It is not clear what this actually means, in terms of the actual number and

types of equipment that would be used under normal circumstances versus the mitigated condition, nor are any assurances provided as to how this would be enforced.

30. Subsection 3.9 of the DEIS does not appear to evaluate the burden that the proposed project would place on involved regulatory agencies in terms of increased monitoring and oversight responsibilities during and after construction.

D. Alternative Locations

1. Overall, Subsection 5.1 of the DEIS provides very little detail of the analysis that was performed in identifying and evaluating alternative sites. At the very least, a map should be provided to identify the sites that were given consideration, illustrating acreages, environmental constraints, and other relevant factors.

2. Paragraph 2 in Subsection 5.1 indicates that alternative locations had to be "within a reasonable distance" of Belleayre Mountain Ski Center. However, the distance that the investigators considered to be "reasonable" is not defined (e.g., in terms of a certain number of miles or typical driving time).

3. The discussion of the "third site" (in ¶ 6 in Subsection 5.1) indicates that one of the reasons that development of this site was eliminated from consideration is that it "would not provide the needed economic benefits to Ulster and Delaware Counties." However, this site appears to be sufficiently close to both of these counties so as potentially to present reasonable employment opportunities to residents of Ulster and Delaware Counties, which would provide certain economic benefits to these two counties (especially the former). Furthermore, this limitation appears to presume that Greene County does not require economic revitalization, which seems to be contrary to the information presented in Subsection 3.10.1 of the DEIS.

4. The last paragraph in Subsection 5.1 states that the applicant engaged in discussions with Shandaken Town officials in an effort to identify alternative sites for the proposed project. However, there is no indication as to whether a similar investigation was performed for the Town of Middletown. If no such parallel investigation was completed for Middletown, the reasons should be explained.

5. The last paragraph Subsection 5.1 indicates that certain properties identified for consideration based on information provided by the Town of Shandaken were "determined to be unsuitable for a number of reasons." Information regarding the location, acreage, and reasons for eliminating each such property should be provided.

E. Alternative Uses of the Site

1. Although titled "Alternative Uses [plural] of the Site", Subsection 5.2 of the DEIS examines only one such alternative, as-of-right residential subdivision, and even that potential development scenario is addressed merely in a superficial manner (see commentary under #E.4, below). Unfortunately, the scoping document is unhelpfully vague in describing the range of alternative uses that should have been included in the DEIS. However, it is reasonable to expect that one of the primary objectives for this component of the DEIS was to provide a meaningful analysis of possible alternative tourist/recreational uses, which would serve some or all of the same general purposes of the proposed action, including the generation of significant economic benefits to the local communities, while also moderating the magnitude of environmental impacts that are associated with the proposed development of the Crossroads assemblage.

   Alternative development plans to accommodate tourist and recreational facilities on the subject property conceivably could have been addressed under the "alternative layouts" discussion in Subsection 5.3. However, Subsection 5.3 is fixated on the types of "world-class" resort facilities that the applicant envisions for the site. Most of that discussion is limited to examining the economic viability implications of variations on the specific uses being proposed. On the basis of conclusions drawn from that analysis, the applicant has discarded as economically untenable any of the "alternative layouts" identified in the scoping document.

   The information presented in Subsection 5.3 of the DEIS regarding the feasibility of reducing the magnitude of the applicant's proposed uses can form a part of the basis used by involved agencies in reaching informed decisions on this matter, provided that this information is fully and independently validated. However, the SEQRA regulations do not support the outright exclusion of other reasonable alternatives that may not precisely conform to the project sponsor's specific objectives and capabilities, especially when at least some of the primary stated purposes for the proposed project (e.g., increased employment opportunities, expanded recreational facilities serving a cross-section of interests, economic revitalization, etc.) potentially could be served by such alternatives. The applicant's objectives and capabilities are one factor that can enter into the decision-making process, but certainly not to the exclusion of other considerations (see comment #E.3 for further discussion).

   It is absolutely necessary for the subject EIS to provide an effective analysis of one or more viable alternatives (other than the applicant's proposed development) for utilizing the subject property for tourist-related and recreational uses. The development magnitude of said alternative(s) should be significantly scaled down from the applicant's preferred plan, and discussed in specific, detailed, quantitative terms, contrasting impacts and benefits relative to the proposed project. CA believes that the absence of such an analysis from the SEQRA record would render the entire process fatally flawed, since there would be no basis of comparison for the involved agencies to determine whether the proposed action is one that avoids or minimizes adverse environmental impacts to the maximum extent practicable "from among the reasonable alternatives available". **This additional analysis should be completed whether or not the applicant undertakes further evaluation or discussion in the EIS with regard to alternative layouts (see Subsection F, below).**

2. Among the alternative uses for the subject property that could (should) be examined in the EIS is a facility, scaled down significantly from the proposed plan, which focuses primarily on addressing the local shortfall of lodging identified in the DEIS. Such an alternative could be designed to provide a range of lodging options, similar to the proposed project, and also could include suitable amenities (e.g., one or more restaurants, lodging-related shops and recreational facilities, to name a few). It would be appropriate for this alternative to include a number of variants, which examine a range of options for lodging facilities and amenities.

3. Subsection 2.2.1.B of the DEIS identifies a number of existing golf courses located in the vicinity of the subject property, but provides no additional information regarding these facilities. Appendix 27, in a brief section titled "The Golf Course Market" starting on page 210, identifies a "sample of 31 golf courses", but does not indicate the location of these facilities relative to the subject property.

   A detailed inventory should be compiled describing all golf courses within a "reasonable" distance of the site (as specifically defined in terms of miles or driving time). This inventory should include the number of holes at each location, general course quality and difficulty, availability for public use, ability to accommodate additional demand (in terms of number of rounds played versus potential number of rounds), and any other relevant information. The analysis of these data should be directed at determining the degree to which existing golf facilities in the project area potentially could be used to serve the demand for golfing opportunities generated by a new lodging development on the subject property.

4. The DEIS's examination of an as-of-right residential alternative which could occur under the existing zoning is cursory, providing no meaningful analysis whatsoever. It seems odd that the applicant would go through the trouble of creating illustrations (Figures 5-1, 5-2, and 5-3) depicting a layout for a conventional 445-lot subdivision of the subject property, with hardly more than a passing reference to these maps.

In the final paragraph of Subsection 5.2, the residential development alternative is summarily dismissed because it does not conform to the "applicant's objective". Although the SEQRA regulations state that a DEIS should describe alternatives "that are feasible, considering the objectives and capabilities of the project sponsor", this is just one factor to be considered in evaluating alternatives. There are no provisions under SEQRA that allow an alternative to be discarded solely because it is not something the applicant would pursue, especially for an alternative which is specifically identified for analysis in the scoping document, as is the case here.

Based on the foregoing, is clear that the content of Subsection 5.2 requires major overhaul to conform to the requirements of SEQRA relative to the discussion of the residential development alternative. However, it would not be appropriate to devote such a discussion to examining the spurious subdivision sketch presented in the DEIS, which would entail extensive disturbance of steep slopes and probably wetlands. Instead, a more valid and meaningful analysis would take into consideration the land use tools at the disposal of the two involved Towns, particularly any provisions in the respective zoning codes allowing for clustering or other mechanisms to reduce the incursion of development into areas of sensitive environmental resources.

F. Alternative Layouts

1. Essentially the entire text of the introduction to Subsection 5.3 is taken more or less verbatim from pages 2-8 through 2-10 of the DEIS. It is not clear how this information, discussing the suitability of the subject property for golf course development, is relevant to the stated purpose of the subsection (alternative project layouts).

2. The second paragraph under the "Overview" heading in Subsection 5.3.4 of the DEIS closes by implying that a detailed analysis of the reduced-scale alternatives is not warranted because site design and construction planning for the proposed action "already minimize or avoid environmental impacts associated with full construction of the site." However, the occurrence of numerous deficiencies in the information presented in the DEIS with respect to project-related impacts (see Subsection C of this comment document) precludes a definitive conclusion as to the scope or magnitude of the environmental impacts that would result from the proposed project. Moreover, the entire foundation of this conclusion is fundamentally flawed, since the DEIS, as incomplete and biased as it is, still admits to some impacts, albeit in greatly watered down fashion. As described in Section 4 of the DEIS, the impacts of the proposed action include loss of existing vegetation and wildlife habitat, potential erosion and sediment transport during construction, generation of fugitive dust and increased noise levels during

construction, change in the visual character of the subject property, and increased traffic on local roadways. It is difficult to imagine an argument, and certainly none is attempted in Subsection 5.3 (nor any other portion of the DEIS that CA has reviewed), to support the contention that these impacts would not be decreased if the project were reduced in scale. Therefore, it is simply not true that the applicant's current plans "already minimize" environmental impacts.

3. Subsection 5.3.4.B of the DEIS contains testimonial statements by reputed experts claiming that the construction of two 18-hole golf courses on the subject property is a critical and economically necessary component of the proposed project. However, these conclusions have been based on what appears to be a highly speculative economic analysis. In fact, the authors of the DEIS's feasibility analysis do not hesitate to acknowledge these uncertainties, with statements like the following (in the section of Appendix 27 titled "A Feasibility Analysis for Crossroads", page 272): "As noted frequently in this feasibility analysis, there are no close comparables anywhere in the surrounding area. Thus, it is impossible to compare projects for sales, pace, pricing, etc. in this report against effected market forces."

4. In Table 5-3, summarizing the results of the applicant's financial feasibility analysis, the proposed project and the alternative layouts (rows #1 through #5) are expressed in terms of the internal rate of return (IRR) for the proposed hotels and golf courses. On this basis, the applicant concludes that the proposed plan "generally meets the industry threshold for a financially sound project" while none of alternatives conform to this standard. However, the proposed lodging units have been excluded from these calculations. Although statements are made to the effect that the lodging units would "add to overall viability" of the proposed project and would "not be sufficient to overcome a low calculated IRR" for the various alternatives, the DEIS does not appear to provide the supporting data and analysis.

   The summary data provided in rows #6 and #7 of Table 5-3 indicate that the proposed lodging units at both sites, by themselves, would provide an IRR that "well exceeds industry threshold". Additionally, Table 5-3 indicates that the "East Resort" alternative has a much smaller shortfall in IRR (at 3.3 percentage points, relative to the industry threshold of viability), as compared to the other alternative hotel-and-golf-course layouts (at 5.6 or 5.7 percentage points). Considering these two factors together, it would appear that the combined development plan currently proposed for the western parcel (including hotel, golf course, and lodging units) may be very close to the threshold of viability, especially when the Highmount Estates subdivision – which does not appear to be considered at all in the DEIS's analysis – is factored into these calculations. Even if there would still be a shortfall when all of these components are considered together, it may be possible to augment certain elements of the "West Resort" scenario to a relatively small degree so as to overcome this difference in a manner that would render the overall project financially viable. In order to properly analyze this contingency, a quantitative IRR analysis for the entire "West Resort" alternative should be provided and, if it can be shown that an IRR shortfall would still occur for this alternative, suitable options (e.g., different mix of the uses being proposed, additional units, etc.) should be explored to determine whether it would be practicable to produce a profitable venture on the western parcel.

5. As noted above, the financial feasibility analysis in the DEIS does not appear to include the proposed 21-lot Highmount Estates subdivision, suggesting that, even by the applicant's own reckoning, this component is not necessary for the viability of the overall development plan being proposed by the applicant. With this in mind, CA believes that the alternative of a project without the proposed single-family homes should be analyzed in detail.

6. Various data presented throughout Appendix 27 appear to belie the applicant's contention that two 18-hole golf courses are economically essential to the success of the proposed development. Some of the most cogent examples are discussed below.

   - Table V-4 in the "Feasibility Analysis for Crossroads" section of Appendix 27 contains case study data for "Active Timeshare Projects in Mountain Areas". Of the 25 projects listed in this table, only five are identified as having any golf facilities. Although the number of holes is not specified in the table, review of the respective web sites for the five locations with golf facilities reveals that not a single one has 36 holes: three of these locations (Fairfield Pagosa, Christmas Mountain Village, and Shawnee-Ridgetop) have 27 holes, while the other two locations (Lake Condos at Big Sky and Bethel Inn & Country Club) have only 18 holes.

   - Based on CA's Internet research, it appears that the vast majority of the 14 "new-style fractional interest projects" listed in Table VI-1 in the "Feasibility Analysis for Crossroads" section of Appendix 27 also lack on-site golf facilities. Of the five locations that do appear to include golf facilities, only Snowmass Resort at Northstar is specifically identified as containing more than one golf course (two courses are indicated), while web sites for Telluride Club advertise the availability of golf but do not reveal how many holes are involved (Table VI-3 in the "Feasibility Analysis for Crossroads" indicates that these facilities actually are located off-site).

   - Section VII in the "Feasibility Analysis for Crossroads" portion of Appendix 27 examines 21 resort hotels in Ulster County. Of these facilities, it is reported that only seven have on-site golf courses, and none of these are identified as having more than one 18-hole course. The remaining 14 (67 percent) of the sample group of hotels rely on off-site courses to satisfy the demand for golf among their guests.

- Appendix 27 also contains a "National Resort Comparable Club Analysis" within a section without page numbers titled "Recommendations Concerning Amenities and Membership Programs", which examines 21 "comparable clubs". Seventeen of these facilities are in warm-weather locales, where golf can be played year-round: two in Puerto Rico, seven in Florida, four in California, two in Arizona, and two in Texas. One facility is in Virginia which, although arguably not a warm weather site, focuses its program on golf and not winter activities, according to its web site. The three remaining resorts included in the analysis are all located in Colorado. With three 18-hole courses, the Broadmoor Golf Club is the only one of these Colorado sites containing more than 18 holes of golf; however, this facility touts a mild climate on its web site and does not advertise an association with winter sports. Therefore, of the 21 "comparable clubs" used in this particular analysis, only two appear to be truly "comparable" to the proposed development in the sense of catering to both summer and winter activities (i.e., primarily golf and skiing), and neither of these sites contains more than a single 18-hole golf course.

- Also presented in the "Recommendations Concerning Amenities and Membership Programs" section of Appendix 27 is a separate "Belleayre Comparable Club Analysis". A total of 19 facilities are examined, of which eight are in warm-weather locales (two in Arizona, one in Florida, four in Georgia, and one in South Carolina). Of the remaining 11 facilities, only one (Lake of the Isles Golf Club on Wellesley Island in the St. Lawrence River) is reported to have 36 holes; two sites have 27 holes, five have 18 holes, and three contain only nine holes. The Lake of the Island facility consists of the golf courses and a clubhouse/catering facility, with no lodging accommodations, according to its web site. Therefore of the 19 "comparable clubs" analyzed in this section of the DEIS, none are truly "comparable" to the proposed development.

- Table 3-4 in the "Fiscal and Marketing Information Addendum – HCS Economic Evaluation" section of Appendix 27 lists eight "selected branded resort hotels" which were examined as part of the "forecast of hotel income" analysis. Two of these resorts have no on-site golf at all, and four have only 18 holes of golf. The remaining two locations have 36 holes of golf, but both are situated in warm-weather locales (Ritz-Carlton in California and Westin La Cantera in Texas).

7. CA has identified numerous deficiencies throughout the DEIS, including a pervasive bias that mutes the proposed project's likely environmental impacts and extols its alleged virtues, which cast a veil of doubt over the objectiveness of the entire document. In light of these circumstances, it would not be advisable to accept the contents of Appendix 27 (*Fiscal and Marketing Information*) without rigorous scrutiny. The SEQRA regulations, at 6NYCRR § 617.9(b)(8), specify that: "The lead agency is responsible for the adequacy and accuracy of the final EIS, regardless of who prepares it." On this basis, it is respectfully suggested that the Department of Environmental Conservation, as the lead agency in this case, is responsible for undertaking a careful and critical review, using its own staff and/or qualified outside consultants if necessary, in order to test and verify the accuracy of the information presented in Appendix 27, including, but not limited to baseline data, assumptions, and calculations.

   Clearly, the entire concept of alternative layouts, which otherwise appears to be environmentally superior to the proposed action, has been eliminated from detailed consideration in the DEIS based solely on the applicant's dubious economic arguments. Therefore, ensuring the completeness of the record regarding these alternatives should dictate that the veracity of the applicant's conclusion regarding the economic infeasibility of these alternatives be thoroughly and independently analyzed. The urgency of such verification is amplified by the information noted above indicating that none of the numerous "comparable" facilities examined in Appendix 27 (which presumably are mostly successful from a financial perspective) have 36 on-site holes of golf. These findings appear to irrevocably contradict the applicant's assertion that the construction of a pair of championship golf courses is absolutely necessary for the financial solvency of the entire proposed project.

8. Any alternative layout for a "world-class" project that is subsequently found to be potentially viable, based on supplemental economic analysis, should be submitted to a comprehensive environmental impact analysis and comparison to the proposed project. Special attention should be paid to the "East Resort" and "West Resort" alternatives, since either of these development scenarios would substantially reduce the magnitude of land clearing and associated impacts that would be involved in disturbing both sites under the proposed plan. In examining these alternatives, the EIS should provide a thorough assessment of the relative merits and drawbacks of developing the eastern versus the western parcel, as well as a comparison to the proposed action, based on all of the relevant environmental and socio-economic variables. Table 5-2 in the DEIS could serve as a useful synopsis. However, a much greater level of detail is needed, addressing the full range of environmental impact issues, including those discussed in Subsection C of this comment document, in order to provide a proper basis for decision-making.

It appears that limiting the project to the eastern parcel may pose a somewhat greater potential for causing environmental impacts with respect to certain critical parameters, when compared to a similar magnitude of development on the western parcel. More specifically, it is noted that the project component currently proposed for the eastern parcel, by itself, would result in a significant increase in the total extent of disturbance and development in the watershed for Ashokan Reservoir (as discussed in comment #C.5). Moreover, the Ashokan Reservoir already is known to be significantly stressed, having been included on the *Section 303(d) List of Impaired Waters Requiring TMDL* (total maximum daily load) since 2002, with silt/sediment being the specific cause/pollutant identified. Ashokan Reservoir comprises approximately 87 percent of the water storage capacity in the Catskill Reservoir System, which provides approximately 40 percent of New York City's daily water demand. This reservoir has been subject to periodic "turbidity events", or episodes of elevated turbidity often caused by storms, which in the past have threatened to shut down the water supply system (according to information available on the U.S. Environmental Protection Agency web site). The five percent increase in the area of developed land in the watershed which would result from the applicant's current proposal carries the potential for significantly exacerbating this situation, especially during project construction when large areas would be cleared of protective vegetation and soils would be exposed, which could further threaten the down-State drinking water supply.

G. No-Action Alternative

1. This subsection opens by indicating that the no-action alternative would result in "a number of impacts". This is an apt prelude to the entire presentation for this alternative, which addresses only three parameters (land use, local and regional planning goals, and socio-economic benefits) and appears to have been composed for the specific purpose of highlighting the purported benefits of the proposed action and relative drawbacks of the no-action alternative. A more balanced assessment of comparative impacts and benefits is needed, which provides a detailed analysis of all relevant variables, including geologic and topographic resources, surface water resources, groundwater resources, terrestrial and aquatic ecology, soils, traffic, visual and aesthetic characteristics, noise community services, and cultural resources.

2. The first sentence in Subsection 5.10.1 states that one of the "impacts" of the no-action alternative is that the subject parcels "will continue to be logged as they have been for over the past fifty years." Although similar statements are made in other parts of the DEIS (e.g., page 3-81), there does not appear to be any more specific information regarding the occurrence of logging at this location. This information is needed to provide the basis for defining the magnitude of environmental impact associated with these activities, and should include a

description of: the historical frequency of logging on the subject property, especially over recent years; the most recent occurrence of logging here; the specific areas (location and spatial extent) that have been affected; the methods that have been used to harvest and remove timber from the site, and the specific environmental impacts they involve; and other relevant details.

3. The second paragraph in Subsection 5.10.1 states that another of the "impacts" of the no-action alternative is that the buyers of the subject parcels "may propose to develop some of these component properties". Such a contingency is not appropriate for inclusion in the no-action alternative since, as specifically acknowledged in the introduction to Subsection 5.10, the no-action alternative entails "leaving the lands in their present state". Any future development of these lands, if the proposed action should not proceed, would likely need some sort of discretionary approval (such as subdivision) and, therefore, would be required to undergo appropriate further review under SEQRA.

4. The second paragraph in Subsection 5.10.1 closes by stating that under the no-action alternative "the opportunity for comprehensively analyzing the effects of large-scale development would be lost, since each potential smaller development would undergo independent local regulatory agency reviews." This assertion appears to ignore the fact that any environmental review under SEQRA is required to examine the potential cumulative effects of such multiple projects. Furthermore, the manner in which the proposed project has been presented in the DEIS, as an all-or-nothing proposition, arguably entails its own substantial environmental perils, as compared to a scenario of gradual development of the subject property whereby impacts would accrue progressively over time and suitable mitigative actions could be implemented as the need arises.

5. The third paragraph in Subsection 5.10.1 highlights the fact that the no-action alternative does not include the development restrictions that the proposed action would place on 1,387 acres of the subject property. However, in order to gauge the true effect of these proposed development restrictions, it would be necessary to evaluate the realistic development potential of the 1,387 acres of land in question, considering the environmental constraints that are present (especially with regard to steep slopes and soil limitations).

6. Subsection 5.10.2 compares the proposed action versus the no-action alternative with respect to local and regional planning goals. However, this discussion focuses exclusively on economic development, and does not consider any relevant local and regional goals for environmental conservation (including watershed protection) and the relative degree to which the no-action alternative and the proposed action would advance such goals.

H. Discussion

The subject DEIS suffers from acute defects on a number of fronts, including questionable methodologies, inadequate disclosure of environmental impacts and, most serious of all, the virtual absence of an analysis of use alternatives for the subject property. As discussed in detail above, alternative layouts for the proposed development are dismissed completely based on dubious economic analyses. The discussion of alternative uses/facilities is limited to a cursory glance at residential subdivision, completely overlooking any of the other myriad uses that could occur on the site. The DEIS section on the no-action alternative unabashedly highlights a handful of professed benefits of the proposed development, while ignoring the much larger sweep of environmental variables for which maintaining the status quo appears to be the preferable option. Overall, the DEIS treats the discussion of alternatives as if it were a minor element of document, akin to the perfunctory sections on "Irreversible and Irretrievable Commitment of Resources" and "Effect of the Proposed Action on the Use and Conservation of Energy". In fact, the truth is exactly the opposite.

The SEQRA regulations are somewhat sketchy in defining certain requirements, but are very clear and precise on the purpose of the alternatives section of a DEIS. Specifically, 6 NYCRR § 617.9(b)(5)(v) states that: "The description and evaluation of each alternative should be at a level of detail sufficient to permit a comparative assessment of the alternatives discussed." Clearly, based on the findings of CA's review, the subject DEIS falls far short of this standard, since the necessary detail either is absent or very limited, thereby utterly thwarting the requisite comparative assessment of alternatives.

I. Conclusions

As discussed above, CA believes it is evident that the subject DEIS is grossly deficient, and is unsuitable as a basis for future decision-making. The magnitude of the omissions and faulty information in the DEIS make it difficult to see how these problems can be remedied in a standard FEIS format. In some cases, it would be necessary to essentially rewrite entire sections of the DEIS. This is especially true with respect to the discussion of alternatives, since the applicant has crafted a scheme that completely avoids addressing use alternatives in any meaningful way. Under these circumstances, the SEQRA regulations indicate that a supplemental EIS may be the most appropriate mechanism for continuing the environmental review process for the proposed action.

Pursuant to 6 NYCRR § 617.9(a)(7), two of the three conditions under which a supplemental EISs may be appropriate, at the discretion of the lead agency, is when there is "newly discovered information" or "a change in the circumstances related to the project". Given the critical absence of any substantive discussion of use alternatives in the DEIS, the preparation of these sections at this time can readily be understood as "newly discovered information", particularly given the central importance that the evaluation of reasonable alternatives has in the context of the entire EIS process.

Additionally, any further analysis that alters the key conclusions presented in the DEIS, including but not limited to the financial analysis, could be interpreted as constituting "a change in the circumstances related to the project", which also would indicate the need for a supplemental EIS.

Based on the findings of our technical review of the DEIS, CA believes that neither the public nor the involved agencies would be well served if the subject SEQRA process were allowed to proceed to the FEIS stage at this time, given the complexity and magnitude of the issues that have not been adequately resolved in the DEIS, and considering the absence of provisions under SEQRA for public review and commentary for an FEIS. Therefore, a supplemental EIS appears to be the only proper course of action.

BELLAYRE RESORT EIS REVIEW PROCESS – ALTERNATIVES ASSESSMENT

THE PROPOSED DEVELOPMENT PROGRAM

The Applicant has proposed a program for the development of 573 acres from a total assemblage of 1,960 acres owned by the Applicant located in Delaware and Ulster Counties of New York State. The project program consists of two major venues, which will center on affiliation with national hospitality brands:

- "Big Indian" – a 5-star, 150-room hotel/spa, 183 detached lodging units, country club with an 18-hole golf course – on land on eastern side of the Bellayre Mountain Ski Center
- "Wildacres" – a 4-star, 250-room hotel/spa, 168 detached lodging units, golf club with an 18-hole golf course – on land on the western side of Bellayre Mountain Ski Center

TESTED FEASIBILITY OF PROPOSED DEVELOPMENT PROGRAM

As part of meeting the Draft EIS requirements, the Applicant commissioned a series of studies that analyzed the economic feasibility of the proposed program as well as various alternatives based on different combinations of the key components of the proposed program (all of which maintain the critical assumption that the development centers on an affiliation with a major national hospitality brand), including:

1) Big Indian Hotel/spa, country club, Wildacres hotel/spa, golf club
2) Big Indian Hotel/spa, country club, Wildacres Hotel/spa
3) Big Indian Hotel/spa, Wildacres hotel/spa, golf club
4) Big Indian only
5) Wildacres only
6) Detached lodging units evaluated separately, under assumption that hotel/spas are constructed first

The studies determined that the only logical and economically feasible approach to the development of the subject property calls for construction of both hotels and country clubs, both 18-hole golf courses, and both of the detached lodging unit communities. This assertion requires further consideration.

SUSTAINING THE NATURAL ENVIRONMENT AND THE ECONOMY – A CAREFUL BALANCE

The subject site is located in a watershed area that not only provides water to more than 9 million people, but also provides a marketable amenity of pristine wilderness that attracts people and investment. The natural environment is the region's core economic asset and long-term competitive advantage. It is therefore imperative that its protection be balanced with the growth of commercial, agricultural and residential uses in the region. Consequently, it is critical to explore environmentally sound economic development that emphasizes area's natural resource-based economy to create and sustain businesses that support the region without compromising opportunities for the future.

ENVIRONMENTAL IMPACT OF THE PROPOSED DEVELOPMENT PROGRAM

The proposed development, in its current form, will result in the production of mountainside runoff and erosion from golf course resort construction and operation and spawn secondary growth in the project vicinity and Route 28 corridor. These repercussions are intensified by the magnitude of the proposed program and are likely to threaten the region's best long term economic asset -- its rural character and environmental amenities.

An EIS requires that the applicant provide a description and evaluation of the range of reasonable and feasible alternatives to the proposed development. The alternatives may specifically explore developments of alternate sites and or scale or magnitude. In view of the quality of the Applicant's site, its location, the extensive proposed development program, and the assessments of alternatives as described above, **HR&A believes that there remain alternatives that have the potential to more effectively mitigate the impact to the environment, while maintaining economic feasibility that warrant careful examination prior to the completion of this EIS process.** Specifically, the assertion that advancing only a portion of the project would not be economically feasible has not been fully explored.

LOWER-RISK ALTERNATIVES:

REDUCED INTENSITY OF CAPITAL INVESTMENT AND LAND USE

The cost to the environment and ultimately the region's economy, of the two resorts is potentially far greater than the incremental benefit to the Applicant and its investors. Reducing the risk profile of a project can allow for exploration of a broader range of alternatives that may allow for less intense land use. Since each distinct element or component of a development project establishes its own risk profile and adds incrementally to the initial capital costs for infrastructure, and consequently increases the required return, reducing the scope of a project to include fewer elements could produce appropriate risk-adjusted returns for an investor. A lower-risk alternative might consider some combination of the following:

- Reduced up-front capital investment and development costs, such as construction of utilities infrastructure (water, sewer and electricity), and pedestrian and vehicular networks;
- A mix of alternative recreational amenities that will individually and therefore collectively produce higher contribution to profit margin;
- A smaller-scale development and facilities;
- Fewer components included in the overall program;
- Less varied components of the program (i.e., a focus on creation of a residential community only)
- Amenities and attractions that are smaller in scale and intensity of land use and more complementary to/harmonious with existing environment;
- Development of a reduced portion of the site; or

- Construction of higher density on a smaller area, providing fewer, larger, highly amenitized lots to enhance lot yields and exploiting economies of scale for infrastructure costs;

A compelling alternative to the proposed program that incorporates many of the above points is a full development of the only the western parcel (the Wildacres golf club, hotel and detached lodging units). This alternative should be carefully assessed for the following reasons:

- **Potential for acceptable returns by including the detached units.**
  According to the Applicant's consultant (HVS), while the calculated expected return for Scenario 1 (development of the entire program on east and west parcels) was the highest at 14.7% and Scenario 5 (development of only the Wildacres golf club and resort) produced an expected IRR of 10.7%, both are marginal returns. The consultant's report further stated that Scenario 1 would require the stronger yields associated with the detached lodging units to counterbalance the risk of investment in the hotel and country club components. Given the strong expected returns produced by the detached lodging units component, it is reasonable to expect that a program that includes the development of Wildacres in its entirety, including the detached lodging units could produce an acceptable risk-adjusted return, and is worth careful consideration.

- **Decreased infrastructure cost and less impact on environment**
  The two components of the Applicant's program involve two very different parcels of land, the development of which have varied implications for the environment. The western parcel is already partially developed with existing infrastructure and its runoff flows to the less-threatened Pepacton reservoir. The eastern parcel is undeveloped forestland and runoff from development there would flow to the more sensitive water body, Esopus Creek. Limiting the development to the western parcel would decrease infrastructure investment costs, risks, and the overall environmental impact.

Within this context, there are several reasonable alternative development schemes that effectively mix the characteristics above and could achieve a more desirable balance between economic viability and environmental impact. Alternatives might include:

- **The Wildacres Alternative**
  Based on the discussion above, the first alternative that should be explored is a program of development for only the western parcel of the site, comprised of the 'Wildacres' component, with the detached units. The inclusion of the detached units in the analysis may counterbalance the risk associated with the hotel/spa and golf amenities. Further, under this alternative, the eastern portion of the property could be sold to New York City or State or fully protected as forest lands, with conservation easements.

- **The Reduced Scale Residential Alternative**
  An all-residential development of a reduced scale that capitalizes on the remaining land by selling either to a public entity or to individual owners or by setting it aside as a preserve as an amenity to the development. This program could include a residential community centered on a single golf club and selling the remaining portion of the site for profit to a public entity that

would create a nature preserve. Alternatively, this could entail a residential community developed on both the eastern and western sides of the site, with no golf club.

- **The Natural Amenity Alternative**
  A destination development focused on alternative outdoor activities or recreational attractions that take advantage of the natural amenity of the unique pristine wilderness of upstate New York and require less environmental impact than a golf course. This could take the form of a program for a hotel/spa resort that offers an equestrian center, mountain biking and hiking trails or yoga retreat, offering a combination of amenities that would contribute a higher profit margin than a golf course.

- **The Single Golf Course (on western parcel) Alternative**
  A mixed vacation and residential development that capitalizes on shared amenities such as a single golf course on the western parcel of the site, club and possibly a golf school, with a nature preserve, developed over possibly a smaller site assemblage.

Successful examples include:

- Spring Island, South Carolina, a recreational community development that began with plans for 5,500 dwelling units and two golf courses later successfully reduced to 500 units and one golf course with a 1,200-acre nature preserve. It follows a no- and low-impact land and habitat management philosophy that emphasizes economic viability, community livability and environmental sensitivity.
- The Reserve, Indian Wells, California, a 21-hole golf course community on 620 acres, with 245 for-sale lots, all designed to have a minimal impact on the natural habitat, marketed to people who want a simple lifestyle based on harmony with nature.
- The Fairmont Sonoma Mission Inn and Spa, in Sonoma, California which focuses on the natural hot springs of the area and drawing on the California Wine Country experience.

CONCLUSION

While the Applicant has presented its definition of the recreational and economic benefits of the proposed program for Bellayre Resort at Catskill Park, like all capital-intensive projects, the proposed program carries a significant risk profile. Since the subject assemblage of land offers numerous and varied opportunities for development, HR&A believes careful attention should be paid to the exploration of additional alternatives that are less capital-intensive and therefore provide risk-adjusted returns that are fair and rational. Selection of a program such as the alternatives suggested above would mitigate many of the expected adverse environmental impacts while providing both a recreational and economic asset to the region.

5/23/02

...ing the Highway Department's existing facilities and moving the bulk of the salt stored ... the banks of the Sawkill Creek to the closed landfill. A smaller "storm shed" is proposed for the Bearsville facility allowing the department to store some sand

DEC has ordered the removal of the salt piles from the current location in Bearsville. The facility sits on the banks of the Sawkill which feeds the aquifer that supplies Woodstock with its water supply. The town has debated a new Highway Department new garage across the road from the existing fac... the Comeau property and had ...ong reservations on placing the garage near the wastewater treatment plant.

Please see Garage, page 10

Belleayre Receiving More Money For Next Season

(HIGHMOUNT) - Coming off two successful seasons, the state owned Belleayre Ski Center will be receiving more money for the coming season under the state's proposed budget. In addition, more funding is being allocated from other state officials who recognize Belleayre's importance to the state and local economy.

According to Belleayre Superintendent, Tony Lanza, Belleayre's operating budget will increase to $4.3 million, up from last year's $4.1 million. Despite a ski season marked by dreadful weather, Belleayre exceeded expectations and came close to equaling the previous season's near record attendance mark.

Last week, State Senator John Bonacic announced the procurement of an additional $750,000. As a member of the Senate Majority's Budget Subcommittee that oversees environmental conservation, Bonacic (R-Mt. Hope) said the additional funding would go towards improvements at Belleayre that will be administered by DEC.

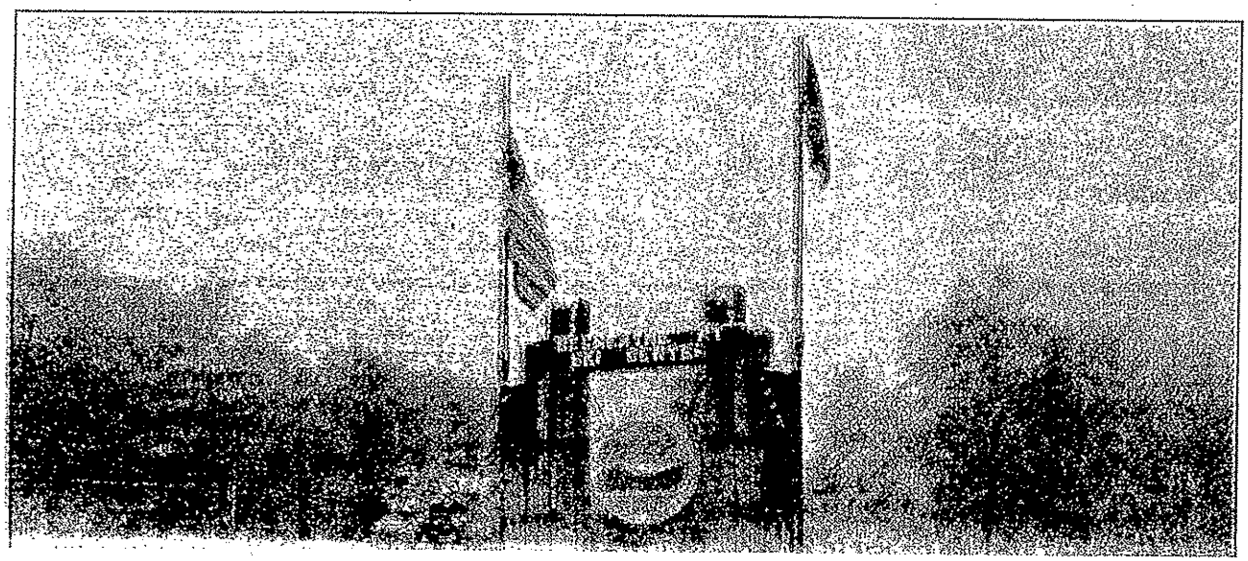
According to Lanza, he and his staff are busy putting the final touches on a new Unit Management Plan for Belleayre. "We out grew the current plan," said Lanza. "It was based on 3,500 people per day and we came close to 6,000 people this past season."

Several years ago, Governor George Pataki allocated $5 million for capital improvements at Belleayre after years of lobbying by local officials and the business community. New trails and lifts were built and Belleayre's market share began to soar. Despite unseasonably warm, dry weather this winter, Belleayre came within $30,000 of its projected revenues while the rest of the ski industry in the Northeast experienced declines upwards to 48 percent.

"We greatly appreciate this additional funding," said Lanza. "Senator Bonacic and the state have provided great support for Belleayre and it is showing."

This year's additional funding will go towards improving the roads and parking areas on the mountain. A similar proposal a few years back was criticized by local officials and the business community. It was

Please see Belleayre, page 10



ject has to supply more details before the proposal moves forward. In a decision dated May 15th, DEC issued a list of areas that have been determined to be inadequate and require further analysis or revision.

Crossroads Ventures, LLC has proposed building a resort straddling the Belleayre Ski Center consisting of two, 18-hole golf courses, two resort hotels and 225 units of housing on 500 acres of a 1,900 acre parcel. DEC is lead agency for the review under the State Environmental Quality Review Act (SEQRA).

Under SEQRA, the developer must file a DEIS outlining potential impacts and proposed mitigation and ...es.

In its ...ement, DEC De... Regional Permit Administ... Alexander F. Ciesluk, Jr. provid... list of issues that need to be clari... It asked for alternatives to the w... water treatment and water su... plans submitted by the devel... Opponents to the proposal have ... pushing the issue of adequate po... water claiming the develope... attempting to use water that ... believe should be used by the ha... of Pine Hill instead of the deve... ment. In addition, the develope... proposed using the New York ... owned wastewater treatment ... that serves Pine Hill for sewage

Amnesty Progran... Vehicles and 1,4...

(ALLABEN) - There is a lot less junk around the town of Shandaken: A total of 220 less junk vehicles and an additional 1,420 or so tires. Under an amnesty program that officially ended May 17th, people with junk vehicles could have them hauled away free of charge. In addition, old tires were could be thrown into the junk vehicles for disposal.

The tire disposal was independent from programs designed to reduce the spread of the West Nile virus. The virus is spread by mosquitoes who can breed in stagnant water, particularly in improperly disposed tires.

Under the town's zoning laws, it is illegal to store more than one unregistered vehicle, even on private property unless it is "garaged" or st... indoors. Violators can face a fir... up to $250 per vehicle, up to 15 ... in jail or both. When a notice of ...lation is issues, besides facing criminal charges, if the violatic... not corrected within 30 days, the vehicles can be removed from pr... property at the owners' expense.

Starting Monday, May 2... Shandaken's Zoning Enforcer... Officer Joe Laing can begin iss... notices of violation. He said t... will be no extension to the amn... since there was ample notice ... plenty of time for people to comp...

"Most people pretty much k... about it," said Laing. "I put s... notices on people's cars.

'Click it or Ticket... Enforcement U...

(ALBANY) - Under a region-wide program, members of law enforcement will be out in force over the Memorial Day weekend conducting seat belt checks and enforcing ... New York has left it up to the m... and individual police agencies to... the word out.

"Simply fastening your seat b... is the most effective way we can

Belleayre

Continued from Page 1

argued there was no reason to increase parking and improve the roads if there was no incentive for skiers to come to Belleayre. But all that changed with the infusion of the $5 million from the Governor.

In addition to road repairs, more money will be invested in the Ski Wee program, which teaches youngsters how to ski. This popular program showed increased participation even though the number of skiers visiting the mountain was about the same as the previous year. And another problem the ski center faced on busy weekends last season was the lack of adequate rental equipment. According to Lanza, on several occasions last season, every available ski and snowboard had been rented forcing staff members to turn away potential skiers that did not have their own equipment.

"We've shown Albany and the industry what we can do," said Lanza. "We appreciate the pledge of support from Senator Bonacic and other officials."

"Belleayre is a tremendous tourism asset for Ulster County and the Catskill Region," said Bonacic. "The improvements made at Belleayre in recent years are outstanding but we cannot stop now. In a time of serious financial problems for the State, I am pleased that this added funding for Belleayre will be made available."

"We were given approval to build 25 miles of trails back in 1949 when Belleayre was created," said Lanza. "We are trying to bring that to fruition. We are making a commitment to grow and make Belleayre better."

Enforcement

Continued from Page 1

Some motorists falsely believe that air bags can save them in the event of an accident. Statistics show that air bags, while successful in preventing deaths, work best when combined with seat belts.

New York's police agencies issued over 500,000 tickets for seat belt violation , including child safety violations in 2000, the last full year where statistics are available. This was an increase from 1998 when less than 200,000 violations were issued.

With the official start of the summer driving season, police agencies will be in abundance on all of New York's roads. It is hoped that with a combination of publicity and a strong police presence on the roads this weekend that New York's motorists get the message: Click it or ticket.

... face-to-face.

The guest speaker, as with last year, was the Superintendent of the Belleayre Ski Center, Tony Lanza. "It ... region forward.

This past season, despite seasonal warm weather and lack of water for snowmaking, Belleayre exceeded its single d

DEC

Continued from Page 1

detail. More percolation tests have been requested to cover the four seasons. Erosion and sediment control need to be looked at further since the project will drain into two different drainage areas, the Ashokan and Pepacton reservoirs.

There were concerns raised over the list of chemicals associated with golf course management and landscaping. While acknowledging that most of the chemicals listed had relatively low toxic levels, some were not approved for use in New York state while others have the potential for migrating outside the proposed treatment areas.

While the majority of the issues raised by DEC are legitimate concerns, there is evidence of issues raised by opponents to the project that appear to be designed to slow the review process or to cost the developer more money. For example, at the public hearing that set the scope of the environmental review, an individual pointed out the presenc Bicknell Thrush, an enc species. But, the Bicknell T seldom seen below 3,000 f below the altitude of any p the proposed resort.

In addition, DEC has r the developer make the 3,0 eight volume DEIS easier to follow. There are apparen sions, redundancies as well that are hard to find. With ment of that size, it is extrem ficult to digest the amount c mation provided. DEC has re more charts and a better indexing the tremendous amo information.

In a statement released by roads Ventures, LLC spo Gary Gailes, he said, "The D given us a detailed commen our 3,000 page document, nar down the subjects they need information on. It is clear th have minutely analyzed our dr

Garage

Continued from Page 1

Green Party Chairman David Menzies gave his blessing as did other speakers. And Gerry Ricci quipped, "Congratulations on a job well done. You have found a solution that satisfies no one so its probably the right solution."

Woodstock has received a grant from the Catskill Watershed Corporation to help defray the costs of a sand and salt storage shed and the town has recently been granted an extension by CWC as it sought a location. "The only stipulation," according to Wilber, "is that we build it outside of New York City's watershed." CWC ... employees a safe place to work Mercer. "We're almost there."

The resolution was unanin passed. "Let' all take a deep b said Wilber after the reso passed without dissent from board members and the audien

In other business, there request to change the parking along Old Forge Road adjacent Village Green. It is currently lis a five minute parking zon according to some business o the time limit is ignored and k enforced. It has become a p place for people to "cruise" tha

Catskill Mountain News

Vol. 141-36 14 Pages - 2 Sections MARGARETVILLE, NEW YORK 12455 Wednesday, March 5, 2003 Periodical Postage Paid at Margaretville, NY 12455 Published Weekly 75¢

HUNGRY—This young deer didn't let the presence of a photographer disrupt its feeding session. Animals in the wild have been very hard-hit by the cold, snowy winter and any food is a welcome sight. — Photo by Dick Sanford

Belleayre seeks trails into Pine Hill community

By Jay Braman Jr.

Belleayre Ski Center would like to run trails down the mountain to Pine Hill and have a lift at the bottom to carry skiers back up. This and other ideas are under discussion now as officials prepare a unit management plan for the state-run ski center.

To calm fears that Pine Hill would be overrun by skiers, Superintendent Tony Lanza told a crowd Saturday night that there are no plans to make any access to the facility from the hamlet, or any parking lots at the end of Bonnieview Avenue.

"It would be a box canyon," he said of the area where the base of the new lift would be.

In other words, skiers could ski down to the lift once they have entered the facility through the main gates. It would be similar to the way skiers use the "Super Chief" chair lift that was built a few years ago at Belleayre. That lift, according to Lanza, has already seen better days. He said that workers now call it "the super sloth" because it takes so long to get skiers up to the top of the mountain.

Due to such deficiencies and other problems like the basic layout of the facility, Lanza envisions a complete renovation of Belleayre, with parking lots down near Route 28, a new main lodge located near the lower lodge and the removal of some smaller chair lifts to make way for longer, bigger and faster ways to get skiers up.

Lanza spoke for approximately two hours to about 50 people in the lower lodge. He explained that the session was the beginning of a long process that would ultimately produce a unit management plan. Saturday's meeting, he said, was designed to let people know what ideas were in the development, but more importantly to get an idea of what people think early in the process and get the community involved in what will eventually become a plan.

"Nothing here is even remotely etched in stone," he said.

The reason Lanza wants community input is because Belleayre is a state-run operation. Unlike private resorts, where communities serve the resort, here it is the other way around. Lanza wants to create a facility that the community wants.

"Belleayre Mountain is here to serve the community," he said.

> *"It would be a box canyon."*
> - Belleayre's Tony Lanza

"A case in point," he said, "is the way they envision the expansion to Pine Hill. There could be parking, tickets sold, cars running up and down the hamlet's Bonnieview Avenue, but that would only happen if that's what the people of Pine Hill wanted." So far, he added, that is not the message he has been getting.

"We have business people here. We have skiers here and we have people who want to be left alone...and they have that right," Lanza said of the hamlet.

Another landowner in the hamlet is Crossroads Ventures, a company planning to build a golf resort next to Belleayre: Crossroads has land at the end of Bonnieview Avenue as well.

A unit management plan is used to guide development and improvements over five-year periods. Periodically, the Department of Environmental Conservation amends the plans as needed. The existing Belleayre UMP needs to be amended to enable the department to go forward with the desired improvements.

But just because a plan is made does not mean it will be funded and put into effect. Belleayre has a history of being ignored when times get to[illegible] in New York State. Senat[illegible] [illegible]n Bonacic has warned that t[illegible] [illegible]ate is facing the worst budget in the last 40 years.

...tition handling charges ...mplaints in Andes voting

...er han- ...for the ... elec- ...nplaint ...ard of ...ed last ... state ...ed that ...ossible ... been ...urned ...eys for ...on on ... taken. ...volved ...sed as ...Village ...he one ...uary 4 ...eting. ...ations ... were ...d both ...mayor ... for ... were

accepted with one petition rejection. Three names will appear March 18 on the ballot for trustee: incumbent Ronald Guichard, Frank Meyer and JoAnn Boerner. Current trustee Richard Canavan is the sole candidate for the mayoral position. Howard Rosenast's petition for mayor was rejected when he made a last minute switch to trustee, which resulted in an unacceptable petition.

Village Clerk Donna Martino stated that she was approached by an individual who alerted her that an inappropriate action regarding the petition application had been witnessed. Without being more specific at this time, Martino agreed that the matter required further inquiry. "It concerns a petition that was submitted for the elections," Martino said. "So I made numerous calls to the appropriate agencies, and the state board of elections said yes, this is something that should be investigated. It's serious enough, I felt I had an obligation to provide the paperwork. I got Ron's statement as to what he saw, and felt it was serious enough to be investigated."

Guichard, who acknowledged providing a signed statement as a witness, stated: "This concerns a series of events that took place with a petition. At the time it occurred, I was aware of something, and it was confirmed by the applicant. I just witnessed what I did, told what I witnessed, told it as I saw it."

Canavan voiced his concern that improprieties concerning what he termed "election-tampering" may have caused an individual the opportunity to run for the board, and was also unsure as to how much information could be revealed at this point in the investigation.

Election in Andes will take place at the technology building across from the school, from noon to 9 p.m.

...ird

'Harassment' cited

Board member quits in police scandal wake

A village board member has resigned in the wake of the ongoing controversy surrounding the Fleischmanns police officer.

A letter of resignation from Roy Todd was read at Monday's meeting. Mr. Todd wrote that "the decisions, goals and expectations I had, have been thwarted at every turn."

Mr. Todd added that he "does not know who to believe" regarding village matters anymore.

After reading the resignation letter, Mayor Ferraro remarked that Mr. Todd has recently been "stalked" at work and his wife has been harassed at her job.

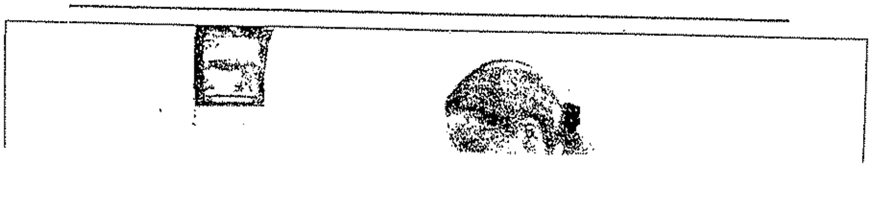
The mayor indicated that these actions were related to the board's hiring of Jacob Sabo as the village police officer.

Mr. Sabo was indicted last week on two felony charges, for offering a false instrument for filing in May 2202, and for defrauding the government. He was also charged with a misdemeanor count of second-degree menacing.

The felony counts were related to Mr. Sabo allegedly using false information regarding a prior criminal conviction on his job application. The second felony charge resulted from an alleged scheme to defraud the Village of Fleischmanns and to obtain property by false pretenses. These charges resulted from Mr. Sabo's contract with the village and his use of the village police car.

Commenting on the [illegible] surrounding Mr. Sabo, the [illegible] read a statement noting, "The indictment and arrest of our police officer has caused unbelievable anguish to the board."

She added, "However, a small group of politically motivated people continue to vilify, embarrass and harass the mayor and [illegible]



Progress on the proposed golf resort in Shandaken has slowed down after the NYS Department of Environmental Conservation (DEC) has asked for further information on the project.

That is the word from the offices of Crossroads Ventures, the development team planning the large golf complex, complete with two championship courses, hotels, and lots of residential units on the mountains between Big Indian and Highmount.

Last week project spokesman Gary Gailes announced that Crossroads had received the state's response to the 3,000-page Draft Environmental Impact Statement (DEIS) his team had prepared, a report the developers hoped would explain how they would avoid any harmful effects the project may have on the environment or community.

While pleased the state has narrowed down the subjects it wants further information on, Gailes admitted the scheduling of public hearings on the report will probably be set back by the DEC's new requirements. Previously, Crossroads had hoped to have all this behind them by July.

"It is clear that they have minutely analyzed our draft and we are somewhat surprised by the scope of their further requirements. Nevertheless, we are confident that in due course we will be able to provide the necessary information," said Gailes.

The May 15 response from the department, written by Alexander F. Ciesluk, Jr. Deputy Regional Permit Administrator for the Department's Region 3, includes a 12-point list of "areas of the document that have been determined to be inadequate and require further analysis or revision, according to Ciesluk.

The department is demanding more information on an entire gamut of topics including possible alternatives to the project, local planning/traffic and socio-economic issues, water supplies and wastewater treatment, storm water management, pesticides, natural resources, other agency and public comments, and permit applications.

Even the document's format came under fire, with Ciesluk saying "Given the size of the document and the extensive amount of information presented...it is recommended that effort be made to improve the use and readability of the document." Adam Nagy, a spokesperson for the Catskill Heritage Alliance, a citizens' group opposing the project, said Friday that his organization needs time to review the state's remarks.

"I don't like to shoot from the hip, he said.

The alliance is expected to weigh in on the state's reaction to the plan soon.

Catskill Mt. News 5/21/02

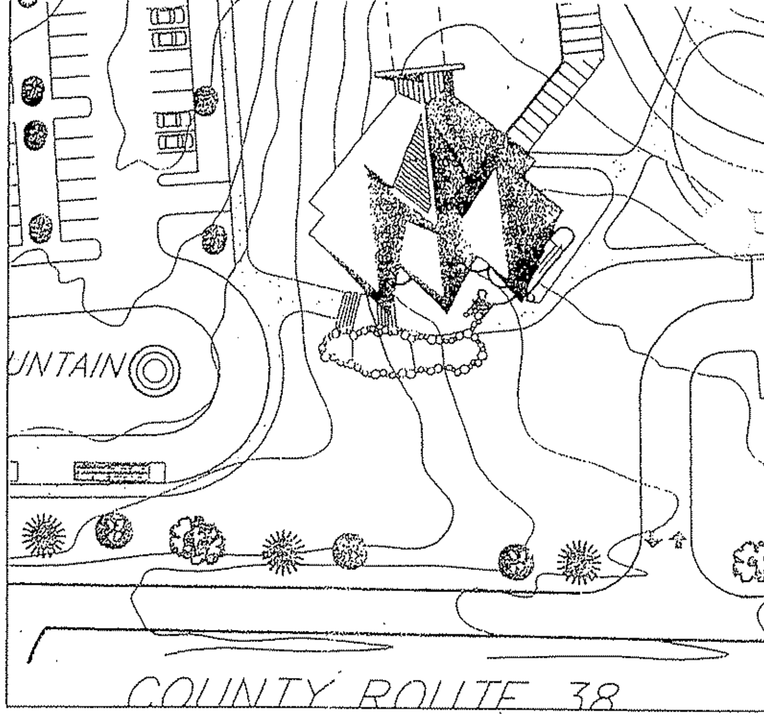
Belleayre planning underway

By Jay Braman Jr.

Major development plans for state-owned Belleayre Mountain are in the works. Staffers are working to prepare a unit management plan for the facility, which will outline the planned growth of the four-season recreational park over the next five to eight years.

According to Belleayre Superintendent Tony Lanza, the plan is already in rough draft

(continued on page 4A)



ON THE BOARDS — This artist's rendering of the proposed Watershed Museum in Arkville shows the museum located near the north end of county Route 38. The former thermometer

Road concerns de

The Town of Middletown is delaying sale of a portion of its industrial park property in Arkville for the proposed Watershed Museum until right-of-way issues along county Route 38 are finalized.

The Delaware County Department of Public Works (DPW) is currently studying county Route 38 (the Arkville cutoff road) to determine changes necessary in the road to handle the increased traffic resulting from museum visitors.

Preliminary figures estimate that the museum would attract 50,000 visitors annually. The M-ARK Project has also proposed to utilize about three acres of the industrial park to esta[illegible] housing for low-income residents.

Route 38 is the second most heavily traveled county-owned roadway. The most recent study of the road shows in excess of 2,500 cars daily on the road.

Wayne Reynolds, director of the county DPW, attended last week's Middletown Town Board meeting and indicated that his primary concerns are sight lines near the proposed museum location (at the northern end of the road) and the blind turn adjacent to Erickson's Auto Body.

Mr. Reynolds said an aerial map of the roadway has been photographed. This information is being used to develop a study model for changes to the roadway.

The DPW director has indicated that the count[illegible] is interested in purchasing so[illegible] the industrial park acreage from the town to assist with the roa[illegible]

Parades set Monda[illegible]

Communit[illegible]

es

John Vellucci

John Vellucci

John J. Vellucci, 80, of Margaretville, died Monday, May 20, 2002 at Samuel S. Stratton Veterans Hospital, Albany.

He was born in the Bronx on September 6, 1921, the son of Angelo and Maria Moretti Vellucci.

He served in the U.S. Army from February 3, 1941-June 17, 1945. He reenlisted from October 23, 1945-June 1, 1947.

John was a maintenance supervisor for postal service at Grand Central Station in New York City retiring in 1974.

He moved to Margaretville from the Bronx in 1987.

He was a member of the Middletown American Legion Post 216 and the Sacred Heart Church, Margaretville.

Surviving are a son and daughter-in-law, Walter and Linda Vellucci, Citrus Heights, California; two daughters, Ann Marie Stern, Arkville and Susan and son-in-law, Victor Fairbairn, Margaretville; two grandchildren, Annatte Decker and Garrett Fairbairn; two great-grandchildren; three sisters, Ida Ritrivi, Suffern, Angie Chmiel, the Bronx, Mary Ciccarone, Suffern; two brothers, Louis Vellucci, Florida and James Vellucci, Suffern. Also surviving are several nieces and nephews.

He was predeceased by a son,

Belleayre

(continued from page 1A)

form and he anticipates reaching out for some preliminary public input within the next two weeks. Afterwards an actual draft of the plan will be circulated and larger public sessions will be held to gain more insight from the community. Lanza expects the plan to be accepted and adopted by the Department of Environment Conservation by the fall.

The plan, expected to call for ambitious expansion of the size of the facility, will be based on plans created in the late 1980s by Sno Engineering, a ski industry-consulting firm.

According to a report prepared in 1997 by the Town of Shandaken Rte. 28 Corridor Committee, the state commissioned Sno Engineering to do a $250,000 study of Belleayre. Pointing to a facility they described as obsolete and inadequate, Sno-Engineering personnel developed an expansion plan based on the belief that unless something was done the local economy would deteriorate along with the slopes.

That plan, the corridor report claims, called for the development of the eastern peak overhanging Pine Hill, the creation of several new modern lift devices including gondolas, the connection of the new facilities with the existing facilities, and the development of the hamlet of Pine Hill as potentially one of the most exciting ski venues in the east: long and varied runs, some approaching two miles in length; and vertical drops of nearly 2,000 feet. Sno Engineering predicted the creation of 1,400 new jobs from this effort, the construction of several new hotel/motels, and the ability to generate considerable year-round athletic and cultural activities.

Lanza said Belleayre needs to plan for handling as many as 10,000 skiers a day in the coming years, up from the 6,000 mark Belleayre currently enjoys on peak days.

He said the unit management plan would enable Belleayre to "live out the dream of the 1949 constitution." Belleayre, except for some modest expansions, has remained pretty much the same as it was when it was created in that year.

"One of the good things that has come from nothing happening for 50 years is that some pretty good minds have had a chance to study it," Lanza said, "I think that these days too much development is done in haste."

According to the State DEC, Unit Management. Plans, they are intended to assess the natural and physical resources present within a unit, identify opportunities for recreational use and consider the ability of the resources and ecosystems to accommodate public use. Further, they identify management objectives for public use which are consistent with the land classification guidelines and the wild character of these lands.

Valkenburgh Finch.

He married Bernice Guild on February 25, 1940 in Fleischmanns.

He was a resident of the Fleischmanns and Arkville areas most of his life.

Floyd was a veteran of the United States Army, having served from April 12, 1945 to December 7, 1945.

He was a logger and truck farmer. Later he worked with his sons on construction projects. Before retirement he worked on the home farm in the stone quarry.

He was a member of American Legion Post 216, Margaretville and attended the Clovesville Baptist Church.

Surviving are his two sons, Raymond Finch of Arkville and Roy Finch of Bloomville and a daughter, Kathleen Finch of Delhi. Also surviving are grandchildren, nieces and nephews.

He was predeceased by his wife Bernice Finch on January 22, 1989.

Funeral services will be held at 1 p.m. Thursday, May 23, at Hy-

SENIOR DINING CENTER NEWS

Dorothea Lage celebrated her 71st birthday last Tuesday with a very special cake. She received many complements.

The previous week Danny McConroy's name was omitted from the list of volunteers who were given a calculator by Joe Temming, senior meals project director under Delaware Opportunities in Delhi.

The new menu schedules, covering the next nine weeks are being given out this week at the center. The monthly evening meal on Thursday brought out 25 seniors. The 50-50 raffle earned $26 for the ongoing van fund due to the two persons who won donating their winnings back.

Manager Vicki Winner would like to remind everyone that this Saturday Country Express and Hilton Kelly and the Sidekicks will be providing the music at the Jamboree being held at th[illegible]des firemen's pavilion. Those without tickets can still get them from her at this center or may purchase them Saturday at the door. Why not come and kick up your heels with some round and square dancing?

New Kingston

by Wanda Lanzi 586-4657

Roger and Pauline Kawczak of Fonda were here Friday, May 10 and visited some friends. They also treated Ila Faulkner to lunch.

Last week Tuesday Elizabeth Nichols and daughter-in-law DeAnne Hoffman of Lincoln, MT and her daughter Bonnie Mack of Fleischmanns visited Wanda Lanzi and had lunch with her. They left Wednesday night from Albany by train for their return home after spen[illegible] a month with her daughter Bonnie.

Betty Elliott attended the DAR meeting Thursday at the home of Jeanette Frantz in Stamford.

Pat Webster of Baldwinsville is spending a few days with her [illegible] Doris Hosier and also Jim scheduled to be completed by the end of August.

failed causing the westbound September 30th.

Please see Detour, page 10

Plan Committee
ntinue its Work

beginning of Monday's meeting, he talked about how the committee was formed and described the process leading up to the release of the draft plan in January.

He said the turnout was a "testament to Shandaken's public interest in its own future". But he went on to blame a grassroots organization called Citizens for Progress for taking out "expensive ads" in this newspaper for inflaming the public with disinformation. "I know that members if the committee are discussing and contemplating how, or if, to proceed," said DiModica. "That's for them to decide. Let's give them time to see what they want to do after their next meeting." That meeting is slated for March 10th at Shandaken Town Hall at 7 pm.

But DiModica was criticized for canceling the previous meeting over the objection of the committee chairman. That evening, a fast moving snow storm created extremely hazardous driving conditions. And, in the name of public safety, DiModica called the meeting off. Still, several people voiced their dissatisfaction on how the matter was handled, especially those who drove to Town Hall only to find a note on the door announcing the cancelation.

DiModica said he would try to find another way to get the word out to the public, either through radio stations or an

Please see Comp. Plan, page 10

Finalizes Plans for
ll Water Purchase

additional grants to rebuild the sidewalks and place information kiosks in Pine Hill and Phoenicia.

The residents of Pine Hill have been trying to acquire the water company assets, which are privately held. A deal was struck several months ago that will permit that to happen. Part of the evening's business at Monday's Town Board meeting was to seek to transfer grants and low interest loans obtained by the owner to the town. This will allow the century-old water system to be rehabilitated and operated by the Pine Hill Water District.

While the Town Board has on several occasions approved the formation of the water district, Monday's actions were legal matters that had to be addressed again. It has also sought the transfer of grants from the state Environmental Facilities

Please see Water, page 10

Belleayre Officials Asking For Input From Public

(HIGHMOUNT) - The Belleayre Ski Center is experiencing growing pains and needs to revamp its way of doing business. But instead of telling the public what it plans to do, officials of the state-owned ski center are asking members of the community for their opinions first.

Close to 100 people attended a public forum on Belleayre's future last Saturday evening at the ski center's lower lodge. In a question and answer session, Belleayre Superintendent Tony Lanza first explained Belleayre's mission statement and the reason for its existence. It was build in 1949 to serve the community by first, providing much needed jobs, and secondly, a place for winter recreation.

But a lot has changed since it was first built. After hearing comments from the public about their opinions on Belleayre, Lanza presented observations from the facility's staff. Displaying photos from that same day, Lanza showed people on line waiting. And waiting, and waiting. He called it "critical mass". "Its not good to have someone drive two hours from New York City or four hours from Philadelphia to have to spend a couple of hours waiting to get to the slopes," said Lanza.

The lodges are no longer big enough to handle the crowds. Even with the expansion of the ski shop, there is still not enough room or equipment to handle the crowds. "There is a five year wait for seasonal lockers," said Lanza. "These are not Giants tickets."

He showed photos of a facility that has outgrown its facilities. And he discussed the differences between when the facility was first built and today. The first trails were built on the upper part of the mountain when there was no such thing as snow making. No trails were cut below 2,500 feet. Eventually, the mountain expanded when the lower area was developed. But this left a fragmented mountain with little continuity. The main parking facility was in the middle of the mountain as is the maintenance building. "There's no reason for these to be where they are," said Lanza.

After again listening to what the public had to say, Lanza showed some ideas from the mountain's staff. There is plenty of room at the base of the mountain near Route 28 for parking and the new maintenance facility, which can be built so it is not seen from the road. That would set the stage for the conversion of the upper parking lot to ski trails that would better connect the top and bottom of the mountain. Or a bridge could be built over the lot allowing skiers to get through while keeping the much needed parking..

There were complaints from the public about the speed of the Superchief quad lift. Some refer to it as the "Supersloth" because it can take as long as 20 minutes to reach the summit on a busy weekend. Lanza noted that without detachable chairs, the lift has to be stopped every time someone has trouble getting off. In the past, according to Lanza, there was a reason for the slow lift. The staff wanted to slow the number of people going up the mountain so it could control the traffic coming down. But with the opening of the west side of the mountain, as well as planned expansion to the east, there was no longer a concern about congestion coming down the mountain.

Preliminary plans call for the possible removal of lifts 1, 2 and 7 to be replaced with a detachable "six pack" that would run from the lower level to the upper lodge area and then on to the summit. By making the Supercheif detachable, skiers and boarders could ride to the summit in only eight minutes. Then there was the eastern expansion.

According to Lanza, two new trails could be cut that would run from the eastern summit down to the outskirts of Pine Hill. They would be 7,700 feet long with a 1,690 foot vertical drop from Cathedral Brook down to Bonnieview Avenue. Lanza said it would be a "box canyon" at the base with no parking areas, no lodge, no facilities and no vehicular access from outside. Lanza has said in the past that allowing vehicular access to this lift could bring hundreds of cars

Please see Belleayre, page 10

Considering Changes in

Ulster County Townsman 3/6/03

cause for concern but there are still plenty of ice slabs between one and two feet thick that have to melt off slowly and easily or else there could be problems.

Belleayre

Continued from page 1

into Pine Hill and he has heard the message loud and clear, Pine Hill cannot handle that kind of traffic.

Intermediate and beginners could access the new lift, which could be a gondola. From the summit, experts could head off in one direction while those with less experience could access a 2.2 mile trail to be bottom.

At its low point, Belleayre attracted some 70,000 skier visits per year. But as of last Saturday, Belleayre had drawn 145,000, a new all time record. "And we have seven weeks left in the season," said Lanza. "We're going off the chart."

The previous Unit Management Plan for Belleayre was based on 2,500 to 3,000 skiers per day. "We at 6,000 per day and we are planning for 7,000 to 9,000 per day," said Lanza. That would mean over 250,000 skier visits per year with an estimated secondary economic impact on the surrounding communities of $88 million.

But the plans and ideas do not stop there. Belleayre has become a 12-month attraction. Plans could include the expansion of the Pine Hill Day Use Area lake facility with an expanded beach, more parking, showers and other amenities.

There were questions from the audience on expanding Route 28 to ease congestion. Some asked about adding snow tubing and mountain biking. There were also suggestions of creating a transportation system to the mountain. But Lanza said these ideas were best left to the private sector. Ski Plattekill is now a magnet for mountain bikes. Hunter and Cortina Valley have snow tubing. And the transportation issue is in the hands of other agencies. He said Belleayre was not trying to take business away from other private facilities.

There will be time to present comments before the new Unit Management Plan is readied for formal presentation to the public. Hearings will be held and an environmental review will be conducted. Comments may be sent to Heather VanBenschoten, Belleayre Ski Center, P.O. Box 313, Highmount, NY 12441.

Lanza said the plan was the public's and not Belleayre's. The more input and comments, the better. All plans are subject to approval so the plan is still a work in progress, according to Lanza. Now is the time to plan for the year 2050, said Lanza.

Water

Continued from page 1

Corporation and a loan from the federal department of Housing and Urban Development.

"Didn't we already apply for these funds?" asked Councilwoman Jane Todd. "EFC is a pain in the neck to deal with," said Supervisor Peter DiModica. "We have to do it again."

The town has retained the Albany-based law firm of Nolan and Heller, LLP, to assist in the process. The firm's agreement with the town enco[illegible]sses negotiating the agreement with the owner of already been commenced seeking to change the agreement with the owner. The water assets are owned by developer Dean Gitter and opponents of his plans to build a resort complex have been trying to wrest control of the water assets for several years. The latest legal challenge was mounted by the Pine Hill Water District Coalition, the Catskill Heritage Alliance and the Natural Resources Defense Council. The challenge claims that by taking a portion of the former Crystal Spring away from the assets of Pine Hill and commit- will be used as leverage for other upgrades to the streets.

According to Budrock, more work needs to be done prior to the April 1st application deadline.

And in conjunction with Shandaken's bicentennial, an additional grant, not to exceed $5,000 will be sought for the kiosks, a brochure for a driving tour of the town as well as a new street-scape for the hamlet of Phoenicia if it is approved for a new sewage treatment plant.

The P[illegible]nicia treatment facility has been on the back

Police Blotter

The following are reports taken either directly from police blotters or supplied to this paper by the law enforcement agency involved. The information that follows only reports an arrest, complaint or report and does not mean the individual or individuals involved are guilty of any crime.

(SHANDAKEN) - Richard E. Buotte, Jr., age 16 of Staatsburg was charged with petite larceny and possession of a forged instrument, misdemeanors following a report of a stolen snow board at the Belleayre Ski Center in Highmount.

Security personnel at the ski center provided Shandaken police with a description of the vehicle Buotte was a passenger in and it was stopped a short time later by police.

Following interviews with the occupants of the vehicle, Buotte was taken into custody. While being processed by Shandaken Police, it was discovered Buotte was in possession of a New York State driver's license with an altered date.

He was issued an appearance

Detour

Continued from page 1

establish a detour using state Route 28 and 375 in Woodstock. But most local motorists will instead try to use Wittenberg Road, which will increase the traffic on that county road. In addition, the Pine Hill-Trailways bus, which usually travels Route 212 will have to find another route during the construction.

As a greater concern, the road closing will cut off a portion of the town of Woodstock from its police, fire and ambulance service. Arrangements are being made with the towns of Olive and Shandaken for coverage in the event of an emergency.

Work is slated to begin on April 17th, weather permitting. It is anticipated that actual construction work will begin around the end of June with a September completion the goal. A performance clause has been included in

Comp. Plan

Continued from page 1

internet service that lists cancelations.

Mark Dixon of Chichester took exception to DiModica's statement that the people were drawn out by the ads in The Townsman. He said the people had a problem with what DiModica's committee had prepared. He accused the committee members appointed by future. A committee was formed and Dan Shuster of Shuster and Associates was hired to assist the committee. What is now known as the Shuster Committee submitted its draft to the Ulster County Planning Board which came back with 70, non-binding suggestions, wh[illegible] DiModica termed "criticism". The plan

;ki resort gets $5 million boost:[THREE STAR Edition]

'imes Union. Albany: Feb 1, 1998. pg. D.5

» Jump to full text

S n:	*Capital Region*
Publication title:	Times Union. Albany: Feb 1, 1998. pg. D.5
Source Type:	Newspaper
ProQuest document ID:	25831696
Text Word Count	392
Article URL:	http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&res_dat=xri:pqd&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&rft_dat=xri:pqd:did=000000025831696&svc

Abstract (Article Summary)

The state-owned Belleayre ski resort, long a poorer cousin to Gore and Whiteface mountains, will get a $5 million lift from the government.

Belleayre Mountain, which is enjoying a 25 percent increase in ski visits this year, is one of the finest family ski centers in the Northeast, Gov. George Pataki said Saturday. "We need to make intelligent investments in Belleayre to ensure that it remains an economic engine for the Catskills region and the Route28 corridor."

Full Text (392 words)

Table]

Albany Ulster officials say Pataki has long forgotten

49-year-old Belleayre

The state-owned Belleayre ski resort, long a poorer cousin to Gore and Whiteface mountains, will get a $5 million lift from the government.

Belleayre Mountain, which is enjoying a 25 percent increase in ski visits this year, is one of the finest family ski centers in the Northeast, Gov. George Pataki said Saturday. "We need to make intelligent investments in Belleayre to ensure that it remains an economic engine for the Catskills region and the Route28 corridor."

The money, which will come out of the 1997-98 state budget for capital improvements, will be used to replace a ski lift, tripling the skier capacity; to construct a new trail to increase the top elevation for skiing from 800 to 1,000 vertical feet; to install another new lift to an expanded snowboard park; to add snow-making pumps, which will increase the capacity from 2,000 to 3,000 gallons; to expand the lodge; and to add a connector lift from the lower to upper ski areas.

Ulster County leaders had pushed hard for the aid for the 49-year-old ski area, which they had called a poorer cousin to the state's other two ski areas in the Adirondacks. The Ulster County Townsman newspaper ran a headline -- "Pataki to Catskills: Drop Dead!" -- that was placed on bumper stickers with a cartoon of a spiderweb-covered skier.

Most of the improvements are expected to be completed for the 1998-99 ski season, but the expanded lodge, new trail and connector lift are slated for the 1999-2000season

The resort also will receive an added publicity boost by its use in the I Love New York promotion campaign and by the addition of signs to the state Thruway to announce its presence off Exit 19.

The resort, operated by the state Department of Environmental Conservation, has 2,166 acres in the Catskill Park. In September, Pataki announced that he would provide $1.5 million from the Clean Water/Clean Air Bond Act to improve waste water treatment at Belleayre. The mountain's aging septic system and its discharges don't meet state water quality standards.

Illustration]

:aption: STEVE JACOBS/TIMES UNION A PROTESTER has his say about the lack of funding for the Belleayre ski resort during an October protest outside the Capitol. The Belleayre resort is an economic pillar in the ski region.

:redit: TIMO'BRIEN Staff writer

CARPENTER
ENVIRONMENTAL
ASSOCIATES, Inc.
CEA ENGINEERS, P.C.

307 Museum Village Road
PO Box 656
Monroe, New York 10950

Phone: 845-781-4844
Fax: 845-782-5591
www.ceaenviro.com

Sender's E-mail: s.garabed@cea-enviro.com

April 20, 2004

New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, NY 12561-1696

Attn: Mr. Alexander Ciesluk, Jr.

Re: Draft Environmental Impact Statement for the Belleayre Resort at Catskill Park
CEA No. 04017

Dear Mr Ciesluk:

Carpenter Environmental Associates, Inc. (CEA) on behalf of Riverkeeper, Inc. (Riverkeeper) has reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Belleayre Resort at Catskill Park. Please find our comments on the DEIS listed below.

1. Page 3-26 of the DEIS states that "No more than 25 acres of soil are proposed to be unstabilized at any given time within either reservoir watershed, but always with enhanced erosion control measures in place." Construction General Permit GP-02-01[1] under the section titled Minimum SWPPP Components, Section a.(4) states "there shall not be more than five (5) acres of disturbed soil at any one time without prior written approval from the Department. The Applicant has not provided sufficient information to justify a waiver of the 5 acre disturbance limit. The Applicant has stated that the CP series of plans exemplify the level of planning and phasing that will be completed for all phases of the project. However, the CP series of plans do not possess sufficient detail to warrant granting of a waiver. For example, CP-15 contains a table that lists the various erosion control technologies which can be used at the site based on the slope of the specific area requiring mitigation. Based on this plan twenty different technologies could be used in an area with slopes greater than 100%. The Applicant does not show which technology has been selected for use. Prior to starting work in an area, the Applicant, the New York State Department of Environmental Conservation (NYSDEC) and the public must know exactly what

[1] The SWPPP page 3 of 44 references compliance with the GP-02-01 (SPDES General Permit for Stormwater Discharges from a Construction Activity). However, the NYSDEC has informed me that the Applicant is applying for individual stormwater discharge permits.

erosion controls will be used. The Applicant should be required to show exactly how erosion and sediment control will be addressed in an area. The Applicant is requesting that NYSDEC waive its disturbance requirement, but the Applicant has not properly demonstrated that proper erosion and sediment controls will be used to protect these large areas of soil disturbance. Without specific erosion control plans and details the Applicant's waiver request should be denied.

2. The Applicant proposes the potential use of gabions and retaining walls at the site. These are structural controls which require engineering design. The Applicant should be required to show on the plans precisely where these controls and any other controls requiring engineering design will be installed. The NYSDEC and the public must know exactly what structural controls are to be used so that their design and placement can be evaluated.
3. Page 2-37 of the DEIS states that a number of locations have been identified as being suitable for stockpiles, and that these stockpiles will be stabilized by "enhanced erosion and sediment controls". All stockpile areas along with the "enhanced erosion and sediment controls" must be shown on the soil erosion and sediment control plans. This is another example of the detail that is missing from the Applicant's plans.
4. Page 3-30 of the DEIS and Page 6 of 44 of the SWPPP (Appendix 11, under Section 6) discusses the sequence of activities for Phase 2 of the construction. This sequence of activities shows that the Applicant will install perimeter control after centerline clearing has taken place. Perimeter control/erosion control measures must be completed prior to any earth disturbing activities.
5. Page 13 of 44 of the SWPPP (Appendix 11) references Figures 3-5 and 3-6 as soils maps for the western and eastern portions of the site respectively. The correct Figure numbers are 3-6 and 3-7.
6. The Drawings PF 1-3, titled Phasing and Erosion Control Plans, are seriously lacking soil erosion device detail. There is extremely limited soil erosion device information on these plans, yet they are titled Erosion Control Plans. Furthermore, the PH series of plans are not consistent with the CP series of plans, in terms of the erosion control devices that are to be used. For example, PH-3 shows the use of silt fence only around the tip of hole 3 at Big Indian Plateau. Yet CP-6 shows the use of silt fence around the perimeter of the entire construction area for this hole. It is understood that PH series of plans cannot show the level of detail that is shown on the CP series of plans. However, these plans should show the major erosion controls that will be used and they should be consistent with the measures shown on the CP series of plans. As stated previously in Comment 1, even the CP series of plans do not provide sufficient detail of the soil erosion and sediment control practices planned for the site.
7. Appendix 9 of the DEIS (Construction Phase SW Management) (page No. 1 in the middle on the Appendix) states that La Group Plan Sheet CP-2 shows the location of the level spreaders. The level spreaders are not shown on this drawing or any other drawing. The locations and dimensions of the level spreaders should be shown on the plans so that the public and interested parties can evaluate the potential impacts that could result from the use of level

spreaders, and so the Applicant can evaluate the feasibility of using level spreaders at the chosen locations.

8. Page 33 of 44 of the SWPPP (Appendix 11) states that surface water monitoring will be completed above and below the project area. Presumably this data will be used to assess the effectiveness of the stormwater and erosion control practices during construction. However, it is unclear how the Applicant will determine when a change in the water quality is due to naturally occurring conditions, or due to the Belleayre project. The Applicant should be required to develop a plan which statistically evaluates the available water quality data and determines the natural fluctuations in the water quality that can be expected to occur. This plan should establish water quality action levels, and provide details on what actions will be taken if the water quality exceeds the action levels. Without such a plan, the collection of water quality data will most likely be useless or of limited value.
9. Page 36 of 44 of the SWPPP (Appendix 11) states that petroleum for fueling the construction vehicles will be stored onsite. Secondary containment or Convault tanks will be used to store the fuel. However, the Applicant does not provide any secondary containment for the area where the vehicles will be fueled (i.e., the fuel transfer area). The Applicant should provide a fuel transfer area with an impervious surface, and containment capable of containing the largest anticipated spill that can occur in the area. The design of the fuel transfer area should also include provisions for the storage of rainwater if it is possible for rainwater to accumulate in the transfer area. The provision for and utilization of a fuel transfer area is a standard Best Management Practice.
10. The soil erosion plan does not utilize the symbols required by the NYSDEC.
11. The detailed soil erosion plans (i.e., CP-1 to CP-18) do not have the sediment basins clearly labeled, which makes the review of the plans difficult.
12. Page 15 of 44 of the SWPPP (Appendix 11) discusses the use of temporary sediment and stormwater basins to capture and hold runoff from the entire subcatchment area draining to them. These basins are designed to store the runoff associated with the 10 year storm. The Applicant's basin design only provides sufficient storage volume to hold stormwater. The Applicant has failed to provide the required sediment storage in the stormwater/sediment basins. For example, Appendix 9 of the DEIS, page 2 of the Hydrocad calculations shows that for subcatchment 211, the runoff from a 10 year storm will generate 1.07 ac-ft of water. The runoff from subcatchment 211 is directed to basin 211. Basin 211 (see page 15 of the Hydrocad calculations) has a peak storage capacity of 1.07 ac-ft. The New York Guidelines for Urban Erosion and Sediment Control (page 5A.47) states that "the sediment storage volume of the basin, as measured from the bottom of the basin to the elevation of the crest of the principal spillway shall be at least 1,800 cubic feet per acre of disturbed area draining to the basin." Using this guidance for subcatchment 211, which has a drainage area of 3.0 acres, 0.124 ac-ft (5,400 ft^3) of sediment storage is required. This would increase the required basin volume to 1.19 ac-ft. The Applicant must increase the storage volume of the stormwater/sediment basins

to allow for the accumulation of sediments. The sediment basins should be designed in accordance with the New York Guidelines for Urban Erosion and Sediment Control.

13. The Final SWPPP must include an accurate construction schedule as required by NYSDEC. The construction schedule included in the Draft SWPPP is incomplete.
14. The SWPPP must include a discussion of the existence of any environmentally sensitive areas as required by the NYSDEC. The Draft SWPPP provided no information on the existence or the lack thereof of environmentally sensitive areas.
15. The NYSDEC has developed a Total Maximum Daily Load (TMDL) for phosphorus within the Ashokan Watershed. According to Appendix 10 of the DEIS, there is flexibility in the loading assigned to non-point sources since as of 1996, the actual phosphorus loading from non-point sources was less than the allocated loading. Data from 1996 is not sufficient to make a determination as to whether there is available loading within the Ashokan Watershed today. After over eight years, there has likely been additional development which has increased the phosphorus loading within the watershed. The cumulative impact of all projects since 1996 and any proposed projects which would be concurrent with the construction phase of the Belleayre project must be considered in determining whether the TMDL will be complied with. For example, the NYSDEC recently released the Draft SPDES permit for the Shandaken Tunnel. This permit includes the Shandaken Tunnel as an additional point source within the watershed and allocates 10,457 kg/yr to the Shandaken Tunnel. Since the discharge from the Tunnel was unaccounted for in the original TMDL allocations[2], the proposed allocation of 10,457 kg/yr exceeds the 8,026 kg/yr margin of flexibility for non-point sources, meaning that no additional inputs of phosphorus would be allowable. The Applicant must reevaluate the phosphorus loading from the site using current data, discharge permits, and planned or completed projects, so that an accurate and up to date assessment of compliance with the TMDL can be completed.
16. The check dam detail shown on plan CP-18 does not comply with the New York Guidelines for Urban Erosion and Sediment Control.
17. Page 16 of 44 of the SWPPP (Appendix 11) states that Chitosan (i.e., Storm Klear) will be used as the flocculant for the stormwater/sediment basins. There is conflicting information on the toxicity of this flocculant to rainbow trout. Toxicity to cultured rainbow trout was observed at concentrations as low as

---

2 Appendix 10 of the DEIS indicates that only 254 kg/yr was allocated to point sources. Therefore, the Shandaken Tunnel was not originally included as a point source in the TMDL. Phosphorus loadings from the Shandaken Tunnel may have been included in the non-point source allocation, although it is not clear from the TMDL documents whether this is indeed the case.

0.075 mg/l after 24 hours of exposure[3]. On the contrary, the information found in Appendix 2 of the DEIS shows that Chitosan used at the proposed dose of 1 to 2 mg/l is not toxic to rainbow trout. Since there is some question as the toxicity of this flocculant, the Applicant must be required to evaluate the potential toxicity of Storm Clear under site specific conditions. This could be accomplished by completing bioassay testing on a stormwater sample collected from the first stormwater/sediment basin installed at the project site. Without such testing, the use of Storm Klear at the site may cause an adverse impact to the trout population of the receiving waters.

Based on the information contained in the DEIS the Applicant has failed to provide sufficient information and has not completed the analyses necessary to satisfy the requirements of SEQRA. If you have any questions regarding my comments on the DEIS, please do not hesitate to contact me at (845) 781-4844.

Sincerely,

CEA ENGINEERS, P.C.

Steven R. Garabed, P.E.
Sr. Engineer

3 "Toxicity of acidified chitosan for cultured rainbow trout (Oncorhynchus mykiss)", Graham Bullock, Vicki Blazer, Scott Tsukuda, Steve Summerfelt, Aquaculture, Elsevier Science, November 7, 1999.

Memo from: Robert Pitt, Environmental Engineer, 2137 Farley Rd Birmingham, AL 35226
(rpittal@charter.net)

To: Robin E. Marx D.V.M., Natural Resources Defense Council, 40 W. 20th Street
New York, NY 10011 (RMarx@nrdc.org)

Date: **April 16, 2004**

Subject: Review of stormwater elements of Belleayre Resort draft EIS

This letter contains my comments pertaining to the use of the WinSLAMM model and related stormwater issues, as part of the Draft Environmental Impact Statement for the Belleayre Resort at Catskill Park. At your request, I reviewed the CDs containing the report and supporting appendices and the WinSLAMM files, along with a set of full-sized engineering drawings. Although I specifically reviewed sections of the draft EIS concerning the use of the WinSLAMM model, I also examined other sections pertaining to stormwater issues.

I am the Cudworth Professor of Urban Water Systems and Director of Environmental Engineering Programs at the University of Alabama. I currently teach classes in urban water resources, stressing the integration of hydrology and water quality issues. Prior to coming to Tuscaloosa three years ago, I was at the University of Alabama at Birmingham for 14 years, and previously was a senior engineer with industry and government for 16 years. My Ph.D. is from the University of Wisconsin-Madison, my MSCE from California State University, San Jose, and my BS from Humboldt State University in Arcata, California.

I have been active in stormwater research for most of my professional career, having conducted research for the U.S. Environmental Protection Agency, the National Science Foundation, Environment Canada, many state and local agencies, and some industries. I have published numerous reports and papers, including several books. I am also the principal author of the Source Loading and Management Model (SLAMM), amongst other programs. The SLAMM Model has become one of the nation's leading computer models for understanding and predicting stormwater flows and pollutants. I am a Registered Engineer in the state of Wisconsin, and am a Diplomate of the American Academy of Environmental Engineers.

In the following sections, I identify major problem areas or questions with the draft EIS relating to stormwater control.

A. Problems With DEIS Application of WinSLAMM Model

My biggest concern found during the review of this draft EIS and its appendices was the applicant's use of the WinSLAMM model to characterize pre-development conditions relating to stormwater runoff at the project site. WinSLAMM was designed to predict stormwater flows and pollutant characteristics after site development, and was never intended for characterizing pre-development pollutant discharge conditions.

In the case of the Belleayre site, the pre-development conditions are almost exclusively heavily wooded areas, undergoing some logging. The "undeveloped" or "open space" conditions in WinSLAMM, however, were meant for small areas of open space in otherwise developed urban land uses. The parameter files supplied with WinSLAMM, and used for this evaluation, were calibrated and verified for urban areas, including small undeveloped parcels in otherwise urban areas. To my knowledge, the model has never been used to evaluate pre-development runoff and pollutant discharge conditions for large forested areas. Moreover, there is no indication that the model results for the pre-development conditions were compared to the existing local water quality and flow measurement data, or that the WinSLAMM files were modified to reflect these local conditions. As with all stormwater models, WinSLAMM needs to be correctly calibrated and verified. As far as I could tell from my review of the draft EIS and Appendix 10A, the WinSLAMM parameter files appeared to be unmodified from those distributed with the program and therefore not applicable for undeveloped forested land.

A second and related problem in the draft EIS and Appendix 10A also concerns stormwater modeling for the project. Neither the draft EIS nor the appendix adequately describe the data or assumptions used as input for the model to calculate stormwater runoff. I therefore reviewed each input file to see how the parameter files were used and how the sites were described in the program. The source of rainfall data was the Tannersville9094 file. I assume this represents local rainfall conditions for the 1990 to 1994 period. Using a local rain file for an extended period is extremely important when running the program, second only to describing the watershed areas correctly. However, all of the other parameter files used (e.g., Bham.ppd, runoff.rsv, Madison.psc, and delivery prr) were the general "default" files supplied with the program. We have found these files to be generally useful when there are limited local data available and for preliminary analyses. However, good modeling practice requires that they be modified to reflect local conditions, by undergoing a basic calibration and verification process, especially for important projects and when absolute pollutant discharge estimates are needed.

Obviously, it is not possible to calibrate a model based upon future conditions that do not yet exist. But regional data for similar conditions as expected in the future should be used for important projects. However, without the use of local data for calibration and verification of the model, the accuracy of the calculations made by the WinSLAMM model is jeopardized. With careful calibration and verification of WinSLAMM using a moderate amount of local data, typical errors of pollutant discharge calculations are usually within 25% of measured values. Additional calibration data can usually reduce these errors even more. To be sure, pollutant reduction estimates associated with stormwater controls can be reasonably calculated using the default parameter files and local rain and site data, as was used in this project. However, without the use of local calibration and verification data (although using appropriate local rainfall data and accurate site descriptions), while post-development runoff volume estimates are usually within 25% of measured values, errors in the pollutant discharge estimates can be much greater.

B. Other Concerns Regarding Projected Stormwater Flow

Another concern I have relates to what may be overly optimistic assumptions concerning the effectiveness of the proposed series of stormwater detention basins. The project sponsor suggests, on page 10 of Appendix 10A, that the model results for post-development conditions "can be considered to be conservative in the amount of pollutant reduction it shows... because the proposed detention basins in some cases will occur in series, which is a situation that the WinSLAMM model cannot simulate." I disagree with this statement because when ponds are in series, only the single largest pond will be effective for the removal of particulate pollutants. Downstream smaller ponds will not be able to remove any of the particulates discharged from upstream larger ponds. In fact, the discharged water from these upper ponds will adversely affect the performance of the lower ponds.

I turn briefly to the issue of the volume of runoff from these ponds. On pages 2 and 3 of Appendix 10A, there is a description of the reductions in stormwater runoff volume associated with pond use. But the ponds will not reduce the runoff volumes unless evaporation or seepage also occurs. The draft EIS projects a 29% reduction in stormwater flow, a figure that seems large for volume losses, especially as the attachment states that the ponds will be lined, thus precluding infiltration. There is insufficient information in the draft EIS to reconstruct this analysis. The approach and data used to arrive at these conclusions need to be explained in the final documents.

I have a third concern related to the assumptions made on the efficacy of stormwater control devices. I question whether the micropool extended detention ponds, planned for the site, will provide 80% suspended solids and 40% phosphorus removal. I feel that these removal rates are overly optimistic, compared to available performance data in the ASCE/EPA Best Management Practices database. Are there local data supporting these high removal rates? And why weren't the most up-to-date data used?

Finally, the DEIS and appendices relating to stormwater runoff do not adequately describe the protocols for maintenance of stormwater controls and water quality testing. These important activities should be fully described. For example, the documents do not discuss the schedule for water quality testing and what will be done if the results indicate poor stormwater control. Equally important is the schedule for maintaining stormwater controls. How often will maintenance and inspection occur? What about after significant weather events? There should be a detailed maintenance plan and a guarantee that maintenance will be performed in perpetuity.

C. Concerns Regarding Runoff from Snowmelt

I next turn to a series of problems with the draft EIS and supporting documents (i.e., Section 5 of Appendix 10A) relating to the management of pollution runoff from snowmelt. Studies from the Upper Midwest and Great Lakes areas have found that pollution loads from snowmelt can exceed pollution loads from mild weather stormwater events for many constituents. Therefore, it is likely that pollution loadings from snowmelt at the project site would be similarly elevated. . The draft EIS documents fail to take these increases into account. A related problem with snowmelt is that it is usually more difficult to control snowmelt with detention ponds due to the finer particle sizes in the snowmelt water. As discussed in the draft EIS, the stormwater ponds for snowmelt normally have to be sized larger than ponds for stormwater runoff. The proposed storage volumes listed in the draft EIS seem to be adequate, but water quality concerns regarding the increased snowmelt loads after development have not been addressed in the draft EIS. Even with runoff controls, the discharges of pollutants from the stormwater and snowmelt will be greater after development than before development. The runoff controls hopefully will reduce the increases, but it is very unlikely that they will reduce these to pre-development levels.

Another problem with stormwater ponds located in cold climates is that during snowmelt, the flow has a tendency to travel under the ice and scour out sediments. The draft EIS, however, does not include plans for modifying pond operation during cold weather, such as lowering water levels during the winter, so that snowmelt runoff can flow across the top of the ice during initial portions of the melt periods.

D. Trout Stream Impacts and Stormwater Mitigation

Table 3-2 lists a number of nearby trout streams that have portions of their watersheds on the project site. These small nearby streams will be affected by the proposed project runoff to a greater extent than the more distant water supply reservoirs, but they receive little attention in the DEIS. The amount of the proposed development in the drainage areas for these streams, along with stormwater control features that will specifically protect these streams, needs to be described. Specific threats to these streams will be construction site erosion material, increased runoff temperatures, increased flow rates and flow volumes, and contaminated snowmelt, along with pollutant discharges from the project stormwater.

An important stormwater control option that is not adequately mentioned is the use of bioretention areas near the buildings and parking areas. These have been shown to be quite effective in controlling runoff temperature (while ponds usually contribute to temperature problems), and are usually less expensive and more effective than porous pavement. They can also be nicely integrated into the site landscaping. While the proposed "green roofs" are interesting, they are not well documented in the region of the site. The use of bioretention facilities are therefore also recommended as a back-up system to the proposed green roofs.

E. Other Concerns with the DEIS' Stormwater Sections

I conclude this report by identifying some of the small technical and labeling errors I found in the draft EIS documents that suggested a lack of attention to detail in their preparation.

- On page 9 of Appendix 10A, the "street delivery files" are defined incorrectly. They are not the particle size files (those are the *.cpz files). The *.std files reflect the limited energy associated with most rains in moving washed-off street dirt during rain events through the drainage systems.
- On page 11, there is some confusion as to the particle sizes of clay and colloids. Clay is defined as containing particles of less than 2 μm. Some of the clay in the runoff would therefore likely be retained on the 0.45 μm filters used for the particulate solids (SS) analyses. Most colloids, however, would pass through the filter. Also on page 11, Total

Kjeldahl Nitrogen (TKN) is defined as the sum of nitrates and nitrites. TKN is properly defined as the sum of organic nitrogen and ammonia.

- Section 10.7 is not labeled as such (it is the attached material to the appendix).

- On page 13 of Appendix 10A, it is noted that Total Kjeldahl Nitrogen (TKN) decreases with development. In fact, the calculated TKN increases with development, but not by much (from 1.74 to 1.89 mg/L).

- The CP-18 sheet, which should have explained project stormwater control designs in detail, is very generic and does not provide specific design information for this project.

- Table 2-3. The planted roof areas will be unique, especially for the size proposed. But the draft EIS fails to provide any data for similar installations in the proposed project area, or to identify design features that will be used to ensure their success for the harsh winter conditions.

- On page 3-34 there is a discussion of percolation tests performed at the proposed detention basin locations. These small-scale infiltration tests are suitable for initial investigations, but small tests usually greatly over-predict the actual infiltration capabilities. Large-scale tests should be conducted to insure that the proposed detention basins will actually achieve the design specifications for the high infiltration rates expected.

- Pg 3-49. There is a lack of performance data for micropool extended ponds. The ASCE/BMP database, the most comprehensive survey of pollutant removal by best management practices, shows highly inconsistent performance for micropool extended detention ponds such as those proposed in the draft EIS. The ASCE/BMP database lists pollutant removals ranging from about 0 to 65% for suspended solids. Higher levels of performance are associated with large pool areas and when the influent pollutant concentrations are high. Thus it is unlikely that the proposed stormwater ponds will remove the levels of phosphorus and suspended solids as predicted in the draft EIS.

- In Tables 3-4 to 3-7 (Appendix 18), it is not clear if the existing water quality data are only for dry weather, or if wet weather events are also represented. Generally, it seems that these background data represent reasonably good conditions (the min. for DO at one site is low and the fecal coliform maximums are periodically high, for example). Background conditions for wet weather should also have been included.

If you have any questions pertaining to these comments, please contact me.

Missing Items - These are items that you mentioned in our first phone call, but which are not discussed in your comments. It would be great if you could add a few sentences on each so that we could incorporate them into your existing comments.

--not much discussion of the small streams near the project and the value of headwaters
--effects of increased temperature in streams
--project will influence these streams much more than the reservoirs

--no discussion of bioretention around parking lots

KNISEL REPORT

Subject: Fertilizer and Pesticide Risk Assessment, Draft Environmental Impact Statement, The Belleayre Resort at Catskill Park, NY, Revised November 2002

A review of the subject DEIS was made as requested by Dr. Robin Marx, NRDC. The purpose of the review was to ascertain if sufficient information is included in the report to determine if the GLEAMS model was properly applied for the conclusions drawn by the authors.

Without actual model parameter files, it is impossible to make a concrete decision on whether the model was validly applied. Selection of some parameter values is somewhat subjective and this writer is not experienced in the geographical area of concern. Information gleaned from the DEIS for the different models, i.e. soils, site topography/model representation, fertilizer and pesticide application data, might indicate adequate GLEAMS application, but limited data make a firm conclusion impossible. Sample output was shown only for the plant nutrient (fertilizer) component, but not for the hydrology and pesticide components of the model. And despite the fact that three fertilizer scenarios were outlined, the sample GLEAMS output did not correspond to any of them.

Some parameter values were not specified in the report, i.e. soil horizon thickness and effective rooting depths. It would be helpful if the DEIS gave the respective soil textural classification in addition to the series names, i.e. Vly silt loam, for all soils. Likewise, it is not known from the DEIS if all soil series were modeled. It was not stated if topsoil would be stockpiled during construction of greens and fairways to be used on the golf course, or if soil material with different physical and chemical characteristics would be imported from elsewhere. Soil fill characteristics were not included on porosity, degree of compaction, etc. No indication is given if porosity values used in the LEACHM model are for "as is" conditions or those following long-term settled conditions from overburden compaction or for the existing residual soil in situ.

There is no information in the DEIS about nitrogen and phosphorus losses for the natural "as is" condition before construction. This is essential in determining the impact of constructing the golf courses. There is some nitrogen in rainfall and native phosphorus in the soil in the natural condition, but what is the increase due to golf course construction/management?

From my 50 years experience in hydrology and water quality research and modeling, I do not agree with the authors' use of the highest rainfall year as being the worst case. Certain sequences and timing of rainfall events in a lower rainfall year can cause significantly more pesticide leaching than the highest rainfall year. High rainfall years may result in considerable dilution of leached pesticides and result in lower pesticide losses. A given mass of soluble pesticide or fertilizer available in the soil may be removed with large volumes of runoff and percolation water, or removed by smaller volumes of runoff and percolation. Highest concentrations of pesticide leaching and runoff would result from smaller volumes of percolate/runoff water. This is the very reason the GLEAMS developers made provisions to simulate up to 50 years in a single model run using the rotation or continuous crop feature and examine the number of exceedances of threshold values such as LC_{50}. Will there be one exceedance in 50 years? Or does one exceedance occur every year? Because the DEIS only modeled one year, these questions were not answered.

The DEIS used the LEACHM model for pesticide leaching and the GLEAMS model for pesticide runoff. These independent simulations may be all right, but GLEAMS can give both runoff losses and leaching losses simultaneously. The authors' applications are dealers' choice, but there is only a given amount of pesticide available for runoff and for leaching. Runoff and leaching occur simultaneously. The DEIS's applications says there is no runoff, and that LEACHM will give the worst case leaching losses. Then they turn around and use GLEAMS to determine pesticide runoff losses which are properly partitioned between runoff and percolation.

The DEIS does not discuss harvesting (clipping) the golf course fairway. If grass is clipped and removed, nitrogen and phosphorus are transported out of the system. If clippings are not removed, there is a biomass accumulation with recycling of nitrogen and phosphorus which is included in the GLEAMS model. This may be discussed in other parts of the DEIS, but it does have long-term effects.

There is one falsehood in the DEIS: GLEAMS was developed by the USDA-ARS and University of Georgia, not USEPA.

In summary, the DEIS must be more specific to give soil textures for each of the series, and show the results for all soils represented. If all soils on the site have the same textural classification, this should be stated in the DEIS to explain why only one soil is represented. A sandy loam soil would give different results from the silt loam soil used in model application. Also, all conditions represented in the modeling should be given so the reader will know exactly what they did. That is, are they modeling the soils *in situ* (as they are now), reconstructed/replaced soils from the site, or reconstructed soils brought in from off-site? If soils will be brought in what are the characteristics of those soils? Model applications must be made for several years (3 to 10) to give a range of climate, i.e. rainfall and snow accumulations, to ascertain the long-term interactions of soils, climate and management.

Prepared April 20, 2004

Walter G. Knisel, Ph.D.
GLEAMS Developer/Consultant (Retired)
1606 Rutland Road
Tifton, GA 31793
wknisel@planttel.net
229-382-1332

April 23, 2004

Alexander Ciesluk, Jr.
Deputy Regional Permit Administrator, NYSDEC
21 South Putt Corners Road
New Paltz, NY 12561-1620

Re: The Belleayre Resort at Catskill Park

Dear Mr. Ciesluk:

We are submitting these comments as consultants to the Natural Resources Defense Council on the Draft Environmental Impact Statement for the Belleayre Resort at Catskill Park. In particular, our study reviewed four areas of water resources, as stated below.

The Gaia Institute is a 501(c) 3 not-for-profit corporation. Focused on environmental research and development, education and design, our work is centered on the restoration and ecological re-engineering of natural systems to protect and enhance environmental quality. The work of the Gaia Institute couples ecological engineering and restoration with the integration of human communities in natural systems. While much environmental engineering has the worthy aim of minimizing harm, the Gaia Institute explores, through research and development, design and construction, how human activities and waste products can be treated to increase ecological productivity, biodiversity, environmental quality, and economic well being. The purpose of the Gaia Institute is to test through demonstration the means by which the ecological components of backyards, communities, towns and cities, as well as watersheds and estuaries, can be enhanced through integrated wastes-into-resources technologies.

We have extensive experience working in the NYC watershed – both East and West of the Hudson. As pioneers in the study of soil infiltration and the interaction of vegetation and soil systems in the rhizosphere, we have worked with natural systems to enhance the capture of rain water, including runoff from buildings and other infrastructure. To apprehend the interaction of precipitation and natural systems and landscapes, methods utilized are grounded in an examination of water budgets the flows within the components of a system. In this context it is expected that precipitation falling on the forests and slopes of the area under design for the Belleayre Resort presently follows pathways and routes which predominantly entrain the great majority of this precipitation as groundwater. This is the process which, according to the USGS study cited below, and many others, preserves and enhances water quality and quantity. If disturbed, and if the pathways which presently move water into the water table are not restored, it is expected that consequent negative effects will inevitably follow [1]. This brief investigation attempts to identify the scale and extent of some of these consequences.

Prior experience in golf course and housing construction on steep slopes has provided us with direct experience in the erosive effects of such work. The Gaia Institute was retained by the Pine

[1] Effects of Residential and Agricultural Land Uses on the Chemical Quality of Baseflow of Small Streams in the Croton Watershed Southeastern New York. USGS. Dept. of the Interior. WRIR 99-4173. March 20000

Tree Lakes Homeowners Association in a complaint against Great Expectations and Pinecrest Associates brought because of severe sedimentation problems associated with housing, infrastructure, and golf course construction. Documentation of sediment deposits and clay and/or colloidal suspension in Pine Tree Lake following storm events demonstrated persistent negative impacts on water quality and habitat in the lake and watershed following construction in 1997 and 1998. Large area construction impacts on steep slopes mobilized tons of sediment and suspended clays which negatively impacted wetlands, feeder streams, and the lake within this watershed.

The Belleayre Resort at Catskill Park is a 573-acre development planned for construction in western Ulster and eastern Delaware counties near the Belleayre Mountain Ski Center. This four season project includes 400 rooms in two hotels, two 18-hole golf courses, detached hotel lodging units, and 1,387 acres of open space with hiking and nature trails. The East of Belleayre Big Indian Resort & Spa, Big Indian Country Club & Golf Course, and Belleayre Highlands, is located within the New York City Ashokan Reservoir watershed, about 20 miles from that waterbody, and would be served by central water (provided by an on-site well) and central wastewater treatment, with effluent discharge to Birch Creek and/or golf course irrigation. The West of Belleayre area includes Wildacres Resort, Highmont Golf Course, and Highmont Estates, is located 14 miles from the Pepacton Reservoir, and would be served by central water (provided by the Village of Fleischmanns water system) and central wastewater treatment, with effluent discharged to an unnamed tributary of Emory Brook and/or golf course irrigation.

Under the present approach, there are four areas of concern.

1. Construction Scale

The proposed 25 acre limit for exposed soil at any one time is too large by an order of magnitude. The reason for this is because, in scalar terms, half the precipitation from two year storm over a 25 acre site is equal to a million and a third gallons of water. By the same approach, if the export coefficient of the construction site approaches one half, runoff from ten year storm, half of six inches of precipitation over a 25 acre site would be two million gallons of water.

Even over a 24 hour period, such quantities of water piped into receiving streams would amount to cubic feet per second, increasing velocity and scour potential. Were such a storm to occur in an intense period of a few hours, discharges could approach 10 or more cubic feet per second, exacerbating scour in the receiving waters and the potential discharge of sediment including clays and colloids into the drinking water supply

Because of the scale of construction, it is likely that this approach will be more destructive than the simple quantity of acreage disturbed, since any management practices to capture and detain the quantities of water produced as runoff from the construction and final site design will themselves need to be large enough to accept quantities of input water. For example, in order to capture water from a two year storm, a detention basin designed to capture runoff from a 25 acre parcel of land would itself need to disturb an estimated 2 to 4 acres of land. If this analysis includes disturbance involved in conduit construction and placement, this estimate could become much larger.

This scale of excavation may also construction monitoring, since a 25 acre site 200 foot wide would be more than a mile long. In times of severe storms, it may not be possible for one certified stormwater monitor to cover such an expanse. No explanation is given as to why it is necessary to expose such a large expanse of soil at one time. This large scale excavation appears to be directly at odds with the bulleted erosion control/sediment control program which appears on page 5 of Appendix 11 of the DEIS which states:

• Land disturbance is divided into small compartments (Phases, Subphases, and Subcatchments) that can be rapidly constructed and stabilized

and

• The erosion control program dictates the construction sequencing

Construction at the scale of 25 acres, a million square feet, on a steep slope, must dictate complementary large scale stormwater catchment, erosion and sediment control measures, creating large scale disturbances to mitigate potential damage to receiving water bodies downgradient.

2. Mitigation Scale Required by Construction Scale

This scale of construction means that if a specific 25 acre track was 200 feet wide, it would be more than a mile long, requiring pipes or swales of which themselves would need to be at least a major fraction of a mile in length in order to direct the water to the catchment. By similar reasoning, a 400 foot wide 25 acre construction track would be more than a half mile in length, requiring similar lengths of stormwater conveyance infrastructure, and the landscape disturbance which goes with it.

3. Soil Types and Water Holding and Processing Capacities

Development of the upland zone in Ulster and Delaware Counties is constrained by the underlying soils. In the case of what are termed Lackawanna soils in the Ulster County Soil Survey, severe restrictions for golf course fairway construction is indicated. An additional problem with the Lackawanna series is low permeability, which, in itself, greatly increases the likelihood of runoff, and the erosion generated by overland flow.

Permeable soils in the same region have, in general, shallow depth to bedrock, at times restricting infiltration capacities. Intense storms of an inch per hour could potentially saturate such soils and lead to surface flow and erosion, especially in steep to very steep environments, such as those on each of the development sites. Severe restrictions for turf grass installation exist for a major fraction of soil coverage on these two planned construction sites.

Due to this, the plan to use sod in likely to be ineffective in mitigating erosion problems, and, on soils which are presently permeable, is likely to diminish permeability, since turf grass sod contains fewer macropores for soil infiltration than developed soils in forested landscapes. As noted above, sod together with the stormwater conveyance and discharge infrastructure will diminish the groundwater contribution to the local streams, diminishing high quality base flow input to the neighboring trout streams. The USGS study in the Croton of groundwater contribution to high quality inputs cited above corroborates this point[2].

4. The Entire Stormwater Mitigation Program Relies on Retention Basins and Involves Direct Discharge into Waterbodies at the Base of the Slopes.

Regional hydrology relies on water capture and recharge of the aquifers which feed the tributaries of the Pepacton and Ashokan Reservoirs. Since 500 to 600 acres in each development will be disturbed by golf course, hotel, structure and infrastructure construction, because of the dependence of detention ponds and discharge with no apparent focus on infiltration or groundwater recharge, it is to be expected that hundreds of acre feet of water will be diverted from groundwater storage and natural, biogeochemical filtration annually. For each 500 acres impacted by construction and stormwater conveyance out of groundwater, about two million gallons of groundwater will be lost, or about 20 million gallons for a foot of water over each 500 acres so impacted.

The entire stormwater management program appears to hinge on the behavior of detention basins at the base of the slopes. This strategy does not retain water, but discharges it from the system in the course of each storm. In effect this displaces resource water downstream, negatively impacting the store groundwater.

Paul S. Mankiewicz, Ph.D.
Executive Director
The Gaia Institute

[2] USGS, March 2000.

3

New York State Department of Environmental Conservation

In the Matter of the Applications of

Application Number
0-9999-00096/00005

CROSSROADS VENTURES, LLC
For The Belleayre Project at Catskill Park
for permits to construct and operate pursuant to the
Environmental Conservation Law

CURRICULA VITAE FOR EXPERTS
PETITION FOR PARTY STATUS
by the
Catskill Preservation Coalition *
And the Sierra Club

* [The Natural Resources Defense Council, Inc., Catskill Heritage Alliance, Pine Hill Water District Coalition, Theodore Gordon Flyfishers, Inc., Zen Environmental Studies Institute, Friends of Catskill Park, Catskill Center for Conservation and Development, Trout Unlimited, New York Public Research Interest Group and Riverkeeper, Inc.]

Law Office of Marc S. Gerstman, Esq.
Attorneys for the Catskill Preservation Coalition
Robinson Square
313 Hamilton Street
Albany, New York 12210

CURRICULA VITAE - EXHIBITS

CV –A. Peter Smith
CV –B. Mary Kopaski
CV –C. Danny Sundell
CV –D. Andrew Michalski
CV –E. Thaler
CV –F. Paul A. Rubin
CV –G. Brian Ketchum
CV –H. Piotr Parasiewicz
CV –I. Chad P. Dawson
CV –J. Erik Kiviat
CV –K. Michael Burger
CV –L. Graham L. Cox
CV –M. Myrna Hall
CV –N. Mary Tyrell
CV –O.John M. Ellsworth
CV –P. John H. Alschuler
CV –Q. Peter Swift
CV –R. Steven R. Garabed
CV –S. Robert E. Pitt
CV-T. Walter G. Knisel
CV-U. Paul S. Mankiewicz

peter smith, aicp, mcip, rla

principal
peter j. smith & company, inc.
1896 Niagara Street
Buffalo, NY 14207
(716) 447-0505 - telephone
(716) 447-0545 - facsimile
psmith@pjscompany.com - e-mail

715 Lakeshore Road
Fort Erie Ontario
(905) 871 6364

education

Doctor of Philosophy (ABD)
Economic Geography
University at Buffalo, Department of Geography
Buffalo, New York

Master of Urban Planning (1993)
University at Buffalo, School of Architecture and Planning
Buffalo, New York

Master of Landscape Architecture (1984)
University of Guelph
Guelph, Ontario

Bachelor of Arts in English Literature (1973)
Minor in Philosophy, Fine Arts
University of Western Ontario
London, Ontario

experience

PETER J. SMITH & COMPANY, INC.
Buffalo, New York and Fort Erie, Ontario
Principal - 1984 - Present

Peter is actively involved in the design, organization, administration and implementation of all projects undertaken by peter j. smith & company inc. He is personally committed to maintaining the philosophy and integrity of the firm and addressing modern urban and environmental issues. Peter's involvement in projects begins during the design concept phase and continues through to the projects implementation. Peter has worked on planning, urban design and landscape architecture projects in both the United States and Canada, combining practical experience with creative problem solving abilities.

During his professional career, Peter has developed an expertise in policy, economic planning, urban design and landscape architecture for a variety of municipal clients. Projects exemplifying his expertise include: smart growth strategies, corridor master plans, mixed use developments, waterfront and marina design, park and recreation master plans, land use regulations, downtown revitalization plans, feasibility studies, heritage plans, cost/revenue analyses and environmental assessments. In recognition of professional efforts the firm has received twenty-four awards over the last decade.

associations

Ontario Association of Landscape Architects
Canadian Society of Landscape Architects
Member Canadian Institute of Planners
Ontario Professional Planners Institute
American Institute of Certified Planners
American Planning Association
American Society of Landscape Architects
Registered Professional Planner: Ontario
Registered Landscape Architect: Ontario, New York, Pennsylvania

projects

Principal - Land Use Planning

Mat-Su Borough, AK - Core Area Comprehensive Plan
Township of Pine, PA - Comprehensive Plan
"Smart Growth" in Niagara - Niagara Region, Ontario, Canada
City of Buffalo, NY - Comprehensive Plan - Phase II
Town and Village of Lancaster, NY - Regional Comprehensive Plan
Town of West Bloomfield, NY - Comprehensive Plan and Zoning
Village of Pittsford, NY - Comprehensive Plan
City of Rochester, NY - Zoning and Design Standards
Mt. Lebanon, PA - Zoning Code Update
City of Utica, NY - Zoning Update
Village of Fredonia, NY - Zoning Ordinance and Design Guidelines
Village of Lancaster, NY - CBD Zoning and Design Guidelines
Ontario County, NY - Route 5 & 20 Corridor Management Plan
Town of New Hartford, NY - Open Space and Recreation Master Plan
Town of Boston, NY - Parks and Recreation Master Plan

Principal - Waterfront Design and Planning

Port Colborne, Ontario - West Street Redevelopment

Lauderdale By The Sea, Florida - Master Plan
Long Island North Shore Heritage Area - Heritage Management Plan
City of Yonkers, NY - Local Waterfront Revitalization Program
City of Binghamton, NY - Local Waterfront Revitalization Program
New York State - Seaway Trail Corridor Inventory and Assessment
Village of Tarrytown, NY - Waterfront Master Plan
Finger Lakes Region - Cayuga Lake Scenic Byway Nomination
Chadwick Bay Region, NY - Local Waterfront Revitalization Program
Evans, NY - Lake Erie Beach Redevelopment
Dunkirk, NY - Pier Redevelopment

mary kopaskie, aicp, mcip, rpp

principal planner
peter j. smith & company, inc.
1896 Niagara Street
Buffalo, NY 14207
(716) 447-0505 - telephone
(716) 447-0545 - facsimile
mkopaskie@pjscompany.com - e-mail

94 Fairfield Street
Buffalo, NY 14214
(716) 835-3249

education

Master of Urban Planning (1991)
University at Buffalo, School of Architecture and Planning
Buffalo, New York

Bachelor of Arts in Geography (1981)
Minor in Planning, Math, Computer Science
SUNY at Plattsburgh
Plattsburgh, New York

Grant Writing Skills Course (1995)
Buffalo State College

Negotiations and Conflict Resolution Seminar (1995)
University at Buffalo

Land Use Law Courses (1991)
University at Buffalo

experience

PETER J. SMITH & COMPANY, INC.
Buffalo, New York and Fort Erie, Ontario
Senior Planner - 1991-Present

Over the past two decades, Mary has gained experience in various aspects of land use related projects, including the management of comprehensive planning projects, developing land use regulations and leading any projects that are land use based. As a lead project manager, Mary is responsible for ensuring that projects are completed efficiently and effectively to meet the expectation of our clients. With her strong organizational and management skills, Mary is responsible for managing in-house staff and sub-consultants for large-scale projects completed by the firm. Her involvement with the Western New York section and Upstate New York chapter of the American Planning Association ensures she is up to date on planning issues throughout the Country.
Mary's area of expertise include land use and environmental planning. She has managed projects that cross a broad range of planning issues including comprehensive plans, parks and recreation master plans, corridor access management plans, site selection studies and smart growth strategies. Mary has developed an expertise in interpreting land use law to develop effective zoning ordinances, design guidelines, subdivision regulations and adult use laws.

NEW YORK STATE TEMPORARY COMMISSION ON TUG HILL
Watertown, New York
Municipal Management Assistant - 1986-1989

Mary was responsible for providing planning assistance to planning, town and village boards in the Fort Drum impact area. She reviewed site plans and subdivisions, drafted municipal master plans, updated and revised zoning, site plan and subdivision regulations, assisted with policy development and implemented community surveys. Mary assisted special interest groups including recreation, senior citizen housing and master plan committees.

DUTCHESS COUNTY DEPARTMENT OF PLANNING
Poughkeepsie, New York
Planning Consultant -1985-1986

Mary researched and reviewed master plans for Towns and Villages throughout the County. She examined commuter patterns of county residents and prepared a comprehensive report summarizing findings. Mary implemented and analyzed community values surveys for various planning projects including zoning ordinance and master plan updates. Mary developed and maintained computerized planning databases for the entire Planning Department.

associations

American Institute of Certified Planners - 1991
American Planning Association
Western New York Section American Planning Association
Treasurer (1997-2000)
Deputy Director (1995-1997)
Treasurer (1992-1995)
Awards Committee and Co-Chair (1992 - 1994)
Upstate New York Chapter American Planning Association
Membership Chairperson (2003- Present)
Member at Large (1997-2003)
Awards Committee Chair (1997)
Conference Committee (1995)
Canadian Institute of Planning - 1992
Member
Ontario Professional Planners Institute - 1992
Registered Professional Planner - 1995
Buffalo Friends of Olmsted Parks (1991-1997)
Friends of the Buffalo River (1991-1997)
Greenspaces Committee
Contribution to Local Newsletters and Professional Magazines

projects

Expert Testimony

Evans, NY - Waterfront Design and Planning
Old Westbury, NY - Land Use Planning

Project Manager - Land Use Planning

Mat-Su Borough, AK - Core Area Comprehensive Plan
Township of Pine, PA - Comprehensive Plan
Niagara Region, Ontario - "Smart Growth" in Niagara
City of Buffalo, NY - Comprehensive Plan - Phase II
Town and Village of Lancaster, NY - Regional Comprehensive Plan
Town of Newstead/Village of Akron, NY - Comprehensive Plan
Town of Boston, NY - Comprehensive Plan
Town of West Bloomfield, NY - Comprehensive Plan and Zoning
Village of Pittsford, NY - Comprehensive Plan
City of Rochester, NY - Zoning and Design Standards
Mt. Lebanon, PA - Zoning Code Update
City of Utica, NY - Zoning Update
City of Buffalo, NY - Union Ship Canal Zoning and Design Guidelines
City of Dunkirk, NY - Zoning Ordinance
Village of Fredonia, NY - Zoning Ordinance and Design Guidelines
Village of Lancaster, NY - CBD Zoning and Design Guidelines
Ontario County, NY - Route 5 & 20 Corridor Management Plan
Town of New Hartford, NY - Open Space and Recreation Master Plan
Town of Boston, NY - Parks and Recreation Master Plan

Principal Planner - Waterfront Design and Planning

Port Colborne, Ontario - West Street Redevelopment

City of Yonkers, NY - Local Waterfront Revitalization Program
City of Binghamton, NY - Local Waterfront Revitalization Program
New York State - Seaway Trail Corridor Inventory and Assessment
Village of Tarrytown, NY - Waterfront Master Plan
Finger Lakes Region - Cayuga Lake Scenic Byway Nomination
Chadwick Bay Region, NY - Local Waterfront Revitalization Program
Evans, NY - Lake Erie Beach Redevelopment
Dunkirk, NY - Pier Redevelopment
Thorold, Ontario - Lake Gibson Conservation Area Master Plan
Niagara Falls, NY - Griffon Park Redevelopment and Permitting
Fort Erie, Ontario - Oaks Sugar Bowl Park Redevelopment and Permitting
Hamburg, NY - Athol Springs Redevelopment Plan

danny sundell, rla, asla

senior landscape architect
peter j. smith & company, inc.
1896 Niagara Street
Buffalo, NY 14207
(716) 447-0505 - telephone
(716) 447-0545 - facsimile
dsundell@pjscompany.com - e-mail

74 Second Avenue
Lancaster, NY 14086
(716) 681-2502

---

education

Bachelor of Landscape Architecture, (1983)
University of Idaho - Moscow, Idaho

experience

PETER J. SMITH & COMPANY, INC.
Buffalo, New York and Fort Erie, Ontario
Landscape Architect - 2000-Present

As project manager for significant landscape architecture projects, Dan is responsible for projects from concept development through design and final implementation. He is often responsible for public meeting and open house presentations, including the preparation and presentation of graphic materials. In addition, Dan is responsible for preparing cost estimates and completing working drawings, construction details and specifications for the firm's clients. Throughout his career, Dan has developed an expertise in planning and designing various landscape architecture projects, including parks, golf courses, streetscapes, waterfronts, sports facilities, trails, nature areas, marinas and playgrounds. Dan brings significant graphic skills to all of his design work, resulting in superior final presentation products.

Clients for projects that Dan has worked on at peter j. smith & company, inc. are all governmental. Some examples include the NYS Canal Corporation, City of Buffalo, City of Tarrytown, Village of Lancaster, Erie County, City of Binghamton, etc.

URS CORPORATION
Buffalo, New York
Landscape Architect – 1997-2000

Dan was a project manager for numerous landscape related projects ranging from landfill closures, golf courses, recreation trails, parks and sports fields, university plazas. He also worked on visual analysis of cellular tower installations. Clients included General Motors, Town of Amherst, City of Buffalo, New York State Office of Parks Recreation and Historic Preservation and the US Army Corps of Engineers.

WENDEL DESIGN
Buffalo, New York
Landscape Architect -1995-1997

Dan was a project manager working on projects ranging from trails, parks, to private developments. Clients included the City of Buffalo, Lockport School District, City of Niagara Falls, Town of Lancaster, etc.

BECK & BAIRD LANDSCAPE ARCHITECTURE
Boise, Idaho
Landscape Architect -1986-1995

Dan worked on all aspect of projects for private corporations, developers and governmental agencies. Clients included the US Forest Service, Hewlett Packard, Boise State University, and numerous private developers.

THE SARATOGA ASSOCIATES
Buffalo, New York
Landscape Designer -1984-1986

Technical assistant on landscape architecture projects.

associations

American Society of Landscape Architects – New York Upstate Chapter
Chapter President (2002 - 2003)
Executive Committee Member (2000 to Present)

Idaho Water Conservation Council
President (1994-1995)

professional certifications

Licensed Landscape Architect – New York State – 1996
Licensed Landscape Architect – Idaho State – 1987

selected project experience

- Erie Canalway Trail – Erie County, NY
- Pinnacle State Park Feasibility Study – Addison, NY
- Walden Park Improvements – Buffalo, NY
- Mount Morris Dam Facility Master Plan – Mount Morris, NY
- Black Rock Lock Master Plan – Buffalo, NY
- Town of New Hartford Parks and Recreation Plan – New Hartford, NY
- Town of Boston Recreation Master Plan – Boston, NY

ANDREW MICHALSKI, Ph.D., CGWP, PG

MICHALSKI & ASSOCIATES, INC.
1301 JANKOWSKI COURT
SOUTH PLAINFIELD, NEW JERSEY
(908) 757-8867

EDUCATION

Ph.D. Technical Sciences (Geological Engineering),
University of Mining and Metallurgy (AGH), Krakow, Poland - 1974

M.S. Hydrogeology and Engineering Geology,
University of Mining and Metallurgy (AGH), Krakow, Poland - 1969

PROFESSIONAL CERTIFICATION

- Certified Ground Water Professional (CGWP)
by the National Ground Water Association - No. 272
- Certified Professional Geologist in Virginia - No. 670
- Registered Professional Geologist in Delaware - No. S4-0000812
- Registered Professional Geologist in Pennsylvania - No. PG-003076-G
- Certified to conduct Underground Storage Tank
Subsurface Investigations in New Jersey - UST No. 0011543

SUMMARY OF PROFESSIONAL EXPERIENCE

Michalski & Associates, Inc.
South Plainfield, N.J.

In 1995, Dr. Michalski formed a specialty environmental consulting firm which provides hydrogeological and environmental remediation services to industrial clients, law firms, consulting engineering firms, government, and citizen groups. Major clients include Merck & Co.; Shell Oil Co.; Consolidated Edison of NY; Georgia Pacific Corp.; Stepan Chemical; Wayne Twp, NJ.; Cattaraugus County, NY; USEPA; and US Attorney District of NJ.

Dr. Michalski has over 30 years of consulting and academic experience in hydrogeology and applied geosciences, with emphasis on ground-water remediation, regulatory compliance, siting of sensitive waste disposal facilities, evaluation of ground-water resources and expert testimony.

Dr. Michalski is a recognized expert on hydrogeology in fractured bedrock of the Newark Basin. He published seminal papers on this subject, and was invited to make presentations to technical staff at NJDEP and PADEP. Dr. Michalski has extensive project experience in remediation of chlorinated solvents (DNAPLs) and petroleum products in porous and fractured aquifers. As an expert witness, he prepared a number of expert reports, testified in courts and at adjudicatory hearings.

Rutgers University,
New Brunswick, New Jersey
Visiting Part-Time Lecturer ***1986-1995***

For nine years Dr. Michalski had served as a visiting part-time lecturer of hydrogeology at the Geology Department, Faculty of Arts and Sciences, Rutgers University.

The Whitman Companies, Inc.
East Brunswick, N.J.
Director of Hydrogeology ***1989-1995***

As director of hydrogeology, Dr. Michalski provided technical expertise, leadership and supervision in the areas of site assessments, geologic and hydrogeologic characterization, remedial investigations, and ground water remediation projects. Some of his professional accomplishments at Whitman include:

Dr. Michalski directed and performed numerous ground water investigations, assessments and cleanups under the ISRA (ECRA), BUST, NJPDES and State Case Management programs in New Jersey.

He developed an innovative testing methodology for characterization of fractured aquifers. This methodology were used with great success to characterize fracture flow and contaminant migration in bedrock at several complex sites within the Newark Basin.

Dr. Michalski designed a successful treatment train for enhanced recovery of residual DNAPL solvents below the water table in northern New Jersey. Record-setting volumes and per cent recovery of DNAPLs were achieved. This project won the national Excellence in Environmental Engineering Award in small project category in 1997.

Dr. Michalski provided expert hydrogeologist's opinions on proposed low-level radioactive waste disposal sites in New York and Connecticut. As an expert witness, he testified before the Low-Level Radioactive Waste Siting Commission in Illinois on a proposed disposal site in Martinsville. For NRC, he prepared an expert opinion on potential impacts of a release from a nuclear power plant on ground water system.

He prepared expert reports on dating contaminant discharges and allocating of cleanup responsibility for several industrial sites and seven gasoline service stations in New Jersey. Dr. Michalski also served as an expert witness before an AAA panel in a case involving cleanup responsibility for a 600,000 gallon fuel oil spill in southern New Jersey.

Other cases for which he prepared expert hydrogeologist's opinions include contaminated municipal wells in Wallington, NJ, a proposed commercial sanitary landfill in Cattaraugus County, NY, and a large salt mine collapse near Rochester, NY.

TRC Environmental Consultants,
Somerset, N.J.
Principal Hydrogeologist *1987-1989*

Responsible for the technical supervision and management of diverse ground water projects for industrial clients, developers and government. Other responsibilities pertained to hydrogeologic training of technical staff and development of internal standards for conducting hydrogeologic investigations at hazardous waste sites. Dr. Michalski's major projects included:

Contaminant assessments and development of cleanup plans for an industrial site in North Jersey featuring fractured aquifer contaminated with chlorinated hydrocarbons and for a large chemical plant site in Central Jersey contaminated with a myriad of compounds.

Preparation of DICAR reports and remediation of two contaminated UST sites.

Providing expert hydrogeologist's opinion on proposed municipal landfill sites for Somerset County, New Jersey and two counties in New York State.

The Earth Technology Corporation,
Somerset, N.J.
Senior Hydrogeologist *1983-1987*

Responsibilities included planning, management and technical supervision of hydrogeologic investigations at hazardous waste facilities, landfills, superfund sites, industrial (ECRA) sites, and a nuclear power plant. Selected projects include:

For the USEPA, Dr. Michalski performed technical reviews of ground water monitoring systems and landfill designs of RCRA Part B Permit Applications. Designed and implemented ground water investigations at two CERCLA sites.

As part of an Environmental Assessment for a candidate high level nuclear waste site at Richton Salt Dome, Dr. Michalski authored technical memoranda on fluids in salt deposits, anomalous zones, and in-situ stresses in salt domes. He also investigated worldwide occurrences and mechanisms of gas outbursts in salt and potash mines.

Dr. Michalski was responsible for technical management of extensive ground water and subsidence studies for RCRA regulated facilities located in the karst terrain of Puerto Rico. The studies involved numerous borings and deep monitoring wells, use of several geophysical methods, geomorphologic and geotechnical analyses, and dye tracing. He developed an innovative analysis of water level response to storm water discharge through on site sinkholes.

University of Port Harcourt, Nigeria
Senior Lecturer and Director of
Studies in Geology ***1977-1982***

Dr. Michalski taught hydrogeology, engineering, geology, soil mechanics, methodology of subsurface exploration and general geology courses.

As director of studies at a newly established university, he developed applied geology curriculum, organized teaching and research facilities, and initiated regional studies of sea water intrusion into coastal aquifers of the Niger Delta.

University of Mining & Metallurgy,
Krakow, Poland
Assistant Professor ***1969-1977***

Taught engineering geology, hydrogeology, and mining geology courses.

Dr. Michalski performed an extensive physical modeling of coupled fluid and heat flow in the process of underground smelting of sulfur deposits for variable hydrogeological conditions and well layouts. He used finite element modeling to investigate stress and elastic 1energy distributions in the vicinity of mining face approaching faults.

Dr. Michalski served as geotechnical and hydrogeologic consultant to sulfur, coal, and salt mining industries in Poland.

PROFESSIONAL ORGANIZATIONS

Association of Ground Water Scientists and Engineers - Member since 1984
Association of Engineering Geologists - Member since 1984; Vice President of NY-Phila Section
Geological Association of New Jersey - Past Counselor-at-large

PUBLICATIONS

The most recent of his over 40 technical publications include:

Michalski, A. "Practical Approach to Bedrock Aquifer Characterization in the Newark Basin." In: Geology in Service to Public Health Proceedings and Field Guide of Eighteen Annual Meeting of the Geol. Assoc. of New Jersey, Oct. 26-27, 2001;P. Lacombe & G. Herman, Eds.

Michalski, A. Discussion of Paper "Fractured-Aquifer Hydrogeology from Geophysical Logs: Brunswick Group and Lockatong Formation, Pennsylvania" by R.H. Morin, L.A. Senior and E.D. Decker. Ground Water, November-December 2000 Issue, p. 806-7.

Michalski, A and R. Britton. "The Role of Bedding Planes in the Hydrogeology of Sedimentary Bedrock - Evidence from the Newark Basin, New Jersey." Ground Water, March-April 1997 Issue, p. 318-327.

Michalski, A. "Conceptual Flow Models for Newark Basin Bedrock and Their Implications for Remediation of DNAPL Sites." 39th Annual Meeting of Assoc. of Eng. Geol., E. Brunswick, NJ, Sept. 1996.

Michalski, A. "The Use of Short Duration Pumping Tests for Characterization of Fractured Sedimentary Bedrock." (Abstract) Ground Water, September-October 1995 Issue, p. 851.

Michalski, A. "DNAPL Site Problems: Search for DNAPL and Effective Remedial Technologies." Environmental Law Section Newsletter New Jersey State Bar Assoc., Vol. XII, No.4, June 1995.

Michalski, A., M.N. Metlitz and I.L. Whitman. "A Field Study of Enhanced Recovery of DNAPL Pooled Below the Water Table." Ground Water Monitoring and Remediation. Winter 1995 Issue.

Michalski, A. and I.L. Whitman. "Taking Care of Ground Water Contamination." New Jersey Lawyer, February 8, 1993.

Michalski, A., R. Britton and A.H. Uminski. "Integrated Use of Multiple Techniques for Contaminated Investigations in Fractured Aquifers: A Case from Newark Basin, New Jersey." Proceedings of NGWA Focus Eastern Conference, October 13-15, 1992. Boston, MA. Published by NGWA.

Michalski, A. and T. Gerber. "Fracture Flow Velocities in the Passaic Formation in Light of Inter-well Tracer Tests." Environmental Geology of the Raritan River Basin. 9th Annual Meeting of the Geology Association of New Jersey, Somerset, New Jersey. October 30-31, 1992.

Michalski, A., R. Britton and A.H. Uminski. "Bedrock Hydrogeology of the Manville-Bridgewater Section of the Raritan River Valley." Environmental Geology of the Raritan River Basin. 9th Annual Meeting of the Geology Association of New Jersey, Somerset, New Jersey. October 30-31, 1992.

Michalski, A. "Hydrogeology of the Brunswick (Passaic) Formation and Its Implication for Ground Water Monitoring Practice." Ground Water Monitoring Review, Fall 1990 Issue, pp. 134-143.

Michalski, A. "Hydrogeologic Characterization as a Key Factor for Aquifer Remediation in Fractured Brunswick Formation." In: Aquifer Reclamation and Source Control Conference, Woodbridge, NJ, November 1990. Conference sponsored by USEPA and NJIT.

Michalski, A. and G.M. Klepp. "Characterization of Transmissive Fractures by Simple Tracing of In-Well Flow." Ground Water, Vol. 28, No. 2 (1990), pp. 191-198.

Michalski, A. "Application of Temperature and Electrical Conductivity Logging in Ground Water Monitoring." Ground Water Monitoring Review, Summer 1989 Issue, pp. 112-118.

Michalski A. "Conductive Slug Tracing As A Single Well Test Technique for Heterogeneous and Fractured Formations." Proceedings of Conference on New Field Techniques for Quantifying the Physical and Chemical Properties of Heterogeneous Aquifers, Dallas, March 20-23, Published by National Water Well Association, 1989.

Michalski, A. and J. Torlucci, Jr. "Testing of a Limestone Aquifer Using Water Table Response to Storm Water Discharged into Sinkholes." Ground Water, Vol. 26, No. 6, (1988), pp. 751-760.

Eriksson, L.G. and A. Michalski, 1986. Hydrostatic Stress Conditions in Salt Domes - Possible Reality or a Modeling Simplification. Proc. Int. Symp. on Rock Stress Measurements, Stockholm, Sweden, Sep. 1-3, 1986. Centek Publishers.

Michalski, A., 1977. Hot Water Consumption With Advance of Mining Front During Underground Sulfur Smelting. Przeglad Gorniczy, v. 33, no. 5, Katowice. (in Polish)

Michalski, A. and M.Y. Al-Noori, 1977. Relationship Between the Effects of Hot-Water Mining and Geological and Technological Parameters for Mishraq Sulfur Mine in Iraq. Zeszyty Naukowe AGH, Geologia z. 3, Krakow. (in Polish)

Michalski, A., 1977. Rock-Burst Hazard Evaluation for Longwall Approaching a Fault. Przeglad Gorniczy v. 33, no. 9, Katowice. (in Polish)

Kidybinski, A. and A. Michalski, 1977. Stability and Determination of the Thickness of Coal Protective of Weak Roof. Przeglad Gorniczy, v. 33, no. 12, Katowice. (in Polish)

Michalski, A., 1976. Rock-Mass Behavior Around a Roadway Driven Through a Fault Zone. Przeglad Gorniczy, v. 32, no. 6, Katowice. (in Polish)

Michalski, A., 1976. Factors Affecting the Shape of Smelted Zone in Hot-Water Sulfur Mining. Siarka, Tarnobrzeg. (in Polish)

Krajewski, R. and A. Michalski, 1975. Hot-Water Consumption Index and Recovery Ratio in Borehole Sulfur Mining. Zeszyty Naukowe AGH, Gornictwo, Krakow. (in Polish)

Michalski, A., 1973. Results of Model Investigations of Effects of Geological and Technological Factors on Sulfur Recovery by the Borehole Method. In: Problemy Exploatacji Otworowej Surowcow Stalych, Sympozjum. Published by Slask, Katowice. (in Polish)

EXHIBIT E

CV-E

HydroQuest

Paul A. Rubin
P.O. Box 387
Stone Ridge, N.Y. 12484
845-687-4020
hydroquest@yahoo.com

Paul A. Rubin

EDUCATION:

M.A. - Geology, May 1983, State University of New York at New Paltz. Major fields of study: Hydrogeology, Water Quality and Pollution, Structural Geology, Photogeologic Interpretation. Thesis topic: *Hydrogeology and Structure of the Shawangunk Mountains, Ulster County, New York.*

B.A. - Anthropology, minor Geology, May 1977. State University of New York at Albany.

SPECIAL SKILLS:

Hydrologic and Geologic Characterizations; Land Use Planning; SEQRA reviews; Expert Testimony and Litigation Background; Surface Water and Groundwater Quality Evaluations; Sediment Transport; Evaluation of Remedial Technologies; Geotechnical Assessments; Hydrologic Investigations (Design, Coordination, Implementation, and Evaluation); Aquifer Testing and Analysis; Karst Hydrology; Rosgen Analyses; GIS Map Making and Analyses; Affidavit and Report Preparation; Public Speaking; Public Relations; Research Skills; Strategy Development; Leadership.

EXPERIENCE:

HYDROLOGIST/ HYDROGEOLOGIST:

Independent Consultant. Stone Ridge, New York. Consulting firm name: *HydroQuest*.

1994 - Present

Provide hydrologic, geologic and land use technical consulting services to environmental groups, Towns, business associations, law firms, and individuals. Assist groups in identifying issues and developing strategies designed to protect water resources and community character.

***HydroQuest* work includes SEQRA reviews, review and fatal flaw analyses of consultant reports and environmental impact (EISs) analyses, field characterizations, stream and wetland evaluations, geotechnical analyses, hydrologic and geologic mapping, hydrogeologic analyses, regulatory assessments, public presentations, coordination work with attorneys and Technical Committees, strategy development, panel member at Town meetings with legislators, press interactions, report and affidavit preparation.**

INSTRUCTOR:

Jan. 2001- Present

Employed full-time by a college - name intentionally omitted to avoid any possible association between this work and hydrogeologic consulting work. Teach ArcGIS, Environmental Geology, Geology, Hydrology, and Geography. Coordinator of the Geographic Information Systems certificate program. Also teach a summer field hydrology course at the College of the Atlantic in Bar Harbor, Maine.

HYDROLOGIST:

New York City Department of Environmental Protection (NYC DEP), Division of Drinking Water Quality Control, Shokan, New York.

April 1993- Jan. 2001

Conducted research and field studies designed to assess the water quality of watersheds. Responsible for directing geologic research designed to assess the sources, geomorphic context and best management practices (BMPs) related to sediments causing turbidity water pollution problems. Hydrologic and geologic work included geologic mapping of glacial sediments, field evaluation of stream channel armoring, morphologic characterization of stream channels (including Rosgen analyses), bedload transport studies, assessment of critical shear stresses, particle size analysis, stream gauging, water quality sampling and trend analysis, chemical and sediment loading calculations, graphic production, report preparation and technical presentations. Assisted other governmental divisions in evaluating lands for possible purchase, conducted geotechnical assessments of structurally unstable stream reaches, evaluated BMP designs. Supervised several Research Assistants.

RESEARCH SCIENTIST:

Martin Marietta Energy Systems, Inc. April 1993 under contract with the U.S. Dept. of Energy; Oak Ridge National Lab; Environmental Sciences Division, Oak Ridge, TN.

Aug. 1991- April 1993

Responsible for hydrogeologic evaluation of groundwater issues (e.g., characterization, monitoring network setup, data analysis, remedial design evaluation) at multiple Oak Ridge Reservation hazardous waste sites. Developed and documented conceptual model of carbonate and shallow storm flow systems comprising pathways of rapid contaminant transport. Work also involved characterization of hydrologic and geochemical trends and thermal infrared photo analysis. Presented results of research at conferences, as well as to DOE management and State and Federal officials. *Served in a Resource Management Organization as the hydrologic lead for the Environmental Sciences Division.*

HYDROGEOLOGIST:

New York State Attorney General's Office; Environmental Protection Bureau, Albany, New York.

Feb. 1983- Aug. 1991

Responsible for the design, protocols, coordination, implementation, evaluation, characterization and remediation of many major water and soil contamination sites throughout New York State (e.g., Love Canal, Superfund sites). Designed, performed and supervised chemical field sampling at hazardous waste sites. Evaluated geotechnical and chemical data sets.

Primary responsibilities included coordination of multiple companies along with their respective legal and scientific consultants. Worked with all parties involved to produce test plans and consent decrees to facilitate site remediation. Responsible for the management of the testing, site characterization and technical assessment. Worked with attorneys on summary judgment motions, complaints, trial preparation and depositions. Attorney General's spokesperson at public meetings. Expert witness at SEQRA hearings. Testimony given before the Assembly Standing Committee on Environmental

HYDROGEOLOGIST continued:

Conservation and Grand Jury. Worked with DOL staff and attorneys to develop office initiatives (e.g., Racketeering; bottled water contaminants). Initiation, development and drafting of legislation.

Supervision of personnel: expert witnesses, consultants, research assistants, interns. Responsible for selection, job descriptions, work schedules, and products.

HYDROGEOLOGIST:

Stone & Webster Engineering Corporation, Geotechnical Division, Boston, Massachusetts.

Oct. 1981- Feb. 1983 Directly responsible for the planning, preparation, execution, and analysis of pumping tests and a fluid sampling program designed to investigate deep basin groundwater characteristics for the siting of a nuclear waste repository within the Permian Basin of the Texas panhandle.

ACTIVITIES:

Cave exploration, hiking, and skiing. Former Captain: Albany-Schoharie County Cave Rescue Team. Made a Fellow of the National Speleological Society in recognition of karst research and water resource protection. Boy Scout Merit Badge Counselor for Environmental Science, Soil and Water Conservation, Geology, Skiing, Archaeology and Orienteering.

PUBLICATIONS & REPORTS Over 24 technical publications and over 100 reports and affidavits. Partial list available upon request. Leader of geology conference field trips.

ADDENDUM - SELECTED REPORTS AND SELECTED PUBLICATIONS

SELECTED OAK RIDGE NATIONAL LABORATORY REPORTS

1993	Jan. 2; Rubin, P.A.; Copper Ridge Cave: facts, observations, and interpretations. Report details flow readings, structural and hydrologic conditions controlling groundwater flow in Oak Ridge carbonate aquifers, and geomorphic interpretations; 9 pages, 1 map.
1992	Nov.; Rubin, P.A.; Pulse train analysis: A relatively cheap and rapid technique to establish the hydraulic connection between highly transmissive Oak Ridge Reservation wells. Includes discussion of methodology, relevant hydraulics, and an example.
1992	July 13; Rubin, P.A.; Grant Proposal: Location of karst exit pathways: geophysical high resolution subsurface imaging methods to locate conduits in bedrock terranes overlain by thick residuum; Submitted to the Dept. of Energy Characterization, Monitoring and Sensor Technology Integrated Program; 9 pages, 3 figures.
1992	July 8; Rubin, P.A.; Presence of active Oak Ridge Reservation karst flow systems further confirmed; 7 pages, 1 figure.
1992	June 22; Rubin, P.A.; ORR carbonate "cavities"; with emphasis on the Y-12 solution cavity and related Bear Creek Valley land use implications; 6 pages, 2 figures.
1992	June; Rubin, P.A., Poling, R.S., and Lemiszki, P.J., Hydrogeologic characterization plan for the Oak Ridge K-25 site; Oak Ridge, TN. Prepared for Martin Marietta Energy Systems, Inc., K-25 Plant, Report No. K/EM-1.
1992	May 21; Rubin, P.A., Huff, D.D., Stow, S.H., and Early, T.O.; Karst hydrology of Parcel A2 (technical discussion of contaminant concerns related to sale of DOE lands, with specific recommendations); 3 pages, 3 figures.

SELECTED ATTORNEY GENERAL REPORTS

1986-1991	Rubin, P.A.; Love Canal trial activities - depositions, photointerpretation, testimony preparation, witness preparation, cross-examination.
1991	February; Rubin, P.A. and Sommer, D.S.; Complaint - State of New York against Allied-Signal Corporation; 8 pages.
1991	February 1; Rubin, P.A.; Tully Valley trial proofs; 5 pages.
1990	August 29; Rubin, P.A.; Hydrogeologic dynamics leading to the formation of the Tully Valley, New York mud boils and remedial considerations for effluent treatment; 15 pages.
1990	June 7; Ayers, J.C. and Rubin, P.A.; Geochemistry and hydrogeology of groundwaters and sand volcano effluents in Tully Valley, New York; 122 pages, multiple tables, figures, maps and appendices.
1990	January-October; Rubin, P.A.; Chemical sampling and characterization of five construction and demolition sites for Racketeering office initiative.
1990	April 30, Rubin, P.A.; Testimony before Grand Jury regarding tracer testing in Schenectady criminal case. Indictment achieved and company shut down.
1990	March 20; Rubin, P.A.; Affidavit in support of motion for summary judgment: The State of New York (plaintiff) against Becker Electronics Manufacturing Corp. (defendant); Affidavit deals with the hydrogeology and aquifer characteristics of a contaminated bedrock aquifer, 11 pages, 4 exhibits.
1990	March 20, Rubin, P.A.; Piezometry and groundwater flow directions proximal to the Johnstown landfill, 3 pages, 9 figures; draft.

1990	January 24; Rubin, P.A.; Multiple reports and testimony before Investigative Grand Jury relating to criminal case involving Kodak. Testimony helped lead to out-of-court settlement.
1989	December 14; Rubin, P.A.; Testimony before New York State Supreme Court regarding contaminant migration in a West Hurley fractured bedrock aquifer. Testimony led to rapid case settlement.
1989	October 25; Rubin, P.A.; Hydrogeologic testing required to fully assess aquifer contamination and insure State cost recovery; West Hurley, New York; 7 pages.
1989	August 30; Rubin, P.A.; Philmont aquifer analysis evaluation; Claverack Quad., N.Y.S.; 5 pages, 1 table, 5 figures.
1989	June 6; Rubin, P.A.; Pulse-train analysis; a relatively cheap and rapid technique to establish the hydraulic connection between the Allied brine field and the sand volcanos; 14 pages, 1 figure.
1989	April 12; Rubin, P.A.; Aquifer analysis of the proposed Newman distribution well; West Branch Creek, Allegheny Town, New York; 34 pages, 8 tables, 5 figures.
1989	February 2; Rubin, P.A. and Grady, K.A.; Man-induced evaporite karst formation via mechanical failure of formerly competent beds above a solution mining operation; Tully Valley, New York; 42 pages, 51 figures, 3 tables.
1988	November 16; Rubin, P.A.; Hydrogeologic assessment of risk factors associated with sand and gravel mining proximal to the Philmont municipal well; Claverack Quad., N.Y.S., 11 pages, 2 tables.
1988	August 31; Rubin, P.A.; Affidavit in support of motion for summary judgment: The State of New York (Plaintiff) against Sabin Metal Corporation and Yardney Electric Corporation (Defendants); Affidavit (draft) deals with hydrogeology of the Sabin Metal site; Modena, New York, 16 pages, 12 exhibits.
1988	July 14; Rubin, P.A. to Executive Chamber of the Governor; Analysis, comments and recommendations regarding Legislative Bill No. 8663-A, Article 20-A Petroleum Well Casings and Pipes; 3 pages, attachment.
1988	July 12; Rubin, P.A.; Affidavit in support of motion for summary judgment; The State of New York (Plaintiff) against The City of Gloversville, New York (Defendant); Affidavit deals with hydrogeology of the Gloversville landfill, 6 pages. Summary judgment awarded.
1988	June 10; Rubin, P.A.; Affidavit in support of motion for summary judgment: The State of New York (Plaintiff) against the City of Gloversville, New York et al. (Defendants); Affidavit deals with hydrogeology of the Gloversville landfill, 8 pages, 1 exhibit.
1988	April 14; Rubin, P.A.; Affidavit in support of motion for summary judgment: The State of New York (Plaintiff) against the City of Gloversville, et al. (Defendant); Affidavit deals with hydrogeology of the Gloversville landfill, 8 pages, 8 exhibits.
1988	February 25; Rubin, P.A.; Hydrogeology and chemical interpretation of existing analytical data as applied towards the components of the FICA landfill RI/FS work plan; 30 pages, 7 figures, 14 tables, 7 appendices.
1988	February 19; Rubin, P.A.; Chemical and aquifer testing designed to evaluate a new multi-family water distribution system; West Branch oil contamination - Allegheny Town (State v. Newman Oil); 5 pages, 2 addenda.
1987	September 23-24; Rubin, P.A.; Panel member/speaker DOT Highway Maintenance Engineers' Conference - Road salt: hydrogeologic dynamics associated with groundwater and surface water contamination, cleanup and prevention; Glens Falls, New York.
1987	September 1; Rubin, P.A.; Hydrogeologic evaluation of proposed remedial options at the Becker Electronics site as related to human exposure to a contaminated drinking water supply, East Durham, New York; (includes aquifer analyses of Becker Electronics site and a New Paltz site); 29 pages, 6 figures, 1 table.

1987 July 15; Rubin, P.A.; Testimony before Grand Jury regarding tracer testing in Canajoharie criminal case.

1987 June 26; Rubin, P.A.; Presentation to NYSDOH, DOL and DEC: Hydrogeology and potential health risks associated with the Onondaga Landfill; 80 slides, geologic cross-section, 4 maps, rose diagram, 10 figures, 7 tables.

1987 May 19, Rubin, P.A.; Review of draft Disaster Preparedness Commission report; pages 13-18 (on Fort Hunter Thruway bridge collapse - hydrology); 4 pages, 3 computer graphs on flood return intervals.

1987 April 29; Rubin, P.A.; The anatomy of the Fort Hunter Thruway bridge failure: floodwater frequency analysis, soil mechanics, and design considerations - an offer of technical assistance(with specific details); 9 pages.

1987 April 17; Rubin, P.A.; Onondaga landfill Phase II work plan particulars as designed to enhance contaminant definition in a karst network; 10 pages.

1987 April 10; Rubin, P.A. and Chinery, R.; Solvent Savers "Supplemental Data Collection" work plan of March 27, 1987; 23 pages, 3 figures.

1987 February 12, Rubin, P.A., et al.; State of New York Senate-Assembly (S. 2236-A; A. 3075-A) Title 6 Legislation on road salt; 4 pages.

1987 February; Rubin, P.A.; Hydraulic gradients and groundwater flow directions at the Solvent Savers and Novak Farm sites; 7 pages, 8 figures, 5 tables.

1987 January 8; Rubin, P.A.; Hydrogeology of the Sabin site, Modena, New York; 20 pages, 3 tables, 15 figures; 2 pages analytical parameters.

1986 December 2; Rubin, P.A.; New York State's interpretation of the hydrogeology of the Novak Farm site; 2 hours of testimony presented before Judge Munson; 30 pages, 9 figures.

1986 September 26; Rubin, P.A.; Geotechnical assessment of the hydrologic testing conducted to date and recommendations for additional testing to provide the necessary proofs for a summary judgment motion documenting groundwater contamination resulting from the Newman West Branch Creek oil field water flooding operation; 21 pages.

1986 September 4; Rubin, P.A.; Review of the remedial investigation work plan for the Johnstown landfill (essentially a total rewrite of a consultants poor work plan outlining all necessary testing and methodologies); 17 pages, 7 page appendix, 1 figure, 2 tables.

1986 May 16; Munro, D.A., Rubin, P.A., and Chinery, R.: State of New York v. Allied Corporation, et al. - Solvent Savers site (Calculations on seepage velocities and mounding as related to a proposed flushing remedial scheme); 12 pages.

1986 February 27; Rubin, P.A., Flatow, J., and Kupferman, R.; Proposed legislation initiatives to remediate contaminated groundwater and surface water resulting from road salting activities; 11 pages, 13 pages of appendices.

1986 February 25; Rubin, P.A.; Hydrogeology and chemical interpretation of the FICA landfill as applied toward a RI/FS work plan; 22 pages, 13 tables, 4 figures.

1985 December 24; Rubin, P.A.; Geophysical assessment of the Cortese landfill and environs, Narrowsburg, New York; 9 pages, 5 figures, 1 table.

1985 October 23; Rubin, P.A.; Public investigatory hearings into the adverse effects, remedies, and legislation governing salt storage and dispersal; 13 pages.

1985 October 17; Rubin, P.A. and Flatow, J.; Salt storage and deicing related policy in the northeastern states; 28 pages.

1985 October 2; Rubin, P.A.; Appraisal of groundwater contamination adjacent to the Cortese landfill based on visual Delaware River soil and water contamination; 8 pages, 1 map.

1985 September 19; Spiegel, N., Osar, R.L., and Rubin, P.A.; Consent order agreement with attached work plan in New York State v. Sabin Metal Corp., et al.; 20 pages.

1985 July 24; Rubin, P.A.; The concept of "unusual" or "act of God" precipitation being responsible for the release of chemicals from Love Canal (prepared for use as an affidavit analyzing return intervals in the Love Canal litigation); 7 pages, 3 figures.

1985 May 3; Moore, M.J., Skinner, P.N., and Rubin, P.A.; Testimony of the office of New York State Attorney General before the Assembly Standing Committee on Environmental Conservation; Concerns about the impacts of oil and gas drilling practices on the quality of New York's groundwater; (Water well drilling requirements); 15 pages, 2 maps, 1 figure, 1 table.

1985 March; Rubin, P.A.; Report on the chemicals, technical processes used and residual contamination found at the Yardney Electric and Sabin Metals Corporations site in Modena, New York; 57 pages, with numerous tables.

1985 January 10; Rubin, P.A.; Plan for remedial investigation and feasibility study of the Cortese landfill, Narrowsburg, New York; 31 pages.

1984 December 28; Rubin, P.A.; Road salt contamination - tracer selection and detection methodology, Churchland Lane, Town of Saugerties; 10 pages.

1984 September; Rubin, P.A.; Report on the status of groundwater contamination in the vicinity of the Johnstown landfill; 48 pages with numerous chemical tables.

1984 March 22; Rubin, P.A.; Groundwater investigation for the American Thermostat Corporation site; 29 pages.

SELECTED PUBLICATIONS FROM PROFESSIONAL AND PERSONAL RESEARCH

Rubin, P.A., Engel, T., Nardacci, M. and Morgan, B.E., 2002, ***Geology and paleogeography of Mount Desert Island and surrounding area, Maine.*** Guidebook paper National Speleological Society annual meeting, Camden, Maine, p. 47-91, Trip Leader.

Rubin, P.A., Schultz, B. and Haberland, P., 2002, ***Hydrologic, land use, and historic concerns relative to the Rosendale mining industry.*** Abs. National Speleological Society annual meeting, Camden, Maine.

Rubin, P.A. and Morgan, B., 2002, ***Relict sea caves record temporary coastal stillstands.*** Abs. National Speleological Society annual meeting, Camden, Maine.

Morgan, B., Albrechtsen, C., Dido, R., Hubsch, R., Rubin, P.A., Sheeley, D., Skerritt, F. and Vaeth, L., 2002, ***Development of a GIS-based land-use coverage: Black Creek Watershed, Southeastern NYS.*** Abs. Northeast Natural History Conference VII. N.Y. State Museum Circular 64: p. 50-51.

Hubsch, R., Albrechtsen, C., Dido, R., Morgan, B., Rubin, P.A., Sheeley, D., Skerritt, F., Terzella, D. and Vaeth, L., 2002, ***Critical environmental area delineation in the Black Creek Watershed, NYS via GIS analysis.*** Abs. Northeast Natural History Conference VII. N.Y. State Museum Circular 64: p. 51.

Sheeley, D.A. and Rubin, P.A., 2002, ***Land-use preservation scenarios in the Black Creek Watershed using GIS; NYS.*** Abs. Northeast Natural History Conference VII. N.Y. State Museum Circular 64: p. 51.

Schultz, B., Rubin, P.A. and Haberland, P., 2002, ***GIS-based historic inventory of early cement district industrial artifacts: Southeastern NYS.*** Abs. Northeast Natural History Conference VII. N.Y. State Museum Circular 64: p. 40.

Rubin, P.A. and Morgan, B., 2002, ***Geomorphic reconstruction of emerged and submerged coastlines using GIS technology, Mount Desert Island, ME.*** Abs. Northeast Natural History Conference VII. N.Y. State Museum Circular 64: p. 39.

Rubin, P.A. and Privitera, J.J., 1997, ***Engineered and* unregulated degradation *of karst aquifers: Two case studies in New York State, USA.*** *In* The Engineering Geology and Hydrogeology of Karst Terranes, Beck & Stephenson (eds), Proceedings of The Sixth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst; Balkema, Rotterdam; p. 467-476.

Rubin, P.A., Engel, T., and Nardacci, M., 1995, ***Geomorphology, paleoclimatology and land use considerations of a glaciated karst terrain, Albany County, New York.*** Guidebook for joint meeting of the New York State Geological Association (67th Annual) and the American Association of Petroleum Geologists. Trip leader, p. 81-107.

Rubin, P.A., 1995, ***The geology of Clarksville Cave, Albany County, New York.*** Guidebook for joint meeting of the New York State Geological Association (67th Annual) and the American Association of Petroleum Geologists. Trip leader, p. 251-273.

Rubin, P.A., 1995, ***The geology of Cherokee Caverns; Tennessee.*** *In* Karst Geohazards (ed. by B. Beck), Proceedings of: The Fifth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst; Sponsors include the National Ground Water Association and the American Society of Civil Engineers, Gatlinburg, TN, p. 541-547.

Rubin, P.A., 1994, ***Paleohydrology of the Kämper Avenue area; Mammoth Cave National Park, Kentucky.*** Mammoth Cave National Park's Third Science Conference; Sponsored by Mammoth Cave National Park and The Cave Research Foundation, Mammoth Cave National Park, Kentucky, p. 265-279.

Rubin, P.A., Zerr, B., Davies, G.J., Lemiszki, P.J., Neuhoff, P.S., and Aiken, J., 1993, ***Preliminary hydrogeologic studies in carbonate aquifers of the Oak Ridge Reservation, Tennessee.*** Abs. Fourth Annual Walker Branch Watershed Research Symposium, Oak Ridge, TN, p. 15-16.

Davies, G.J., Rubin, P.A., and Quinlan, J.F., 1993, ***Indirect observation of the rapid-flow and slow-flow components of recharge to the Knox aquifer, Oak Ridge, Tennessee.*** Abs. Fourth Annual Walker Branch Watershed Research Symposium, Oak Ridge, TN, p. 17.

Rubin, P.A., Lemiszki, P.J., and Poling, R.S., 1992, ***Strategy for definition and protection of East Tennessee karst groundwater basins.*** Tennessee Water Resources Symposium (5th, Nashville, TN., Oct. 1992), Proceedings. American Water Resources Association, Nashville, TN, p.7-10.

Rubin, P.A. and Lemiszki, P.J., 1992, ***Structural and stratigraphic controls on cave development in the Oak Ridge area, Tennessee.*** Tennessee Water Resources Symposium (5th, Nashville, TN., Oct. 1992), Proceedings. American Water Resources Association, Nashville, TN, p. 111-117.

Rubin, P.A., Lietzke, D.A., and Schmidt, V.A., 1992), ***Aspects of the geomorphology of Oak Ridge, Tennessee.*** Abs. National Speleological Society Convention, Salem, IN.

Rubin, P.A., 1992, ***Strategy for aquifer and stream protection in karst terranes.*** Abs. The New York Natural History Conference II, New York State Museum Circular 54, p. 61, Albany, New York.

Rubin, P.A., 1992, ***Karst hydrology of Oak Ridge, Tennessee.*** Abs. Third Annual Walker Branch Watershed Research Symposium, Oak Ridge, TN, p. 34.

Rubin, P.A., 1992, ***Land-use planning and watershed protection in karst terranes.*** Hydrogeology, Ecology, Monitoring, and Management of Ground Water in Karst Terranes Conference (3rd, Nashville, Tenn., Dec. 1991), Proceedings. National Ground Water Association, Dublin, Ohio, p. 769-793.

Rubin, P.A., Ayers, J.C., and Grady, K.A., 1992, ***Solution mining and resultant evaporite karst development in Tully Valley, New York.*** Hydrogeology, Ecology, Monitoring, and Management of Ground Water in Karst Terranes Conference (3rd, Nashville, Tenn., Dec. 1991), Proceedings. National Ground Water Association, Dublin, Ohio, p. 313-328.

Palmer, A.N., Rubin, P.A., and Palmer, M.V., 1991, ***Interaction between karst and glaciation in the Helderberg Plateau, Schoharie and Albany Counties, New York.*** Guidebook for New York State Geological Association Annual Meeting, Oneonta, New York, p. 161-190.

Palmer, A.N., Palmer, M.V., Porter, C.O., Rubin, P.A., and Mylroie, J.E., 1991, ***A geological guide to the karst and caves of the Helderberg Mountains, Schoharie and Albany counties, New York.*** Guidebook paper for National Speleological Society annual meeting, Cobleskill, New York, p. 105-167.

Rubin, P.A., 1991, ***Modification of preglacial caves by glacial meltwater invasion in East-Central New York.*** Appalachian Karst Symposium, Proceedings. National Speleological Society, Radford, Virginia, p. 91-100.

Rubin, P.A., 1991, ***Flow characteristics and scallop forming hydraulics within the Mill Pond Karst Basin, East-Central New York.*** Appalachian Karst Symposium, Proceedings. National Speleological Society, Radford, VA., p. 101-108.

Rubin, P.A., 1991, ***Emerged sea caves and coastal features as evidence of glacio-isostatic rebound, Mount Desert Island, Maine.*** Appalachian Karst Symposium, Proceedings. National Speleological Society, Radford, Virginia, p. 75-83.

Rubin, P.A., 1983, ***Structural geology and geomorphology of the Shawangunk Mountain caprock, Southeastern New York.*** Abs. Geol. Soc. Amer. N.E. Ann. Mtg., Kiamesha Lake, New York; and Abs. Mohonk Research Associates Conference, Mohonk Lake, New York.

Rubin, P.A. and Briedis, J., 1982, ***Acid precipitation and volcanism linked to Mesozoic dinosaur extinction.*** Abs. Geol. Soc. Amer. Ann. Mtg., New Orleans. Louisiana.

Rubin, P.A., Smiley, D., and Egemeier, S.J., 1981, ***Acid precipitation in the Shawangunk Mountains, Southeastern New York.*** Abs. AMS/CMOS International Conference on Long-Range Transport of Airborne Pollutants, Albany, New York; and Abs. Geol. Soc. Amer. N.E. Ann. Mtg., Bangor, Maine.

Rubin, P.A., 1981, ***New Aspects of the stratigraphy and structure of the Shawangunk Mountains, Southeastern New York.*** Abs. Geo. Soc. Amer. N.E. Ann. Mtg., Bangor, Maine.

Egemeier, S.J., Liff, C.I., Smiley, D., and Rubin, P.A., 1981, ***The safe yield of the "sky" lakes of the Shawangunk Mountains of Southeastern New York.*** Abs. Geol. Soc. Amer. N.E. Ann. Mtg., Bangor, Maine.

Brian T. Ketcham, P.E.
Executive Vice President and Technical Director, Konheim & Ketcham, Inc.

Professional Background

Brian Ketcham is an innovative transportation engineer with recognized expertise in all transportation related fields: traffic, transit, air quality and noise impact analyses, truck routing, parking plans, pedestrian flow, and associated socio-economic analyses. With more than 30 years of hands-on transportation experience, he has performed dozens of complex traffic and air quality studies, managed transportation and environmental assessments of large-scale projects (highways, shopping centers, residential developments, hospitals) and prepared extensive maintenance and protection of traffic and truck route plans, primarily for New York City and State agencies. He produces practical improvements by developing an intimate knowledge of travel patterns and user needs through repeated observation, targeted data collection and optimizing traffic flow with modeling that tests real world effects and builds consensus on solutions. These forward looking approaches have marked his career since he authored the nation's first comprehensive plan to control mobile source emissions, which pioneered strategies now known as transportation systems management.

Representative Relevant Experience

Area-wide maintenance and protection of traffic (M&PT) plans for major construction projects:

- Worked closely with NYC Department of Transportation over many years to evaluate alternative closure plans for reconstruction of the Queens Boulevard Bridge using TRANPLAN models of a 2 square mile area Long Island City road network and all East River crossings. For the selected option, optimized traffic patterns and signal controls with Synchro/SimTraffic modeling of more than 100 intersections, which produced unexpected bonus of better than ever traffic flow throughout the area.
- Built TransCAD model of the arterial network with a six mile radius of the Triborough Bridge to assist MTA Bridges & Tunnels choose among 13 alternative strategies for redecking all bridge spans.
- Used TRANPLAN model of three mile area around the Kosciuszko Bridge to test alternative concepts for NYS Department of Transportation of reconstructing the bridge, including a parallel bridge.
- Analyzed pedestrian-vehicle conflicts on service road of the Clearview Expressway to help NYSDOT and community and school officials assess need for changing local street pattern as part of plan for diversion routes during reconstruction of the interchange of the Clearview-Long Island Expressway.
- Developed diversion routes for NYSDOT during repaving the Staten Island Expressway based on assessing the hour-by-hour capacities of roads adjacent each segment of the six mile highway.
- Developed for NYCDOT detailed work zone M&PT plans for rehabilitating the Mill Basin and Gerritsen Bridges on the Belt Parkway and assessed mainline impacts of proposed lane reductions.

Analysis of design alternatives of highways and other major projects

- Analyzed alternative configurations of new toll barriers on the Bronx-Queens and Manhattan toll plazas of the Triborough Bridge in terms of safety and access to/from Randall's Island, expressed as externality costs for users and toll revenues for MTA B&T.
- Developed internal roadway plan of new East End Terminal at LaGuardia Airport for the Port Authority of New York & New Jersey, and for NEPA EIS assessed traffic, air and noise impacts on surrounding roads and community.
- Evaluated travel and air quality costs and benefits of roadway transport vs. cross harbor barging of goods delivered to the Port of Brooklyn. The study for the PANY&NJ was selected by the U.S. Department of Transportation as one of the "10 Best Congestion Management and Air Quality projects."
- Assessed traffic flow conditions using CORSIM model of six alternative merge configurations of FDR Drive from Triborough Bridge off ramp and exit to large retail complex under construction at 116th Street in Manhattan.

- Determined best configuration for deceleration ramps, using Synchro/SimTraffic, on Bronx River Parkway at Gun Hill Road and at Mosholu Parkway, will use CORSIM to refine designs for NYSDOT.
- Examined impact of closing northbound exit on Major Deegan Expressway at 230th Street with Synchro/SimTraffic, will use CORSIM for additional study for NYSDOT of feasibility of building new exit and entry ramps to accommodate traffic anticipated from a new Target store at 225th Street.
- Used Synchro/SimTraffic model to augment City Environmental Quality Review of traffic, parking and pedestrian analysis and mitigation of major expansion of New York-Presbyterian Hospital, in particular, to test entry and exit patterns at hospital entrance and recommend comprehensive improvements to circulation patterns around Columbia Presbyterian Medical Center campus.
- Prepared a detailed forecast of traffic and pedestrian demand for a LIRR Sunnyside Station Pedestrian Connector planned to be built by the MTA in Long Island City as part of its East Side Access project.
- Developed pedestrian and cyclist safety improvements at both ends of the Brooklyn Bridge, the Manhattan end for NYCDOT, the Brooklyn end for Community Board No. 2 as participants in NYCDOT Downtown Brooklyn Traffic Calming Study, by proposing to replace highway-type ramps with signalized crosswalks and reconfigured intersections. Synchro/SimTraffic modeling of the complex Brooklyn approach showed enormous traffic flow benefits of new left-turn lane for southbound vehicles. Concepts selected by the Municipal Art Society as two of the "100 Best Ideas for NYC in the 21st Century."
- Directed High Accident Location studies of numerous locations for NYSDOT in which causal factors and recommendations are so well documented that the Regional Office uses the reports as models for other consultants.
- Analysis of traffic and air quality impacts for CEQR review of a proposal to add 30 industrial and commercial trip generators in College Point Corporate Park, Queens, NY.
- Performed for the Brodsky Organization, traffic, parking, transit and pedestrian analyses and mitigation of impacts for CEQR review of 1,000 unit residential complex and adjacent 10 million square foot development on 140 block traffic network of upper West Side of Manhattan
- Multiple studies related to resource recovery facility proposed by Middlesex County (NJ) Utilities Authority: county-wide analysis of 16 potential sites; transfer station analysis; county-wide truck route study; traffic analysis of selected site; redesign of complex traffic circle. Similar studies for facilities in Passaic and Camden, NJ and Conshhocken, PA. Brian also developed enforceable refuse truck routes through close consultation with haulers in Passaic, Middlesex, Somerset and Essex Counties.

Designed and directed numerous area-wide traffic data collection programs:
- Hutchinson River Parkway and I-95 in the Bronx, NY for corridor safety study for NYSDOT.
- Brooklyn-Queens Expressway Corridor for M&PT plan for reconstruction of BQE, north of Queens Blvd. by NYSDOT. Traffic data collection augmented by pedestrian/vehicle conflict analyses.
- Catskill Watershed for M&PT plan for reconstruction of 12 reservoir bridges by NYCDEP.
- All above traffic analyses.

Education
Case Institute of Technology, B.S.M.E., 1962
Massachusetts Institute of Technology, all course work for M.S. in mechanical engineering, 1966

Professional Registration
Licensed Professional Engineer, 1969, New York State #045144

Societies
Institute of Transportation Engineers
Transportation Research Board
Air & Waste Management Association
Society of Automotive Engineers

Selected Publications

Suffolk County Transit Alternative Fuels Study, presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 2002. Co-authored with Arthur Vatsky.

Effective Transit Requires Walkable Communities: Land Use Lessons of Transport Patterns in Four World Cities, presented at the Annual Meeting, Transportation Research Board, Washington, D.C., January 2000, Published in Transportation Research Record, February 2001. Co-authored with Carolyn S. Konheim.

Real World Applications of Cost-Benefit Models, presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1999. Co-authored with Carolyn S. Konheim.

Four World's Cities Study: Lessons for the New York Metropolitan Area; Presentation, Smart Growth Conference, organized by the National Audubon Society, Albany, NY, March 1999. Also presented to NJ Transportation Leadership, Workshop on the Four World Cities Study, Rutgers University, June 17, 1999.

Walking and Land Use: Walking is the Defining Characteristic of Smart Growth; Contributing author of Pedestrian Section of TRB publication on Transportation at the Millennium, April 1999.

The Development of a Regional GIS-Transportation ITS Network, co-author M.S. Iqbal, presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1995, and published in the Transportation Research Record, No. 1497, Washington, D.C., 1995.

A Validation of the Time-Space Corner and Crosswalk Analysis Method, co-authored by J. Fruin and P. Hecht, Paper No. 870389, Transportation Research Board, January 1988.

Beyond Autocracy: The Public's Role in Regulating the Auto, co-authored with S. Pinkwas, Government, Technology and the Future of the Automobile, edited by D.H. Ginsburg and W.J. Abernathy, 1980.

Diesel and Man, co-authored with S. Pinkwas, New Engineer Magazine, April 1978. (This article won the 1978 Business Journalism Award.)

Environmental Impact of Goods Movement Activity in NYC, co-authored with M. Arrow and J. Coyle, Transportation Research Record No. 496, Urban Goods Movement, Transportation Research Board, National Research Council, Washington, D.C., 1974.

The Implications of Present Trends for Air Quality, Proceedings of the International Conference on Transportation Research, Bruges, Belgium, Transportation Research Forum, Chicago, IL, 1974.

Automotive Pollution Control: An Alternative Approach, International Conference on Transportation Research, Bruges, Belgium, June 18, 1973.

Urban Transportation, co-authored with J.P. Romauldi, C. Stark and W. Sprietzer, Public Affairs Report No. 2, Society of Automotive Engineers, Inc., New York City, January 1973.

Curriculum Vitae

Piotr Parasiewicz

September 2003

Current address

Office:
Department of Natural Resources
Cornell University
202 Fernow Hall
Ithaca, NY 14853
(607) 227 5619 voice (208)728-7305 fax
Email: pp67@cornell.edu

Home:
49 Janivar Drive
Ithaca, NY 14850

Education:

1998 - Ph. D. Natural Resources Management and Water Engineering, University of Agricultural Sciences in Vienna, Austria.
Advisors: Univ. Prof. Dr. Mathias Jungwirth and ao.Univ. Prof. Dr. Stefan Schmutz.

1993 - M.S., Environmental and Water Engineering, University of Agricultural sciences in Vienna, Austria.
Advisors: Univ. Prof. Dr. Mathias Jungwirth and Univ. Prof. Dr. Siegfried Radler.

1988 - B.S., Environmental and Water Engineering, Department of Hydrobiology, Fisheries and Aquaculture, University of Agricultural Sciences, Vienna, Austria.

1984 - Arabic, University of „Al Fateh", Tripolis, Lybia.

1980 - Advanced Mathematics Program in "Klement Gottwald" High School, Warsaw, Poland.

Research expertise and interests

Habitat modeling: Quantitative modeling of running water ecosystem with focus on system scale physical habitat assessment and modeling, Instream Flow/Habitat Models.

River restoration: Assessment and maintenance of ecological integrity, comprehensive river management concepts, river restoration planning, construction and evaluation.

Fish ecology and fisheries management: Fish community structure, diversity and population dynamics.

Fish passage: Development of innovative technologies for diadromous and freshwater fishpassage (design, planning, construction and evaluation).

River Survey and Instrumentation: physical and biological survey designs Development and application of flow meters and multiplex sensors, ADP, GPS, Aerial Photography.

Computer Aided Design (CAD), Digital Terrain Models (DTM), Geographical Information Systems (GIS), Acoustic Doppler Profiling (ADV), environmental statistics, computer programming.

Academic and professional appointments

2000-present. Cornell University, Ithaca, NY.
Research Associate IV. Department of Natural Resources. Director, Instream Habitat Program.

2000-present. University of Massachusetts, Amherst, MA .
Adjunct Assistant Professor in Aquatic Ecology and Engineering, Department of Natural Resources Conservation.

2003-present. University of Connecticut, Storrs, CT.
Adjunct Assistant Professor in Aquatic Ecology and Engineering, Department of Natural Resources Management and Engineering,

2003-present. US Army Corps of Engineers.
Consultant. Habitat Restoration Team an oversight committee of Onondaga Lake Watershed Restoration project, Syracuse, NY.

2002 Natural Resources Council of Maine.
Consultant. Review of existing by-pass channels for dam removal study. Augusta, ME.

2002 US Bureau of Reclamation
Consultant. Expertize on fish passage options at San Acacia Dam on Middle Rio Grande River, Albuquerque, NM.

2002 US Fish and Wildlife Service.
Consultant. Expertise on instream flow settings on the Santee River below Willson Dam, FERC re-licensing project, Charleston, SC.

2001-2002 US Army Corps of Engineers.
Consultant. Supervision of planning of nature-like bypass channel on Lock and Dam Number 1 on the Cape Fear River, Wilmington, NC.

2001-2002 US Fish and Wildlife Service.
Consulting expert for construction of fish-passage facility on New Savannah Bluff Dam, Savannah River, Augusta, GA.

2001 Trout Unlimited.
Consultant. Report: Instream flows of the Upper Delaware River, Roscoe, NY.

1999-2000 Cornell University, Ithaca, NY.
Post Doctoral Fellow, Aquatic Ecological Engineering, New York Copperative Fish and Wildlife Research Unit

1998-1999 University of Agricultural Sciences, Vienna, Austria.
University Lecturer, Institute of Water Provision, River Ecology and Waste Management
Department of Hydrobiology, Fisheries and Aquaculture,

1994-1998 University of Agricultural Sciences, Vienna, Austria.
Research Associate, Institute of Water Provision, River Ecology and Waste Management.
Department of Hydrobiology, Fisheries and Aquaculture,

1988-1994 Research Assistant, Department of Hydrobiology, Fisheries and Aquaculture, University of Agricultural Sciences, Vienna, Austria.

1985-1989 Auto-Erhart Travel, Vienna, Austria.
Chauffeur and tour guide.

1979-1981 Experimental fish farm, Rudzienko, Poland
Production manager.

Research Projects since arrival in US (1999)

- International Network to Harmonize and Improve Knowledge and Assessment Methods of Biotic-Abiotic Interactions in Running Waters as a Conservation Tool. The Nature Conservancy. Principal Investigator. 12/1999-12/2000. $25,000
- Ecohydrology study of Quinebaug River. Principal Investigator. New England Interstate Water Pollution Control Commission. Principal Investigatior. 10/1999-12/2003. $508,000
- River Scale Instream Flow Simulation - New York State Water Resources Institute. Principal Investigator. 3/2000-2/2001. $6,000.
- Instream Flow Requirements of Mill River – Hatfield, MA. Massachusetts Department of Environemtal Management. Co-Principal Investigator (with S. DeStefano and S. Jackson). 6/2000-6/2001. $30,000
- Cvonservation planning on the Mill River on Hattfield. The Nature Conservancy and Massachusetts Environmental Trust. Principal Investigator. 11/2001-10/2002. $24,000.
- Feasibility study of removal of Hatfield Dam – Hatfield, MA. Massachusetts Environmental Trust. Co-Principal Investigator (with S. Jackson). $30,000
- Demonstration of integrating instream habitat assessment into local watershed management. New York State Water Resources Institute. Principal Investigator. 3/01-2/02. $18,000.
- Application of MesoHABSIM on Stony Clove – PHASE I and Demonstration of integrating instream habitat assessment into local watershed management. Green County Soil and Water Conservation District and New York City Department of Environmental Protection. Principal Investigator. 6/02-8/03. $43,800
- Developing a sustainable management plan for the Pomperaug River watershed. Pilot study. Connecticut Department of Environmental Protection. Pricipal Investigator. 6/02-10/03. $25,000
- Developing a sustainable management plan for the Pomperaug River watershed. Phase II. Pomperaug River Watershed Coalition. Principal Investigator. 5/03-7/05. $58,300.
- Instream habitat evaluation of Santee River, South Carolina below Wilson Dam. Santee Cooper AG. Principal Investigator. 1/03-1/05. $250,000.
- Fish habitat study for Long-Term Impact Analysis of the University of Connecticut's Fenton River Water Supply Wells on the Habitat of the Fenton River. University of Connecticut. Principal Investigator. 4/03-4/05. $46,300.

- Defining restoration needs for Beartrap Creek. Onondaga Lake Partnership and Isaak Walton League. Principal Investigator. 6/03-12/03. $4,700.

Select non-profit consulting, professional services and invited lectures

Rhode Island Water Resources Board – invited expert for Water Allocation Program Advisory Council, Providence, RI. 7/23/2003

Institute of Ecosystem Studies – Invited speaker for conference Hudson River Tributaries: the State of Our Knowledge. Millbrook, NY. 6/12/2003.

American Fisheries Society – Bioengineering Section – Member of education committee for development of fluvial engineering curriculum. 2002 -2004.

Potomac River Basin Commission - Invited expert for Potomac Minimum Instream Flow Methods Workshop, Potomac, MD. 4/8-9/2003

INRS Eau terre et Environnement, Canada – Invited plenary speaker for international workshop on "State of the art in habitat modeling and conservation flows", Quebec City, Canada. 3/4 -5/2003.

Iowa Institute of Hydraulic Research: Hydroscience and Engineering, The University of Iowa – Distinguished lecturer, Iowa City, IA. 2/7/2003.

New York Chapter of American Fisheries Society – Invited speaker for annual - meeting on "Restoring Natural Flow Regimes: Dam Removal as a Tool in River Restoration" Canandaigua, NY. 1/9/2003.

European Commission – Invited expert for the "Upscaling Workshop" of COST Action 626: "European Aquatic Modelling Network", Gent, Belgium. 12/11-13/2002.

Massachusetts River Restore Program – Invited expert for workshop on Environmental Risk for Dams, Marlborough, MA. 11/19/2002.

University of Wisconsin-Madison - Invited lecturer for short course on Engineering Innovative Fish Passage Dam Removal and Nature-like Fishways, Waterville Valley, NH. 10/20-10/24/2002.

Trout Unlimited Chapter– Invited presentation of Instream Habiat Program, Kingston, NY 9/5/2002.

New York Department of Environmental Conservation – Hydrological Habitat Modification work group of Non-Point Source Pollution Committee, Albany, NY. 2001-present.

American Fisheries Society – Organizing committee of Fisheries Bioengineering Symposium, Baltimore, MD. 8/25-30/2002.

Invited expert for Connecticut Water Planning Council Technical Committee - New Britain, CT 6/30/2002.

New England Interstate Water Pollution Control Commission – Invited presentation of Instream Habitat Program, New London, CT 5/16/2002.

Invited expert for Platte River Workshop organized by Pallid Sturgeon/Sturgeon Chub Task Force. Lincoln, NE 1/23-24/2002.

Invited panelist for conference: Managing the flows for biodiversity – A conference on science, policy and conservation action. Colorado State University. Fort Collins, CO 7/30-8/2/2001.

European Commission – invited expert for the plenary meeting of COST Action 626 "European Aquatic Modelling Network", Trondheim, Norway, 5/11-12/2001.

University of Oslo, Norway – guest lecturer on the Zoological Museum of University of Oslo, Oslo, Norway. 5/8/2001.

University of Wisconsin-Madison - invited lecturer for short course on Urban Channel Design and Rehabilitation: Biotechnical engineering, Watershed concepts, recapturing the stream corridor, Engineering alternatives, Madison, WI, 11/28-30, 2000.

US Fish and Wildlife Service Eastern Hydropower Licensing Workshop Northeast and Southeast Regions – invited expert - National Conservation Training Center, Shepherdstown, WV, 8/29-31/2000.

HydroVision 2000 Conference - Requested and sponsored panelist on Session: International Water Power Regulations and Compliance, Charlotte, NC, August 2000.

US Fish and Wildlife Service, National Conservation Training Center – Invited instructor for Fish Passageways and Bypass Facilities-East Course, Hadley, MA, 7/10/2000.

Instream Flow Council National Meeting – invited speaker, Higgins Lake, MI. 5/22-24/2000.

US Army Corps of Engineers invited speaker for workshop "Passage for Non-Salmonid Fishes in Streams and Rivers: A Critical Element in Ecosystem Management and Restoration", Wilmington, NC, 4/25-4/27/2000

US Fish and Wildlife Service – Requested and sponsored expert, participant, and discussion assistant for the US Fish and Wildlife Service, North Carolina Field Office, Roanoke River hydropower licensing workshop, Raleigh, NC.11/30-12/2/99.

Scientific committee of 3rd International Symposium on Ecohydraulics. Salt Lake City, UT. July 1999.

European Commission – Participant and discussion assistant in international workshop "Water Related Conflicts: Research Deficits and Demands" in preparation of Fifth Framework Program. 1998.

Austrian Network for Environmental Research – Expert and facilitator of River Ecology Sub-network 1997-99.

Founding member of International Aquatic Modeling Group, 1995.

Special training courses

1994 – Instream Flow Incremental Methodology (IFIM) - Stream Habitat Sampling Techniques" Colorado State University, Ft. Collins, CO.

1994 - "Using Computer-Based Physical Habitat Simulation (PHABSIM) System", Utah State University, Logan, UT.

Honors and awards

1993 - First award and grant „*100 Jahre Kulturtechnik und Wasserwirtschaft*" for Master Thesis : CAD-application in eco-morphological investigations of running waters. - Eternit ATS 10,000.

1998 - Summa Cum Laude

1999 - International network to harmonize and improve knowledge and assessment methods of biotic-abiotic interactions in running waters as a conservation tool. - The Nature Conservancy: David H. Smith Fellowship - International Collaborations. $25,000.

Languages

Fluent in Polish, Russian, German, English.
Passive knowledge of Hungarian and Arabic.

Professional societies

International Aquatic Modelling Group
American Fisheries Society

Chad P. Dawson

Office Address: State University of New York
College of Environmental Science and Forestry
320 Bray Hall
Syracuse, NY 13210
315-470-6567
315-470-6535 (FAX)
cpdawson@esf.edu

Education: Ph.D., Resource Management and Policy, College of Environmental Science and Forestry, State University of New York, Syracuse, New York. 1983.

M.P.S., Resource Policy and Planning, Department of Natural Resources, College of Agriculture and Life Sciences, Cornell University, Ithaca, N.Y., 1979.

B.S., Conservation and Resource Planning, Department of Natural Resources, University of Michigan, Ann Arbor, MI., 1970.

Professional Experience:

3/03 to present: Chair and Professor, Faculty of Forest and Natural Resources Management, College of Environmental Science and Forestry, State University of New York, Syracuse, NY.

Managing the Faculty of Forest and Natural Resources Management (FNRM) includes academic programs leading to the BS, MPS, MS and Ph.D. degrees at Syracuse and the NY Ranger School, a technician degree program at Wanakena. FNRM includes research and continuing education and public service programs throughout New York state, northeastern states, and the nation. Areas of excellence include forest ecosystem science and applications, resource policy and management; watershed management and forest hydrology, recreation resource management, and quantitative methods for resource science and management. Professor Dawson also teaches undergraduate and graduate courses on wilderness and river recreation management and outdoor recreation management.

8/96 to 2/03: Professor, Recreation Resources Management, Faculty of Forest and Natural Resources Management, College of Environmental Science and Forestry, State University of New York, Syracuse, NY.

Taught undergraduate and graduate courses on psychology of leisure behavior, commercial recreation, wilderness and river recreation management, tourism planning, and outdoor recreation management. Recruited and advised graduate and undergraduate students in the Recreation Resources Management program option. Developed and conducted social science research on wilderness visitor management, recreation resources management issues, and the human dimensions of natural resources management for state and federal agencies. Delivered recreation management workshops for state and federal agency managers. Published agency research reports, professional publications, and outreach and teaching materials. Served on faculty governance committees within the department and college such as chairing search committees and serving as the Chair of the Promotion and Tenure Committee for the department and Chair of the search committee for the FNRM chairperson. Revised and developed the curriculum in the Recreation Resources Management program option.

6/92 to 5/01: Board of Education member for the Mexico Central School District, Mexico, NY.

Elected public official serving 9 years as a Board member with six years as a President or Vice-President of the Board of Education. Contributed to policy guidelines and budgetary decisions for a rural school district with 2,800 students, 200+ teachers, five schools, and over $26 million annual budget. Worked very closely with District administrators and the public to create a vision and strategic plan for financial stability, growth of educational programs, creation and construction of a multi-million dollar state-of-the-art technology system for teaching and learning, and maintenance and expansion of the physical facilities, such as a recently completed $10 million building construction project.

8/92 to 8/96: Associate Professor and Graduate Program Coordinator, Faculty of Forestry (now named Forest and Natural Resources Management), College of Environmental Science and Forestry, State University of New York, Syracuse, New York.

Coordinated department recruiting and selection activities in the graduate program and manage the graduate education program. Taught undergraduate and graduate courses in principles of management and organizational behavior, commercial recreation, social science research methods, wilderness and river recreation management, and tourism planning. Advised graduate and undergraduate students. Developed and conducted research on wilderness visitor management, human dimensions of fisheries management, and commercial recreation business management. Published agency research reports, professional publications, and outreach and teaching materials. Served on faculty governance committees within the department and college. Received SUNY Chancellor's Award for Excellence in Teaching in 1995.

8/89 to 8/92: Assistant Professor, Faculty of Forestry (now named Forest and Natural Resources Management), College of Environmental Science and Forestry, State University of New York, Syracuse, New York.

Designed, developed, and taught undergraduate and graduate courses in commercial recreation, research methods, wilderness and river recreation management, tourism planning, and principles of management. Advised graduate and undergraduate students. Worked in partnership with Cornell Cooperative Extension and New York Sea Grant Program to develop and conduct research in cooperation with public agencies and private foundations on socio-economic aspects of fisheries management, commercial recreation businesses, and recreational issues related to natural resources management. Published extension materials for recreation and tourism decision-makers. Served on faculty governance committees within the department and college.

9/85 to 8/89 Senior Extension Associate and Team Leader, Cornell University Cooperative Extension and New York State Sea Grant Extension Program.

Provided leadership for the Tourism and Small Business Education Team concerned with applied research and educational programs for public and private sector decision-makers. Designed, implemented, and evaluated educational programs relating to natural resource based recreation, tourism, commercial recreation businesses, and community tourism planning throughout New York's Great Lakes region. Designed and conducted applied research projects on recreation, tourism, and commercial recreation business management topics and related economic impacts; including working with the Great Lakes Sea Grant network across the Great lakes states. Developed written and audio-visual educational materials. Assisted regional and state tourism interests in identifying needed technical and educational assistance.

9/86 to 8/89 Adjunct Assistant/Associate Professor, College of Environmental Science and Forestry, State University of New York, Syracuse, New York.

Designed and presented graduate courses in Commercial Recreation and Recreation and Tourism Planning. Served as a graduate faculty committee member for graduate students with thesis projects and internships on recreation and tourism topics.

9/83 to 9/85 Assistant Professor and Extension Agent, Recreation and Tourism, University of Minnesota Cooperative Extension Service and Minnesota Sea Grant Program.

Planned, developed, implemented, and evaluated educational programs on planning, development, and management of natural resource based recreation and tourism. Wrote information publications and provide technical assistance for public and private sector decision-making. Conducted applied social science research studies on recreation and tourism and cooperate with Sea Grant funded researchers. Conducted and coordinated educational programs with Minnesota Agricultural Extension Service staff and with Great Lakes Sea Grant Extension agents.

7/79 - 1/82 Research Associate, Outdoor Recreation Research Unit (now the Human Dimensions Research Unit), Department of Natural Resources, Cornell University, Ithaca, N. Y.

Major responsibilities were to design, implement, analyze, and report on applied social science research studies in (1) socio-economic values and recreational considerations in natural resources management and (2) outdoor recreation planning and management. Research projects required interaction with federal and state agencies from the proposal stage through funding, implementation, and statistical analysis as well as interaction with the private sector recreational users and commercial recreation businesses. Research implementation required training and supervision of office and field staff. Consulting services on recreation projects were provided to state and federal natural resource planning and management agencies.

9/75 - 7/79 Research Support Specialist, Outdoor Recreation Research Unit (now the Human Dimensions Research Unit), Department of Natural Resources, Cornell University, Ithaca, N.Y.

Research work included planning and implementing public survey research and field interviews related to applied social science research for outdoor recreation and natural resources planning and management. Statistical analysis of data, computer use, and writing project reports and publications were also major responsibilities.

Selected Professional Involvement:

- Managing Editor for the International Journal of Wilderness (started as co-managing editor in 2001). Responsible for managing the manuscript editing and review process and all production aspects for three issues per year. Corresponding office for IJW is located at ESF.
- Executive committee member for the Northeastern Recreation Research Symposium (1990-2002). Share responsibility with executive committee and as host state for organization and planning of annual conference for 150-200 professionals.
- Society of American Foresters; Recreation and Wilderness Working Group member.
- Cooperating researcher with the Aldo Leopold Wilderness Research Institute on wilderness visitor studies (Social Science Research Program).
- Member of International Association for Society and Natural Resources.
- Member of state and national wilderness management and stewardship organizations.

Selected Professional Presentations:

- Northeastern Recreation Research Symposium, 1990 through 2002
- National Wilderness Conference, 1994, 1999 (invited for 2004)
- World Wilderness Conference, 1993, 1998 (invited for 2004)
- International Symposium on Society and Resource Management 1996, 1998, 2002 (invited for 2004)
- American Fisheries Society Conference, 1998
- Adirondack Research Consortium Conference, 1995, 1996
- New York State Parks and Recreation Society Conference, 1996
- International Outdoor Recreation & Tourism Trends Symposium, 1985, 1990, 1995
- The Empire Forest: Changes and Challenges, 1995
- Environmental Interpretation Conference, 1993
- Social Aspects and Recreation Research Symposium, 1992
- Society of American Foresters Convention, 1990, 1993

Publications:

Books and Book Chapters

Ecotourism and Nature-Based Tourism: One End of the Tourism Opportunity Spectrum? Chad P. Dawson. *In* Stephen F. McCool and R. Neil Moisey. 2001. Tourism, Recreation and Sustainability: Linking Culture and the Environment. CABI Publishing, CAB International, Wallingford, UK. pp. 41-53.

Wilderness Management: Stewardship and Protection of Resources and Values (3rd edition). John C. Hendee and Chad P. Dawson. 2002. Fulcrum Publishing, Golden, CO. 640 pages

Social Science Perspectives in Wilderness Management. Chad P. Dawson and John Hendee. 2004. Chapter in book to be published by International Symposium on Society and Resource Management.

Publications In Peer Reviewed Journals

Willingness of New York Farmers to Incur White-Tailed Deer Damage. T.L. Brown, D.J. Decker and C.P. Dawson. 1978. Wildlife Soc. Bull. 6(4):235-239.

Social Considerations Associated with Marine Recreational Fishing Under FCMA. C.P. Dawson and B.T. Wilkins. 1980. Marine Fisheries Review 42(12):12-17.

Comments on the Importance of Late Respondent and Nonrespondent Data from Mail Surveys. T.L. Brown, C.P. Dawson, D.L. Hustin and D.J. Decker. 1981. J. Leisure Research 13(1):76-79.

Motivations of New York and Virginia Marine Boat Anglers and Their Preferences for Potential Fishing Constraints. C.P. Dawson and B.T. Wilkins. 1981. North Am. J. Fish. Management 1(2):151-158.

Attitudes of Marine Boat Anglers in New York Toward Potential Sportfishing Regulations. C.P. Dawson and B.T. Wilkins. 1983. New York State Fish and Game Journal 30(2):210-219.

Bed and Breakfasts: A Matter of Choice. C.P. Dawson and T.L. Brown. 1988. Cornell Hotel and Restaurant Administration Quarterly 29(1):17-21.

Bed and Breakfast Business Programming. C.P. Dawson and T.L. Brown. 1989. Journal of Extension 27(2):26-27.

The Charter Boat Fishing Industry in the Great Lakes. C.P. Dawson, F.R. Lichtkoppler and C. Pistis. 1989. North American Journal of Fisheries Management 9(4):493-499.

The Failure of Success in Natural Resources Program Administration: Pacific Salmon Harvest Policy in New York State. N.A. Connelly, B.A. Knuth and C.P. Dawson. 1993. Policy Studies Review Journal 11(2): 28-40.

Salmon Snagging Controversy: New York's Salmon River. C.P. Dawson, N.A. Connelly and T.L. Brown. 1993. Fisheries 18 (4):6-10.

College and University Curricula in Ecotourism or Nature-Based Tourism. R. Robertson, C. P. Dawson, W. Kuentzel, and S. Selin. 1996. Journal of Natural Resources and Life Sciences Education 25(2):152-155.

Dimensions of Wilderness Privacy for Adirondack Forest Preserve Hikers. C. P. Dawson and W. E. Hammitt. 1996. International Journal of Wilderness 2(1):37-41.

Defining Characteristics of U.S.A. Wilderness Experience Programs. Chad P. Dawson, Jim Tangen-Foster, Gregory T. Friese, and Josh Carpenter. 1998. International Journal of Wilderness 4(3):22-27.

Risk Management in Wilderness Experience Programs. Jim Tangen-Foster and Chad P. Dawson. 1999. International Journal of Wilderness 5(3):29-34.

Satisfaction with Recreation Leasing of Industrial Forestlands in the State of New York. Sergio Capozzi, C. P. Dawson, and Rene Germain. 2002. Northern Journal of Applied Forestry 20(1): 27-33.

The Complexities of Coping Behavior in Adirondack Wilderness. Andrew Johnson and Chad P. Dawson. 2002. Leisure Sciences (pending publication).

Publications In Conference Proceedings and Non-peer Reviewed Journal Articles

Public Access Hunting: A 1974 Pilot Study Evaluation. T.L. Brown and C.P. Dawson. 1977. Trans. North Am. Wildlife Natural Resources Conf. 42:255- 263.

Human Attitudes Toward Urban Wildlife. C.P. Dawson, R.L. Miller and T.L. Brown. 1978. Trans. N.E. Sect. Wildlife Soc. 34:143-153.

Expanding Hunters' Access to Private Lands: Potentials, Problems and Research Needed. D.J. Decker, C.P. Dawson and T.L. Brown. 1979. Trans. N.E. Sect. Wildlife Soc. 35:160-168.

Interests and Attitudes of Metropolitan New York Residents About Wildlife. T.L. Brown, C.P. Dawson and R.L. Miller. 1979. Trans. North Am. Wildlife Natural Resources Conf. 44:289-297.

Deer Hunting Violations and Law Enforcement in New York. D.J. Decker, T.L. Brown and C.P. Dawson. 1980. Trans. N.E. Sect. Wildlife Soc. 35:113-128.

Management Preferences of Boaters and Landowners Along the Upper Delaware Scenic and Recreational River. C.P. Dawson, D.J. Decker and R.A. Smolka, Jr. 1982. In D. W. Lime (Tech. Coordinator). Forest and River Recreation: Research Update, pp. 14-19. Agri. Forest Exp. Sta. Misc. Pub. 18, Department Forest Resources, University of Minnesota, St. Paul.

Monitoring Local Trends in Recreation and Tourism Through Visitor Statistical Abstracts. C.P. Dawson. 1985. Proceedings 1985 National Outdoor Recreation Trends Symposium II, Volume II, pp. 371-381. U.S.D.I. National Park Service, Southeast Regional Office, Atlanta, Georgia.

The Development of the Lake Ontario Sportfishery: Socioeconomic Impacts in New York State. C.P. Dawson and M. Voiland. 1988. In Hickcox, D.H. (editor). Proceedings of the Symposium on the Great Lakes: Living With North America's Inland Waters. American Water Resources Association Tech. Pub. Series TPS-88-3. pp. 259-268.

New York State Bed & Breakfast Business Programming: How Successful Was It? C.P. Dawson and T.L. Brown. 1989. In Proceedings of the National Extension Workshop on Using Tourism/Travel as a Community and Rural Revitalization Strategy, Minnesota Extension Service Report CD-BU-3822, University of Minnesota, St. Paul. pp. 147-152.

Courtesy is Contagious: Hospitality Skills Training in New York State. C.P. Dawson. 1989. In Proceedings of the National Extension Workshop on Using Tourism/Travel as a Community and Rural Revitalization Strategy, Minnesota Extension Service Report CD-BU-3822, University of Minnesota, St. Paul. pp. 153-156.

The Pro's and Con's of Rural Recreation Development: A Private Sector Perspective. C.P. Dawson. 1990. In Proceedings of the 1990 Society of American Foresters Convention, SAF publication Number 90-02, pp.446-451. Bethesda, MD.

Sportfishing in New York State: Trends Toward the Year 2000. C.P. Dawson and T.L. Brown. 1990. In T.A. More, et al. (editors), Proceedings of the 1990 Northeastern Recreation Research Symposium, p. 147-151. USDA Forest Service Gen. Tech. Rep. NE-145. Radnor, PA.

The Demand for Great Lakes Sportfishing: Some Future Marketing Implications. C.P. Dawson and T.L. Brown. 1990. In J.T. O'Leary et al. (editors), Proceedings of the 1990 Outdoor Recreation Trends Symposium III , Volume II, pp. 528-536. Indiana University, Indianapolis, IN.

The Great Lakes Charter Fishing Industry in the 1990's. C.P. Dawson and M. P. Voiland. 1990. In J.T. O'Leary et al. (editors), Proceedings of the 1990 Outdoor Recreation Trends Symposium III , Volume II, pp. 694-706. Indiana University, Indianapolis, IN.

The Great Lakes Snagging Angler: Exploiter, Sportsman, or Hybrid? T.L. Brown and C.P. Dawson. 1990. In J.H. Gramann (Compiler), Proceedings of the Third Symposium on Social Science in Resource Management, pp.32-34. Texas A & M University.

A Reassessment of the Angler Specialization Concept. C.P. Dawson, R. Buerger and M. Gratzer. 1992. In G.A. Vander Stoep (editor), Proceedings of the 1991 Northeastern Recreation Research Symposium, pp. 156-159. USDA Forest Service Gen. Tech. Rep. NE-160, Northeastern Forest Experiment Station, Radnor, PA.

The Angler Specialization Concept Applied: New York's Salmon River Anglers. C.P. Dawson, T.L. Brown and N. Connelly. 1992. In G.A. Vander Stoep (editor), Proceedings of the 1991 Northeastern Recreation Research Symposium, pp. 153-155. USDA Forest Service Gen. Tech. Rep. NE-160, Northeastern Forest Experiment Station, Radnor, PA.

Suggested Applications by Seaway Trail Inc. for a National Scenic Byway. T. H. Mitchell, V. J. Dee and C. P. Dawson. 1992. Transportation Research Record 1363: 1-4. National Research Council, National Transportation Research Board, National Academy Press, Washington, DC.

Impacts of Land Use Changes on Recreation and Open Space in the New York-New Jersey Highlands Region. C.P. Dawson and W.C. Zipperer. 1992. In D.J. Chavez (Tech. Coord.), Proceedings of the Symposium on Social Aspects and Recreation Research, pp. 67-68. USDA Forest Service, General Technical Report PSW-GTR-132. Paciific Southwest Research Station, Albany, CA.

Importance-Performance Analysis: Congruity/Disparity Between Charter Boat Captains and Customers. C.P. Dawson and R. Buerger. 1993. In G. A. Vander Stoep (editor), Proceedings of the 1992 Northeastern Recreation Research Symposium, pp.41-45. USDA Forest Service Gen. Tech. Rep. NE-176. Radnor, PA.

Management Options Regarding the Presence of Ixodes dammini, the Deer Tick, on the Appalachian Trail. J. A. Oliver, C. P. Dawson and J. J. Howard. 1994. In G.A. Vander Stoep (editor), Proceedings of the 1993 Northeastern Recreation Research Symposium, pp. 49-52. USDA Forest Service Gen. Tech. Rep. NE-185. Radnor, PA.

Effects of Seasonality and Time of Week on Hiker Motivations and Satisfactions in the High Peaks Wilderness Area. K. A. Alberga and C. P. Dawson. 1994. In G.A. Vander Stoep (editor), Proceedings of the 1993 Northeastern Recreation Research Symposium, pp. 119-122. USDA Forest Service Gen. Tech. Rep. NE-185. Radnor, PA.

Wilderness Use and Preservation: A Proposed Adirondack Wilderness Planning Strategy. C. P. Dawson, K. Alberga and M. Washburn. 1994. In J. C. Hendee and V. G. Martin (editors), International Wilderness Allocation, Management, and Research: Proceedings of a Symposium During the Fifth World Wilderness Congress, Tromso, Norway, September, 1993; pp. 133-137. Published by the International Wilderness Leadership Foundation and the University of Idaho Wilderness Research Center.

Adirondack Wilderness Trail Users: Conditions Affecting Trail Selection and Use. C. P. Dawson. 1994. In C. Sydoriak (editor), Wilderness - The Spirit Lives: 6th National Wilderness Conference, pp. 200-204. Bureau of Land Management, Fish & Wildlife Service, Forest Service, National Biological Service, National Park Service, and Society of American Foresters. Santa Fe, NM.

Angler Specialization Among Salmon and Trout Anglers on Lake Ontario. C. P. Dawson. 1995. In G.A. Vander Stoep (editor), Proceedings of the 1994 Northeastern Recreation Research Symposium, pp. 39-43. USDA Forest Service Gen. Tech. Rep. NE-198. Radnor, PA.

Proceedings of the 1995 Northeastern Recreation Research Symposium, April 9-11, 1995 at Saratoga Springs, NY. C. P. Dawson (comp.), 1996. USDA Forest Service Gen. Tech. Rep. NE-218. Radnor, PA, 286 p.

User Satisfactions at Adirondack Forest Preserve Campgrounds. C. P. Dawson. 1996. **In** C. P. Dawson (comp.), Proceedings of the 1995 Northeastern Recreation Research Symposium, April 9-11, 1995 at Saratoga Springs, NY. USDA Forest Service Gen. Tech. Rep. NE-218. Radnor, PA, pp. 96-98.

New York's Changing Bed & Breakfast and Inn Industry: 1987 to 1993. Diane Kuehn and C. P. Dawson. 1996. **In** C. P. Dawson (comp.), Proceedings of the 1995 Northeastern Recreation Research Symposium, April 9-11, 1995 at Saratoga Springs, NY. USDA Forest Service Gen. Tech. Rep. NE-218. Radnor, PA, pp. 131-134.

The Great Lakes Charter Fishing Industry: 1973-1994. C. P. Dawson, F. Lichtkoppler, D. Kuehn and C. Pistis. 1996. **In** J. L. Thompson et al. (editors), Proceedings of the 4th International Outdoor Recreation & Tourism Trends Symposium and the 1995 National Recreation Planning Conference, May 14-17, 1995, St. Paul, MN.. University of Minnesota, College of Natural Resources and Minnesota Extension Service, St. Paul, MN, pp. 573-576.

Trends in University Based Education and Training Programs in Ecotourism or Nature-Based Tourism in the USA. R. Robertson, C. P. Dawson, W. Kuentzel, and S. Selin. 1996. . In J. L. Thompson et al. (editors), Proceedings of the 4th International Outdoor Recreation & Tourism Trends Symposium and the 1995 National Recreation Planning Conference, May 14-17, 1995, St. Paul, MN.. University of Minnesota, College of Natural Resources and Minnesota Extension Service, St. Paul, MN, pp. 460-466.

Changes in Recreational and Open Space Opportunities. C. P. Dawson. 1996. **In** Abrahamson et al. (editors), Conference Proceedings: The Empire Forest - Changes and Challenges, November 13-14, 1995 at Syracuse, NY. SUNY-ESF, Syracuse, NY. pp. 120-126.

A Proposed Adirondack Wilderness Planning Strategy. C.P. Dawson, 1996, Adirondack Journal of Environmental Studies 3(2):25-27.

Angler Segmentation Based on Motivational Scale Scores. C. P. Dawson. 1997. In W. Kuentzel (comp.), Proceedings of the 1996 Northeastern Recreation Research Symposium, March 31-April 2, 1996 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-232. Radnor, PA, pp. 127-130.

Recreational Aspects of Forestland Easements in the Northern Forest Region of New York State. S. Bick, H. L. Haney and C. P. Dawson. 1998. In H. Vogelsong (editor), Proceedings of the 1997 Northeastern Recreation Research Symposium, April 6-8, 1997 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-241. Radnor, PA, pp. 21-24.

Watercraft User Characteristics, Management Preferences, and User Encounters on the Upper Delaware Scenic And Recreational River: 1979-1996. S. Bowes and C. P. Dawson. 1998. In H. Vogelsong (editor), Proceedings of the 1997 Northeastern Recreation Research Symposium, April 6-8, 1997 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-241Radnor, PA, pp. 7-11.

Cognitive Dimensions of Recreational User Experiences in Wilderness: An Exploratory Study in Adirondack Wilderness Areas.. C. P. Dawson, P. Newman and A. Watson. 1998. In H. Vogelsong (editor), Proceedings of the 1997 Northeastern Recreation Research Symposium, April 6-8, 1997 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-241. Radnor, PA, pp. 257-260.

An Exploratory Comparison of Motivations and Crowding Norms Between Ethnic Groups in Downhill Ski Areas of New York State and Korea. C. I. Park and C. P. Dawson. 1998. In H. Vogelsong (editor), Proceedings of the 1997 Northeastern Recreation Research Symposium, April 6-8, 1997 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-241. Radnor, PA, pp. 56-59.

Watercraft User Motivations, Perceptions of Problems, and Preferences for Management Actions: Comparisons Between Three Levels of Past Experience. S. Bowes and C. P. Dawson. 1999. In H. Vogelsong (editor), Proceedings of the 1998 Northeastern Recreation Research Symposium, April 5-7, 1998 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-255. Radnor, PA, pp. 149-155.

Applying Recreation Specialization, Willingness to Pay, and Willingness to Accept to New York State Anglers. Cheng-Ping Wang and C. P. Dawson. 1999. In H. Vogelsong (editor), Proceedings of the 1998 Northeastern Recreation Research Symposium, April 5-7, 1998 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-255. Radnor, PA, pp. 114-121.

A Comparison of Wilderness Privacy Within Two New York State Environments. Cathy Fuller and C. P. Dawson. 1999. In H. Vogelsong (editor), Proceedings of the 1998 Northeastern Recreation Research Symposium, April 5-7, 1998 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-255. Radnor, PA, pp. 51-56.

The Human Dimensions of the Wilderness Experience in the High Peaks Wilderness Area. Peter Newman and C. P. Dawson. 1999. In H. Vogelsong (editor), Proceedings of the 1998 Northeastern Recreation Research Symposium, April 5-7, 1998 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-255. Radnor, PA, pp. 122-129.

Wilderness Experience Programs in the United States: Their Dependence On and Use of Wilderness. Chad P. Dawson, Gregory T. Friese, Jim Tangen-Foster, and Josh Carpenter. 1998. **In**: Watson, Alan E.; Aplet, Greg. 1998. Personal, Societal, and Ecological Values of Wilderness: Sixth World Wilderness Congress Proceedings on Research, Management, and Allocation, Vol. I, Gen. Tech. Rep. RMRS-P-4. Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station; 99-104.

The Interim Management Dilemma: The High Peaks Wilderness Planning Process. P. Newman and C. P. Dawson. 1998. **In**: Watson, Alan E.; Aplet, Greg. 1998. Personal, Societal, and Ecological Values of Wilderness: Sixth World Wilderness Congress Proceedings on Research, Management, and Allocation, Vol. I, Gen. Tech. Rep. RMRS-P-4. Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station; 139-143.

Dramas of Solitude: Narratives of retreat in American Nature Writing. Chad P. Dawson. 1999. Leisure Sciences 21(3):263-264.

User Satisfactions and Perceptions of Crowding in Four Adirondack Wilderness Areas. C. P. Dawson, Peter Newman and Cathy Fuller. 2000. **In** G. Kyle (editor), Proceedings of the 1999 Northeastern Recreation Research Symposium, April 11-13, 1999 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-269. Radnor, PA, pp. 120-126.

Recreational Use of Industrial Forest Lands in New York State. Sergio Capozzi, Rene Germain and C. P. Dawson. 2000. **In** G. Kyle (editor), Proceedings of the 1999 Northeastern Recreation Research Symposium, April 11-13, 1999 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-269. Radnor, PA, pp. 373-377.

The Role of Park Partnerships: A Case Study of Yosemite Institute and Yosemite National Park. Siri Doble, C. P. Dawson and Robin Hoffman. 2000. **In** G. Kyle (editor), Proceedings of the 1999 Northeastern Recreation Research Symposium, April 11-13, 1999 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-269. Radnor, PA, pp. 157-161.

Measures of Wilderness Trip Satisfaction and User Perceptions of Crowding. Chad P. Dawson and Alan E. Watson. 2000. *In* Cole, D. N.; McCool, S. F.; Borrie, W. T.; O'Loughlin, J. Proceedings: Wilderness Science in a Time of Change – Volume 4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. RMRS-P-15-VOL-4: 93-98.

The influence of the Adirondacks on the wilderness preservation contributions of Robert Marshall and Howard Zahniser. Chad P. Dawson and Zahniser, Ed. 2000. *In:* Cole, D. N.; McCool, S. F.; Borrie, W. T.; O'Loughlin, J. Proceedings: Wilderness Science in a Time of Change – Volume 2. Ogden, UT: U.S.D.A. Forest Service, Rocky Mountain Res. Sta. RMRS-P-15-VOL-2: 45-48.

Bob Marshall, 1901-1939: Wilderness Preservationist. Chad P. Dawson. 2001. International Journal of Wilderness. 7(1):10-11.

A Comparison of Recreation Conflict Factors for Different Water-Based Recreation Activities. Cheng-Ping Wang and C. P. Dawson. 2001. **In** G. Kyle (editor), Proceedings of the 2000 Northeastern Recreation Research Symposium, April 2-4, 2000 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-276. Newton Square, PA. Pp 121-130.

Recreation Leasing of Industrial Forestlands in New York State. Sergio Capozzi and C. P. Dawson. 2001. **In** G. Kyle (editor), Proceedings of the 2000 Northeastern Recreation Research Symposium, April 2-4, 2000 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-276. Newton Square, PA. Pp 11-19.

Great Gulf Wilderness Use Estimation: Comparisons from 1976, 1989, and 1999. Chad P. Dawson, Mark Simon, Rebecca Oreskes, and Gary Davis. 2001. **In** G. Kyle (editor), Proceedings of the 2000 Northeastern Recreation Research Symposium, April 2-4, 2000 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-276. Newton Square, PA. Pp 283-288.

Wilderness Stewardship. Chad P. Dawson. 2002. International Journal of Wilderness. 7(3):3.

Stewardship to Address the Threats to Wilderness Resources and Values. John Hendee and Chad P. Dawson. 2002. International Journal of Wilderness. 7(3):4-9.

Visitor Expectations and Satisfactions: Backcountry and Wilderness Users in the White Mountain National Forest. Chad P.Dawson, Rebecca Oreskes, Frederick Kacprzynski, and Tom More, 2002. **In** S. Todd (editor), Proceedings of the 2001 Northeastern Recreation Research Symposium, April 1-3, 2001 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-289. Radnor, PA. Pp. 144-152.

Recreation Conflict of Riparian Landowners with Jetskiing and Motorboating along New York's Great Lakes. Cheng-Ping Wang and Chad P.Dawson. 2002. **In** S. Todd (editor), Proceedings of the 2001 Northeastern Recreation Research Symposium, April 1-3, 2001 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-289. Radnor, PA. Pp. 314-319.

Coping, Crowding and Satisfaction: A Study of Adirondack Wilderness Hikers. Andrew K. Johnson and Chad P.Dawson. 2002. **In** S. Todd (editor), Proceedings of the 2001 Northeastern Recreation Research Symposium, April 1-3, 2001 at Bolton Landing, NY. USDA Forest Service Gen. Tech. Rep. NE-289. Radnor, PA. Pp. 25-31.

Attributes Affecting Campsite Selection at Two Types of Campgrounds in the Adirondack Park. Kye Young Choi and Chad Dawson. 2002. **In** Schuster, Rudolph (editor), Proceedings of the 2002 Northeastern Recreation Research Symposium. Gen. Tech. Report NE (in press). Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

Exploring and Understanding Visitor Satisfaction Among Non-Motorized Watercraft Users in Two Adirondack Canoeing Areas. Becky Pfaffenback, Harry Zinn and Chad Dawson. 2002. **In** Schuster, Rudolph (editor), Proceedings of the 2002 Northeastern Recreation Research Symposium. Gen. Tech. Report NE (in press). Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

State-Designated Wilderness Programs in the United States. Chad P. Dawson and Pauline Thorndike. 2002. International Journal of Wilderness 8(3): 21-26.

Acceptable Number of User Encounters: A Study of Adirondack and Great Gulf Wilderness Hikers. Chad P. Dawson and Kristofer A. Alberga. 2004. **In** Murdy, Jim (editor), Proceedings of the 2003 Northeastern Recreation Research Symposium. Gen. Tech. Report NE (in press). Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

Research And Planning Project Reports

ERTS Evaluation for Land Use Inventory. E.E. Hardy, J.E. Skaley, E.S. Phillips, D. S. Stevens and C.P. Dawson. 1974. Resource Information Lab., Department Natural Resources, Cornell University, Ithaca, NY. 2 Volumes.

Enhancement and Evaluation of Skylab Photography for Potential Land Use Inventories. E.E. Hardy, J.E. Skaley, C.P. Dawson, G. D. Weiner, E.S. Phillips and R.A. Fisher. 1975. Resource Information Lab., Department Natural Resources, Cornell University, Ithaca, NY. 174 pp.

Deriving Social Indices of Farmer Attitudes Toward Deer Management Levels. T.L. Brown, C.P. Dawson and D.J. Decker. 1977. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 98 pp.

Wildlife Interests, Needs and Attitudes of Urban and Suburban Residents of New York - Albany Pilot Study. T.L. Brown and C.P. Dawson. 1977. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 80 pp.

Hunter Access to Lands on Which to Hunt in New York. T.L. Brown, D.J. Decker, C.P. Dawson and D.L. Hustin. 1978. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 124 pp.

Wildlife Interests, Needs and Attitudes of Urban and Suburban Residents of New York - Statewide Study. T.L. Brown and C.P. Dawson. 1978. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 119 pp.

Impacts of Manipulating Lake Levels on Recreational Boating in the Oswego River Basin, New York. C.P. Dawson and T.L. Brown. 1979. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 161 pp.

Workshop on the Use of Human Survey Research in Wildlife Management. T.L. Brown, C.P. Dawson, D.J. Decker and D.L. Hustin. 1979. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 87 pp.

Background Information and Management Strategies for the Development of Recreational Fisheries Management Plans in the Northeast Atlantic Fisheries Conservation Zone. C.P. Dawson. 1979. Department Natural Resources, Cornell University, Ithaca, NY. 70 pp.

Deer Hunting Violations and Law Enforcement in New York: The TJ's and ECO's Perspective. D.J. Decker, T.L. Brown and C.P. Dawson. 1980. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 34 pp.

Forests and Human Values. L.Y. Mudrak and C.P. Dawson. 1980. New York State Forest Resources Assessment: Report No. 12, Department Environmental Conservation, Div. Lands and Forests, Albany, NY. 61 pp.

A Method for Counting Boaters on the Upper Delaware Scenic and Recreational River. C.P. Dawson and D.J. Decker. 1980. Department Natural Resources, Cornell University, Ithaca, NY. 30 pp.

Impacts of Tourism Along the Upper Delaware Scenic and Recreational River. C.P. Dawson, D.J. Decker, T.L. Brown and R.A. Smolka, Jr. 1981. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 108 pp.

Tourism-Related Businesses Along the Upper Delaware Scenic and Recreational River. D.J. Decker, C.P. Dawson and T.L. Brown. 1981. Department Natural Resources, Cornell University, Ithaca, NY. 97 pp.

Impacts of Resident Recreationists Along the Upper Delaware Scenic and Recreational River. C.P. Dawson, D.J. Decker and R.A. Smolka, Jr. 1981. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 42 pp.

Characteristics and Management Preferences of Landowners Along the Upper Delaware Scenic and Recreational River. D.J. Decker, C.P. Dawson and R.A. Smolka, Jr. 1981. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 44 pp.

River Recreation Carrying Capacity Considerations for the Upper Delaware Scenic and Recreational River. C.P. Dawson, D.J. Decker and T.L. Brown. 1981. Department Natural Resources, Cornell University, Ithaca, NY. 71 pp.

Analysis of Sport Fishing Survey Methods for New York Waters of Lake Ontario. T.L. Brown and C.P. Dawson. 1981. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 32 pp.

Analysis of Satisfaction and Participation in Hunting: A Pilot Study. T.L. Brown, C.P. Dawson and D.J. Decker. 1982. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 68 pp.

Qualitative Assessment of Potential Recreational Boating Impacts Due to Additional Locks and Other Navigational Improvements on the St.Lawrence Seaway, New York. R.A. Smolka, Jr., T.L. Brown and C.P. Dawson. 1982. Outdoor Recreation Research Unit, Department Natural Resources, Cornell University, Ithaca, NY. 108 pp.

A Policy Analysis of Free-Flowing Stream Preservation in New York State: Conflicts with Hydroelectric Power Development. C.P. Dawson. 1983. PhD dissertation. State University of New York, College Environmental Science and Forestry, Syracuse, NY. 240 pp.

1984 Western Lake Superior Recreational Boating Needs and Use Patterns. C.P. Dawson and J. C. Laundergan. 1985. Minnesota Sea Grant Extension Program, University of Minnesota, Duluth, Minnesota. 84+ pp.

Bed and Breakfast Business Programming: Program Development and Evaluation. C.P. Dawson and T.L. Brown. 1988. New York Sea Grant Extension Program, SUNY Oswego Campus, Oswego, NY. 8 pp.

Bed and Breakfast Operations: Part-Time or Full-Time Business? C.P. Dawson and T.L. Brown. 1988. New York Sea Grant Extension Program, SUNY Oswego Campus, Oswego, NY. 11 pp.

Seaway Trail Tourism Action Plan. J. Maas, C. Dawson, et al. 1989. Seaway Trail Inc., Oswego, NY. 30 pp.

Lake Ontario Salmonid Fishery Development: How Successful Is It? M. Voiland and C. Dawson. 1989. Paper presented at the 1989 American Fisheries Society Annual Meeting, New York Chapter, Binghamton, NY. 7 pp.

Characteristics of 1987-88 Oswego County Fishing License Purchasers and Snaggers on the Salmon River. C.P. Dawson and T.L. Brown. 1989. New York Sea Grant Extension Program, SUNY Oswego Campus, Oswego, NY. 30 pp.

Evaluating the Impacts of Proposed Changes in Snagging Regulations on the Salmon River. N.A. Connelly, T. L. Brown and C. P. Dawson. 1990. NYS Dept. of Environmental Conservation, Bureau of Fisheries, Albany, NY. 95 pp.

Design of a Marketing Conversion/Evaluation System for Seaway Trail Advertising Programs. T.L. Brown, C. P. Dawson and N. A. Connelly. 1991. Seaway Trail Inc., Sackets Harbor, NY 11pp.

Tourism Monitoring System. C.P. Dawson, T. L. Brown and N. A. Connelly. 1991. Seaway Trail Inc., Sackets Harbor, NY 27pp.

Oswego-Eastern Shore Communities Tourism Development Action Plan. T.L. Brown, C. P. Dawson, N. A. Connelly and P. Horrigan. 1990. Seaway Trail Inc., Sackets Harbor, NY 32pp.

Oswego-Eastern Shore Communities Tourism Development Plan: Resource Document. T.L. Brown, C. P. Dawson, N. A. Connelly and P. Horrigan. 1990. Seaway Trail Inc., Sackets Harbor, NY 142pp.

New York State Snowmobiling Assessment. C. P. Dawson. 1991. Report to the New York State Snowmobile Coordinating Group. 8 pp.

Town and Village of Morristown Public Access Signage Program. C.P. Dawson and T. Mitchell. 1991. NYS Department of State, Division of Coastal Resources and Waterfront Revitalization, Albany, NY. 9 pp.

City of Oswego Public Access Signage Program. C.P. Dawson and T. Mitchell. 1991. NYS Department of State, Division of Coastal Resources and Waterfront Revitalization, Albany, NY. 12 pp.

Recreation and Open Space Inventory and Analysis. C.P. Dawson, K. Grudens and D. Gould. 1992. In L. R. Neville and W. C. Zipperer (editors), New York-New Jersey Highlands Regional Study, pp.54-66. USDA Forest Service, Gen. Tech. Report NA-TP-04-93. Radnor, PA.

Tourism Development Plan for the Town of Newcomb, New York. C. P. Dawson (editor), 1992. SUNY College of Environmental Science and Forestry, Syracuse. 35 pp.

A Tourism Assessment for Ontario County, New York: Towards a Blue Print for Growth. C. P. Dawson, et al., 1994. Prepared For Ontario County Four Seasons Development Corporation, Canandaigua, NY. 38p.

Salmon River Corridor Greenway Protection and Development Concept Plan. C. P. Dawson. 1994. Prepared for the Cooperative Tug Hill Council and Salmon River Corridor Coordinating Committee. 29p.

Lewis County Snowmobile Industry: Recommendations for a County Snowmobile Management Plan. C. P. Dawson and T. L. Brown. 1994. Report Prepared for Lewis County Industrial Development Agency. 55p.

Recreation and Tourism Participation and Demand in the Adirondack Park: An Assessment of the Limited Information Available for Planning and Management. C. P. Dawson, K. Alberga and M. Washburn. 1994. Report Prepared for New York State Department of Environmental Conservation Albany, New York. 45p.

1000 Islands Seaway Recreation and Tourism Economic Impacts Study. Tommy L. Brown and Chad P. Dawson. 1996. 1000 Islands Seaway Region, Oswego County Tourism and Promotion Office, Oswego, NY. 17 pp.

Bed & Breakfast Lodging Operations: A Business Planning Guide for New York State. C.P. Dawson, T.L. Brown and S. Brown. 1989 (Revised edition in 1996). New York State Small Business Development Center, Jefferson Community College, Watertown, NY. 64pp.

A Summary Report on Watercraft Users on the Upper Delaware Scenic and Recreational River in 1996 and 1979. Stephen M. Bowes and Chad P. Dawson. 1997. National Park Service, Upper Delaware Scenic and Recreational River. 10pp.

Watercraft Users on the Upper Delaware Scenic and Recreational River in 1996. Stephen M. Bowes and Chad P. Dawson. 1997. National Park Service, Upper Delaware Scenic and Recreational River. 19pp.

Adirondack Wilderness Visitors: Studies in the St. Regis Canoe Area and the High Peaks, Siamese Ponds, and Ha-De-Ron-Dah Wilderness Areas. 2000. Chad P. Dawson. Report to New York State Department of Environmental Conservation.

Public Perception and Backcountry Recreationists' Experiences Related to Recreation Opportunity Spectrum (ROS) Classes on the White Mountain National Forest. Chad P. Dawson. 2001. US Forest Service, White Mountain National Forest, Gorham, NH. 43 p.

Economic Impacts of Declines in the Sport Fisheries of Eastern Lake Ontario. Tommy L. Brown, Nancy Connelly, and Chad P. Dawson. 2002. Human Dimensions Research Unit, Cornell University. 34 pages.

23 November 2003

ERIK KIVIAT

Professional Experience

Hudsonia Ltd.: *Executive Director*; 1988-; Ecologist, 1981-; Co-founder.

Bard College: *Professor of Environmental Studies*, Graduate School of Environmental Studies, 1987-, Center for Environmental Policy, 2000-; Research Associate, Division of Natural Sciences and Mathematics, 2002-. .

Technical assistance to: Non-governmental organizations; landowners; businesses; planning, law, and engineering firms; sporting associations; federal, state and local government: 200 reports prepared, 1975-.

Fellowships: Cary Summer Research Fellowship 1993, Institute of Ecosystem Studies, Millbrook, NY. Vegetation and biogeochemistry of Blanding's turtle habitats. Short-term Visitor, 1995, Smithsonian Environmental Research Laboratory, Edgewater, MD. Freshwater-tidal and nontidal wetland studies.

Peer Reviewer: *Biological Invasions; Chelonian Conservation and Biology; Estuaries; Journal of Herpetology; Journal of the Marine Biological Association of the United Kingdom; New York State Museum Bulletin; Northeastern Naturalist*; *Wetlands Ecology and Management; Wilson Bulletin*; American Museum of Natural History; Countryman Press; Hudson River Foundation; Long Island Sound License Plate Fund; Marsh Ecology Research Program; Rutgers University Press; San Francisco Bay-Delta Research Enhancement Program; Sea Grant (Connecticut; Rhode Island); State University of New York Press; The Nature Conservancy; U.S. Fish and Wildlife Service; U.S. Office of Technology Assessment.

Volunteer (selected): Ontario Breeding Bird Atlas, Hudson Bay Lowland, Canada, 1985; Osprey survey and herpetological survey, St. Catherine's Island, GA, 1973, Reptile and amphibian population studies, Kalbfleisch Field Research Station, Long Island, NY, 1963, Reptile and amphibian surveys in U.S. and Mexico, American Museum of Natural History, 1961-62.

Education

Ph.D. Ecology, Union Institute, 1991. Thesis: *Wetland human ecology.*

M.A. Biology, State University College at New Paltz, NY, 1979. Thesis: *Hudson Estuary shore zone: Ecology and management.*

B.S. Natural Sciences, Bard College, 1976. Thesis: *Snapping turtle ecology in a New York tidemarsh.*

Professional courses: Wildlife Study Design (1 day), The Wildlife Society, 2002; Biology of Spiders (5 days), Humboldt Field Research Institute, ME, 2001; Mosquito Identification and Surveillance (2 days), New York State Department of Health, 2000; Applied Multivariate Methods (5 days), Institute for Professional Education, VA, 1995; Control of Mosquitoes and Mosquito-borne Diseases in the U.S. (5 days), International Center for Public Health Research, SC, 1993; Understanding Wetland Soils (2 days), Cook College, Rutgers University, NJ, 1989; Landscape Preservation: Ecological and Social Issues (1 day), Institute of Ecosystem Studies, Millbrook, NY, 1987; Energy Analysis (1 day), University of Georgia, Athens, 1977; Freshwater Fishes of New York (5 days), American Museum of Natural History, New York, 1970.

Research Interests

Wetland ecology and management; Estuarine biota; Ecology and management of invasive plants; Turtle ecology and conservation; Habitat ecology, assessment, monitoring, creation, restoration; Human cultural adaptations to wetlands and vector-borne diseases; Economic botany.

Additional Field Work

Arizona, California, Connecticut, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Minnesota, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Vermont, Washington; Manitoba, Nova Scotia, Ontario, Québec; Mexico; Trinidad; Czech Republic; England; Hungary.

Languages: French and Spanish (reading).

Professional Certifications

Certified Ecologist, Ecological Society of America, 1992-; Professional Wetland Scientist, Society of Wetland Scientists, 1995-; Certified Wildlife Biologist, the Wildlife Society, 1983-.

Honors

Awarded to Erik Kiviat or to Hudsonia for projects or programs he directed: Nomination for National Wetlands Award 2002; Certificate of Appreciation, New York State Department of Environmental Conservation, 2000; Good Land Award, Winnakee Land Trust, 1999; Project Facilitation Award, Society for Ecological Restoration, 1997; Marion Thompson Fuller Brown Conservation Award, Garden Clubs of America, 1996; Environmental Award, Museum of the Hudson Highlands, 1996; Award for Environmental Sensitivity, Mohonk Consultations on the Earth's Environment, 1995; Researcher of the Year Award, Hudson River Environmental Society, 1994; Service Award, Dutchess County Environmental Management Council, 1982.

Professional Societies

American Bryological and Lichenological Society; American Mosquito Control Association; American Ornithologists' Union; Association of Field Ornithologists; Association of State Wetland Managers; Ecological Society of America; Natural Areas Association; Society for Conservation Biology; Society for Ecological Restoration; Society for the Study of Amphibians and Reptiles; Society of Wetland Scientists; Southern Appalachian Botanical Club; Torrey Botanical Society; Wilson Ornithological Society.

Public Service

Co-convenor, Hackensack Meadowlands Scientific Symposium, 2003; Advisory Committee for Greene County Grasslands Preserve, 2003-; Advisory Committee for Hudson River Estuary Exhibit, Liberty Science Center, 2002-; Scientific Advisory Committee, New York - New Jersey Trail Conference, 2002-; Co-sponsor, *Phragmites* Forum, 2002; Convenor of the workshop *Purple Loosestrife and Wildlife in North America*, Northeast Fish and Wildlife Conference, 2001; Conservation and Recovery of the Bog Turtle (invited participant), U.S. Fish and Wildlife Service, 1998; Jug Bay Wetlands Sanctuary Advisory Committee, 1998-; Scientific Advisory Committee, Friends of the Great Swamp, 1998-; Hudson River Biodiversity Project Steering Committee, New York State Department of Environmental Conservation, 1997-; Scientific Advisory Committee, Hudson River Habitat Restoration Program, U.S. Army Corps of Engineers, 1994-; Editorial Board, *Water Ways: New York's Waterfront News*, 1990-92; Hudson River National Estuarine Research Reserve Advisory Committee, 1983-, Hudson River Fisheries Advisory Committee, 1979-83, Hudson River Valley Study Advisory Committee, 1978, New York State Department of Environmental Conservation; Wildlife Society New York Chapter, Committee on Exotic Plants (1981-87); Advisory Board of the Trevor Zoo (1981-94); Dutchess County Environmental Management Council Significant Areas Committee (1980-82); Storm King School Environmental Institute Advisory Board, 1983-85; Convenor of Hudson River Marsh Workshop, Hudson River Environmental Society, 1976.

Technical Publications (* Peer reviewed)

Hummel, M. & E. Kiviat. 2004 (in press). Review of world literature on water-chestnut (*Trapa natans*) with implications for management in North America. Journal of Aquatic Plant Management. *

Kiviat, E. Submitted (in revision). Invasive wetland plants and wildlife in the New York City region. Wildlife Conservation Society, Metropolitan Conservation Alliance Technical Report. Rye, New York. *

Kiviat, E., S.E.G. Findlay & W.C. Nieder. In press. Tidal wetlands. In J. Levinton & J. Waldman, eds. The Hudson River Ecosystem. Oxford University Press. (Invited chapter.)

Kiviat, E., M. Gara & S. Braden. Submitted (in revision). Biomass and density of overwintering terrestrial insects and plants in a fresh-tidal marsh. Wetlands. *

Kiviat, E., G. Mihocko, G. Stevens, P.M. Groffman & D. Van Hoewyk. Submitted (in revision). Vegetation, soils, and land use in fens of eastern New York and adjacent Connecticut. Rhodora. *

Kiviat, E., C. Winters & F. Baumgarten. Submitted (in revision). Use of *Phragmites australis* by breeding birds in North America. Environmental Management. *

Schmidt, R.E., T.W. Hunsinger, T. Coote, E. Griffin-Noyes & E. Kiviat. Submitted (in revision). Mudpuppy (*Necturus maculosus*) in the tidal Hudson River with comments on its status as native. Northeastern Naturalist.*

Scullion, K.E. & E. Kiviat. Submitted. Vertebrate and plant use of beaver (*Castor canadensis*) lodges. Canadian Field-Naturalist. *

Kiviat, E. 2004 (in press). Occurrence of *Ailanthus altissima* on a Maryland tidal estuary. Castanea 69(2). *

Kiviat, E., G. Stevens, K.L. Munger, L.T. Heady, S. Hoeger, P.J. Petokas & R. Brauman. In press. Blanding's turtle response to wetland and upland habitat construction. Conservation and Ecology of Turtles of the Mid-Atlantic Region. Bibliomania. *

Swarth, C., W. Roosenberg & E. Kiviat, eds. In press. Conservation and ecology of turtles of the Mid-Atlantic region; Proceedings of a conference. Bibliomania. *

Bannor, B. & E. Kiviat. 2002. Common moorhen (*Gallinula chloropus*). Birds of North America 685, 27 p. *

Findlay, S.E.G., E. Kiviat, W.C. Nieder & E.A. Blair. 2002. Functional assessment of a reference wetland set as a tool for science, management and restoration. Aquatic Sciences 64:107-117. *

Kiviat, E. & K. MacDonald. 2002. Hackensack Meadowlands, New Jersey, biodiversity: A review and synthesis. Hackensack Meadowlands Partnership. 112 p. <http://meadowlandspartnership.org/bn.html#A report> (Web site.) *

Kiviat, E. & E. Hamilton. 2001. *Phragmites* use by Native North Americans. Aquatic Botany 69(2-4):341-357. *

Kiviat, E. & G. Stevens. 2001. Biodiversity assessment manual for the Hudson River estuary corridor. New York State Department of Environmental Conservation, New Paltz, New York. 508 p. *

Connors, L.M., E. Kiviat, P.M. Groffman & R.S. Ostfeld. 2000. Muskrat (*Ondatra zibethicus*) disturbance to vegetation and potential net nitrogen mineralization and nitrification rates in a fresh-tidal marsh. American Midland Naturalist 143:53-63. *

Kiviat, E., G. Stevens, R. Brauman, S. Hoeger, P.J. Petokas & G.G. Hollands. 2000. Restoration of wetland and upland habitat for Blanding's turtle. Chelonian Conservation and Biology 3(4):650-657. *

Meyerson, L.A., K. Saltonstall, L. Windham, E. Kiviat & S. Findlay. 2000. A comparison of *Phragmites australis* in freshwater and brackish marsh environments in North America. Wetlands Ecology and Management 8(2-3):89-103. *

van Hoewyk, D., P.M. Groffman, E. Kiviat, G. Mihocko and G. Stevens. 2000. Soil nitrogen dynamics in organic and mineral soil calcareous wetlands in eastern New York. Soil Science Society of America Journal 64(6):2168-2173. *

Barbour, J.G. & E. Kiviat. 1997. Introduced purple loosestrife as host of native Saturniidae (Lepidoptera). Great Lakes Entomologist 30(3):115-122. *

Kiviat, E. 1997. The book of swamp and bog; Trees, shrubs, and wildflowers of eastern freshwater wetlands. J. Eastman. Canadian Field-Naturalist 111(4):699. (Book review.)

Kiviat, E. 1997. Blanding's turtle habitat requirements and implications for conservation in Dutchess County, New York. P. 377-382 in J. Van Abbema, ed. Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles - an International Conference. New York Turtle and Tortoise Society and Wildlife Conservation Society Turtle Recovery Program. *

Krause, L.H., C. Rietsma & E. Kiviat. 1997. Terrestrial insects associated with *Phragmites australis, Typha angustifolia,* and *Lythrum salicaria* in a Hudson River tidal marsh. P. V-1 to V-35 in W.C. Nieder & J.R. Waldman, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1996. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.

Winogrond, H.G. & E. Kiviat. 1997. Invasion of *Phragmites australis* in the tidal marshes of the Hudson River. P. VI-1 to VI-29 n W.C. Nieder & J.R. Waldman, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1996. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.

Kiviat, E. 1996. The Everglades handbook; Understanding the ecosystem. T.E. Lodge. Canadian Field-Naturalist 110(3):567-568. (Book review.)

Rozycki, C. & E. Kiviat. 1996. A low density, tidal marsh, painted turtle population. P. V-1 to V-35 in E.A. Blair & J.R. Waldman, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1995. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.

Kiviat, E. 1996. American goldfinch nests in purple loosestrife. Wilson Bulletin 108(1):182-186. *

Kiviat, E. & J.G. Barbour. 1996. Wood turtles in fresh-tidal habitats of the Hudson River. Canadian Field-Naturalist 110(2):341-343. *

Groffman, P.M., Hanson, G.C., E. Kiviat & G. Stevens. 1996. Variation in microbial biomass and activity in four different wetland types. Soil Science Society of America Journal 60:622-629. *

Sharma, V. & E. Kiviat. 1994. Habitats of the monkeyflowers *Mimulus alatus* and *Mimulus ringens* on the Hudson River. P. V-1 to V-36 in E.A. Blair & J.R. Waldman, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1992. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.

Leonardi, L. & E. Kiviat. 1990. Bryophytes of the Tivoli Bays tidal swamps. P. III-1 to III-23 in J.R. Waldman & E.A. Blair, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1989. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.

Kiviat, E. 1989. The role of wildlife in estuarine ecosystems. P. 437-475 in J.W. Day, et al. Estuarine Ecology. John Wiley & Sons, New York.

Kiviat, E. 1988. The northern Shawangunk Mountains; An ecological survey. Mohonk Preserve, New Paltz NY. 107 p.

Kiviat, E. 1987. Common reed (*Phragmites australis*). P. 22-30 in D. Decker & J. Enck, eds. Exotic Plants with Identified Detrimental Impacts on Wildlife Habitats in New York State. New York Chapter, Wildlife Society.

Kiviat, E. 1987. Water chestnut (*Trapa natans*). P. 31-38 in D. Decker & J. Enck, eds. Exotic Plants with Identified Detrimental Impacts on Wildlife Habitats in New York State. New York Chapter, Wildlife Society.

Klemens, M.W., E. Kiviat & R.E. Schmidt. 1987. Distribution of the northern leopard frog, *Rana pipiens*, in the lower Hudson and Housatonic river valleys. Northeastern Environmental Science 6(2):99-101. *

Barbour, S. & E. Kiviat. 1986. A survey of Lepidoptera in Tivoli North Bay (Hudson River Estuary). P. IV-1 to IV-26 in J.C. Cooper, ed. Polgar Fellowship Reports of the Hudson River National Estuarine Sanctuary Program, 1985. New York State Department of Environmental Conservation, Hudson River Foundation, and U.S. Department of Commerce.

Westad, K.E. & E. Kiviat. 1986. Flora of freshwater tidal swamps at Tivoli Bays Hudson River National Estuarine Sanctuary. P. III-1 to III-20 in J.C. Cooper, ed. Polgar Fellowship Reports of the Hudson River National Estuarine Sanctuary Program, 1985. New York State Department of Environmental Conservation, Hudson River Foundation, and U.S. Department of Commerce.

Kiviat, E., R.E. Schmidt & N. Zeising. 1985. Bank swallow and belted kingfisher nest in dredge spoil on the tidal Hudson River. Kingbird 35(1):3-6.

Kiviat, E. & J. Stapleton. 1983. *Bufo americanus* (American Toad): Estuarine habitat. Herpetological Review 14(2):46.
Kiviat, E. 1982. Turtles: perspectives and research. M. Harless & H. Morlock, eds. Herpetological Review 13(3):100. (Book review.)
Kiviat, E. 1982. Eastern bluebird remote natural nest sites. Kingbird 32(1):6-8.
Kiviat, E. 1982. Black-capped chickadees eating giant ragweed seeds. Kingbird 32(1):25-26.
Kiviat, E. 1982. Geographic distribution [Five locality records from Jekyll Island, Georgia]: *Rana grylio* (pig frog), *Scaphiopus holbrooki holbrooki* (eastern spadefoot), *Cnemidophorus sexlineatus sexlineatus* (six-lined race-runner), *Eumeces inexpectatus* (southeastern five-lined skink), *Opheodrys aestivus* (rough green snake). Herpetological Review 13(2):51-53.
Kiviat, E. 1981. Hudson River estuary shore zone annotated natural history bibliography with index. Scenic Hudson, Poughkeepsie, NY. 76 p.
Kiviat, E. 1981. A Hudson River fresh-tidal marsh: management planning. Restoration and Management Notes 1(1):14-15.
Kiviat, E. 1980. A Hudson River tidemarsh snapping turtle population. Transactions of the Northeast Section, the Wildlife Society 37:158-168. *
Stone, W.B., E. Kiviat & S.A Butkas. 1980. Toxicants in snapping turtles. New York Fish and Game Journal 27(1):39-50.
Stapleton, J. & E. Kiviat. 1979. Rights of birds and rights of way; Vegetation management on a railroad causeway and its effect on breeding birds. American Birds 33(1):7-10.
Kiviat, E. 1978. Bog turtle habitat ecology. Bulletin of the Chicago Herpetological Society 13(2):29-42.
Kiviat, E. 1978. Hudson River east bank natural areas, Clermont to Norrie. Nature Conservancy, Arlington, Va. 115 p.
Kiviat, E. 1978. Vertebrate use of muskrat lodges and burrows. Estuaries 1:196-200. *
Kiviat, E. & D.C. Buso. 1977. Geographic distribution: *Graptemys geographica* (map turtle). Herpetological Review 8 (3):84.
Kiviat, E. 1976. Goldenclub, a threatened plant in the tidal Hudson River. Paper 21, 13 p. in Fourth Symposium on Hudson River Ecology. Hudson River Environmental Society, Bronx, NY.
Kiviat, E. 1976. A symbol for individuals not adult males. American Birds 29(4):818.
Kiviat, E. 1976. Birds and mammals of the Thompson Pond Preserve. Paper 5, 13 p. in P.S. Busch, ed. The Ecology of Thompson Pond in Dutchess County, New York. Nature Conservancy, Boston, Ma.
Kiviat, E. & N. Zeising. 1976. The wetland flora of Thompson Pond, New York. Paper 4, 28 p. in P.S. Busch, ed. The Ecology of Thompson Pond in Dutchess County, New York. Nature Conservancy, Boston, Ma.
Kiviat, E. 1974. A fresh-water tidal marsh on the Hudson, Tivoli North Bay. Paper 14, 33 p. in Third Symposium on Hudson River Ecology. Hudson River Environmental Society, Bronx, NY.

***Semitechnical and Popular Publications* (selected)**

Kiviat, E. 2003. Have you hugged a taxonomist today? News from Hudsonia 18(2):4, 6.
Hartwig, T. & E. Kiviat. 2003. A second look at invasives. Volunteer Monitor 15(2):13-15.
Kiviat, E. & G. Stevens. 2003. Environmental deterioration of the outwash plains: Necropsy of a landscape. News from Hudsonia 18(1):1, 4-5.
Kiviat, E. & R.E. Schmidt. 2002. A biodiversity anecdote [clam-shrimp]. News from Hudsonia 17(2):6.
Kiviat, E. 2002. A different kind of invasive plant project. News from Hudsonia 17(1):4-5.
Kiviat, E. 2001. "Far from the madding crowd's ignoble strife." News from Hudsonia 16(2):5-6.
Kiviat, E. 2001. Estuarine reptiles and amphibians revisited. News from Hudsonia 16(1):4-5.
Kiviat, E. 2001. Mountain ecology. P. 27-32 in D.D. Chazin, ed. New York Walk Book. 7th edition. New York - New Jersey Trail Conference, Mahwah, NJ.
Munger, K. & E. Kiviat. 2001. The Blanding's turtle. New York State Office of Parks, Recreation and Historic Preservation, Albany. 8 p.
Kiviat, E. 2000. Why natural history is serious science. News from Hudsonia 15(2-3):1-3.
Kiviat, E. 2000. "Humans alter where the wild live." P. 121 in The Hudson Valley; Our Heritage, Our Future. Poughkeepsie Journal, Poughkeepsie, New York.
Heady, L. & E. Kiviat. 2000. Grass carp and aquatic weeds: Treating the symptom instead of the cause. News from Hudsonia 15(1):1-3.
Kiviat, E. 1999. Loosestrife: Purple peril or purple prose? News from Hudsonia 14(2):1-3.

Kiviat, E. 1998. Mountain ecology. P. 29-34 in J. Daniels, ed. New York Walk Book. 6th edition. New York - New Jersey Trail Conference, New York, NY.
Kiviat, E. 1997. Errington, Paul L(ester). P. 254-256 in K. Sterling, et al., eds. Biographical Dictionary of American and Canadian Naturalists and Environmentalists. Greenwood Press, Westport, CT.
Kiviat, E. 1997-98. Where are the reptiles and amphibians of the Hudson River? Parts 1-2. News from Hudsonia 12(2-3):1, 3-5; 13(3):1-7.
Kiviat, E. 1997. Carbon cycling in the Hudson River. News from Hudsonia 12(2-3):1, 6-7.
Kiviat, E. 1995. Tangled locks: The purple loosestrife invasion and biological diversity. Annandale 134(5):34-39.
Kiviat, E. 1995. Nearshore environments of the Hudson River: The state of our knowledge of the shallows, wetlands, and shorelines. News from Hudsonia 11(2):1-6.
Kiviat, E. 1995. Marine mammals in the Hudson River estuary. Tidal Exchange 5(1):5, 10.
Kiviat, E. 1994. Muskrat: Manager of the marsh. News from Hudsonia 10(3):1-3.
Kiviat, E. 1994. Reed, sometimes a weed. News from Hudsonia 10(3):4-6.
Kiviat, E. & T. Hartwig. 1994. Marine mammals in the Hudson River. News from Hudsonia 10(2):1-5.
Kiviat, E. 1994. Mosquito ecology, and management of mosquitoes and people. News from Hudsonia 10(1):1-6.
Kiviat, E. 1993. A tale of two turtles; Conservation of the Blanding's turtle and bog turtle. News from Hudsonia 9(3):1-6.
Kiviat, E., G. Stevens & S. Barbour. 1993. Blossoms and clay: Landfill siting, wetlands, and biodiversity. News from Hudsonia 9(2):1-7.
Kiviat, E. 1993. Under the spreading water-chestnut. News from Hudsonia 9(1):1-6.
Stevens, G. & E. Kiviat. 1992. Ecological impacts of mining. News from Hudsonia (March):1-6 and Up-River/DownRiver (spring):23-28.
Kiviat, E. & G. Stevens. 1991. Regulation and loss of Hudson Valley wetlands. News from Hudsonia (November):1-6 and UpRiver/DownRiver (Nov.-Dec.):54-59.
Kiviat, E. 1991. Ecology of Bard lands. Revised ed. Bard College, Annandale, NY. 40 p.
Kiviat, E. 1991. How biologists assess special resources: All about Eve's Point. News from Hudsonia (July):1-6 and UpRiver/DownRiver (July-Aug.):48-53.
Kiviat, E. 1991. The Shawangunk Kill, a Hudson Valley natural area. News from Hudsonia (March):1-6 and Up-River/DownRiver (March-Apr.):46-51.
Kiviat, E. 1990. Golden opportunity: Biological diversity in the Hudson. News from Hudsonia (October):1-6 and UpRiver/DownRiver (Nov.-Dec.):31-36.
Kiviat, E. 1990. Reflections on Hudson River shorefront development. News from Hudsonia (April):1-6.
Kiviat, E., R.E. Schmidt & J.S. Tashiro. 1988. Epibenthic life in the Hudson River. News from Hudsonia (March):1-2, 5-6.
Kiviat, E. 1987. Mills and minnows; A walk down the Saw Kill. Bard College, Annandale, NY. 22 p. (Nature trail.)
Kiviat, E. 1987. Iona Island Marsh; A Hudson River National Estuarine Sanctuary & Research Reserve. Hudson River Sloop Clearwater and Hudson River National Estuarine Research Reserve. (Brochure.)
Kiviat, E. 1985. Vegetation. P. 101-122, 187 in H. Thomas, ed. Dutchess County, New York Natural Resources. Dutchess County Department of Planning, Poughkeepsie, NY.
Kiviat, E. 1985. Wildlife. P. 123-144 in H. Thomas, ed. Dutchess County, New York Natural Resources. Dutchess County Department of Planning, Poughkeepsie, NY.
Kiviat, E. 1984. Vegetation of Dutchess County, New York. Hudson Valley Regional Review 1(2):144-173.
Kiviat, E. 1984. Landmarks and landscape: the ecology of site works. P. 61-66 in L. Weintraub, ed. Land Marks; New Site Proposals by Twenty-two Original Pioneers of Environmental Art. Bard College Center, Annandale-on-Hudson, NY. (Exhibition catalog.)
Roberts, R., J. Stapleton, J. Morreale, E. Kiviat & M. Rosenthal. 1984. Feasibility of utilizing apple processing wastes. International Bio-Energy Directory and Handbook - 1984:315.
Stapleton, J., J. Morreale & E. Kiviat. 1984. No landfill space for apple waste; When a New York town refused to accept pomace at its landfill, a feasibility study explored alternative, economical options. BioCycle 25(3):46-47.
Kiviat, E. 1983. The river's land; Seeking sanctuary in tidal marshes. Hudson Valley Living 1(1):13-14.
Kiviat, E. & D. Outlaw. 1983. Dutchess County's bobcats. Hudson Valley Studies (June):28-30.
Kiviat, E. 1982. Apple pomace characteristics and uses. Hudsonia, Bard College, Annandale, NY. 28 p.
Kiviat, E. 1982. Environmental conditions of site. In Nuclear Lake Management Committee, Site Clearance Sub-committee. Nuclear Lake, a Resource in Question. Dutchess County Cooperative Extension, Millbrook NY.

Kiviat, E. & F. Dunwell. 1981. The marshes stand watch. Hudson Valley 10(5):33-37.
Kiviat, E. 1980-81. Profile of the Hudson. Hudson Valley 9(8):39, 9(9):24-28, 9(11):28-31, 9(12):39-41.
Kiviat, E. 1980. Low tides and turtle trails. Hudson Valley 9(5):27-29.
Kiviat, E. 1979. Cattail marshes, birds, good water and people. Dutchess Life 3(8):13.
Kiviat, E. 1978. ...and the wildlands. Conservationist 32(6):26. (Photo essay.)
Kiviat, E. 1977. Reptiles and amphibians of the Hudson Estuary. North River Navigator (Hudson River Sloop Clearwater) 8(9):4-5.
Kiviat, E. 1976. Directory of Hudson Estuary marsh people and literature. Currents (Hudson River Environmental Society), (Oct.):1-8.
Kiviat, E. 1976. Listening to the cry of the wilderness. Hudson Valley 4(9):8-11.
Kiviat, E. 1973. Down along the cove. Bard Review (spring):21-23.

MICHAEL F. BURGER

328 Hook Place
Ithaca, New York 14850
(607)-272-0973
E-mail: mburger@audubon.org

EDUCATION

Ph.D. in Natural Resources and Environment (Wildlife Ecology and Management) **University of Michigan**, School of Natural Resources and Environment
Ann Arbor, Michigan — December 1998

Dissertation: "Geographic Variation in the Ecological Energetics and Physiology of the Northern Cardinal (*Cardinalis cardinalis*) in Winter"

M.S. in Natural Resources (Wildlife Ecology and Management)
University of Michigan, School of Natural Resources and Environment
Ann Arbor, Michigan — April 1994
GPA: 4.0

Thesis: "Linking Daily-energy Requirements and Differential Winter Distribution of Male and Female American Kestrels (*Falco sparverius*)"

B.A. *cum laude* in Biology (Minor in Chemistry)
Wittenberg University
Springfield, Ohio — June 1987
GPA: 3.7

Ohio State University, Franz Theodore Stone Laboratory
Put-in-Bay, Ohio — Summer 1986
Field biology station

Institute for European Studies
Vienna, Austria — Fall 1985
Foreign humanities study

AWARDS and HONORS

- National Audubon Society ACE Award for Individual Achievement 2002
- Department of Energy Global Change Fellowship 1992 - 1998
- University of Michigan School of Natural Resources Wildlife Faculty Award for Outstanding Graduate Student 1991
- University of Michigan School of Natural Resources Merit Scholarship 1990–1997
- Wittenberg College Honor Society
- Beta Beta Beta Honor Society
- Phi Eta Sigma Honor Society
- Wittenberg Alumni Scholarship
- Friends of Stone Lab Merit Scholarship

EXPERIENCE

Director of Bird Conservation, National Audubon Society of New York State
Stationed at Cornell Laboratory of Ornithology
Ithaca, NY — January 2000–Present
- Guiding NAS of NY State Program bird conservation research and policies

Forest Ecologist, National Audubon Society of New York State
Stationed at SUNY-ESF
Syracuse, NY — May 1999–January 2000
- Investigating implications of various forest management practices in the Adirondacks for breeding birds and other wildlife

MICHAEL F. BURGER

Department of Energy Global Change Fellow, Dissertation research, University of Michigan
Ann Arbor, MI — January 1992–October 1998
- Investigated mechanism through which climate limits the northern range edge of the Northern Cardinal

Research Intern, United States Fish and Wildlife Service, Idaho Cooperative Research Unit, University of Idaho
Moscow, ID — June–July 1992
- Studied species-habitat relationships and mapping species distributions as part of the USFWS Gap Analysis program

Research Intern, United States Fish and Wildlife Service, Utah Cooperative Research Unit, Utah State University
Logan, UT — July–August 1992
- Aided with field research aimed at monitoring reproductive success and habitat requirements of neotropical migrant birds as part of the USFWS BBIRD program

Laboratory Technician, University of Michigan
Ann Arbor, MI — May–September 1991
- Developed a method to recover and analyze metabolic data

Master's Student, Thesis research, University of Michigan
Ann Arbor, MI — January–March 1991
- Investigated possible energetic reasons for differential winter distributions of male and female American Kestrels

TEACHING

Lecturer, University of Michigan
Ann Arbor, MI — Winter 1999
Big Questions for a Small Planet
- Taught introductory class in Environmental Studies
- Designed course syllabus
- Organized lab activities
- Overseeing graduate student instructors

Graduate Student Instructor, University of Michigan
Ann Arbor, MI — Fall 1997
Biology of Mammals
- Taught identification and life histories of mammals of the world
- Organized and set up laboratory material
- Wrote and graded quizzes and exams
- Graded term papers
- Guest lectured

Graduate Student Instructor, University of Michigan
Ann Arbor, MI — Fall 1989 and 1991
Terrestrial Vertebrate Natural History
- Taught identification and natural history of Michigan terrestrial vertebrates
- Organized and led field trips and labs
- Wrote and graded quizzes and exams
- Helped develop and grade student field research projects
- Guest lectured

MICHAEL F. BURGER

Graduate Student Instructor, University of Michigan
Ann Arbor, MI — Fall 1990
Ecological Issues
- Taught and led discussion about current ecological issues
- Helped write and grade exams
- Guest lectured

Substitute Teacher, Town of Webb Schools
Old Forge, New York — Fall 1988
High school biology and chemistry

PUBLICATIONS

Burger, M. F., D. J. Adams, T. Post, L. Sommers, and B. Swift. 2004. The New York State Bird Conservation Area (BCA) Program: A model for the U.S. *In press* Proceedings of the Third International Partners In Flight Conference, March 20-24, 2002, Asilomar Conference Grounds, California.

Burger, M. F. and J. M. Liner. 2004. IBAs as a conservation tool: Implementation at the State level. *In press* Proceedings of the Third International Partners In Flight Conference, March 20-24, 2002, Asilomar Conference Grounds, California.

Burger, Michael F., and Denver, R. 2002. Plasma Thyroid Hormone Concentrations in a Wintering Passerine Bird: Their Relationship to Geographic Variation, Environmental Factors, Metabolic Rate and Body Fat. Physiological and Biochemical Zoology 75(2): 187-199.

Burger, Michael F. 1998. Geographic variation in the ecological energetics and physiology of the Northern Cardinal (*Cardinalis cardinalis*) in winter. Ph.D. Dissertation. University of Michigan, Ann Arbor.

Burger, M F. 1997. Estimating lipid and lean masses in a wintering passerine: an evaluation of TOBEC. Auk 114(4): 762-769.

Burger, M. F. 1994. Linking daily-energy requirements and differential winter distribution of male and female American Kestrels (*Falco sparverius*). Master's Thesis. University of Michigan, Ann Arbor.

Burger, M. F. 1994. Book review, "A Guide to Michigan's Endangered Wildlife" by D. C. Evers. Endangered Species Update 11(5): 6.

TALKS GIVEN

Hartley, M., **Burger, M.**, and Beyea, J. Effects of Tree Harvest Intensity on Forest Birds in New York.
Northeast Natural History Conference
Albany, NY — April 2002

Burger, M. F. IBAs as a conservation tool: Implementation at the State level.
Third International Partners In Flight Conference
Asilomar Conference Grounds, CA — March 2002

Adams, D., Post, T., Sommers, L., Swift, B., and **Burger, M.** New York's Bird Conservation Area Program.
Third International Partners In Flight Conference
Asilomar Conference Grounds, CA — March 2002

Burger, M. F., Beyea, J., Cox, G., and Arrigoni, J. Incorporating Non-game Wildlife Values in Private Forest Management in New York.
New York Natural History Conference
Albany, NY — April 2000

MICHAEL F. BURGER

Burger, M. F. Geographic variation in body mass, body composition, and basal metabolism of wintering Northern Cardinals: evidence of energetic constraints.
Society of Integrative and Comparative Biology
Denver, CO January 1999

Burger, M. F. Sizes of internal organs reflect energetic environments of wintering Northern Cardinals.
Invited seminar at the Department of Physiology, University of California
Los Angeles, CA June 1998

Burger, M. F. Geographic variation in body size and body fat in wintering Northern Cardinals: An energetic range limit?
Physiological Ecologists' Meeting
Bishop, CA June 1996

Burger, M. F. Climatic determinants of bird ranges: Will more than the climate change? Invited talk given to the Society of Environmental Journalists
Ann Arbor, MI June 1994

Burger, M. F. and Root, T. Geographic variation in winter body size and body fat and their possible link to the northern distribution limit of Northern Cardinals.
Given at the 111th meeting of the American Ornithologists' Union
Fairbanks, AK June 1993

Burger, M. F. The link between daily energy consumption and the differential winter distributions of male and female American Kestrels. Given at the 110th meeting of the AOU
Ames, IA July 1992

Dozens of other presentations to lay audiences.

PROFESSIONAL MEMBERSHIPS

American Ornithologists' Union
Cooper Ornithological Society
The Society for Integrative and Comparative Biology
The Wildlife Society
Wilson Ornithological Society

COMMUNITY SERVICE

Volunteer, Community Supported Agriculture, Westhaven Farm
Ithaca, NY June 2000–Present
Assist with various farm chores

Volunteer, Community Supported Agriculture of Central New York
Syracuse, NY September 1999–June 2000
Help promote community supported agriculture through involvement on steering committee

Volunteer Meal Coordinator, Ann Arbor Homeless Coalition
Ann Arbor, MI April 1997–April 1999
Help coordinate preparation and serving of meals at a homeless shelter

Volunteer Mentor, Ann Arbor Public Schools
Ann Arbor, MI September 1994–June 1995
Worked with a 4th-grade student once a week to bolster his ability to read and write

Graduate Student Representative, Academic Affairs Committee, University of Michigan, School of Natural Resources and Environment
Ann Arbor, MI September 1994–May 1995

MICHAEL F. BURGER

REFERENCES

Dr. Terry L. Root
School of Natural Resources & Environment
University of Michigan
Ann Arbor, MI 48109-1115
Phone & Fax: (734)763-5945
Backup Fax: (734)936-2195
Email: tlroot@umich.edu

Dr. James S. Diana
School of Natural Resources & Environment
University of Michigan
Ann Arbor, MI 48109-1115
Phone: (734) 763-5834
Email: jimd@snre.umich.edu

Dr. Stephen H. Schneider
Dept. of Biological Sciences
Stanford University
Stanford, CA 94305-5020
Phone: (650)725-9978
Fax: (650)725-4387
Email: shs@leland.stanford.edu

Graham L. Cox
Curriculum Vitae, Updated February 2004

Professional Responsibilities/Current Positions
Forest, wetland and open space program coordinator for Audubon New York, the State office of the National Audubon Society, based in Albany, NY.
Convener for the Northern Forest Alliance's New York Caucus (as a consultant to the Alliance.)
Involved on behalf of Audubon New York and the Alliance in Adirondack Park and Northern Forest issues, specifically in sustainable forest management, with a particular involvement in stakeholder participation in forest management at the landscape level.
Serves on the NYSDEC Forest Preserve Advisory Committee, the NYSDEC Region 5 Open Space Advisory Committee and the Catskill Park Centennial Planning Committee.
Also vice-president of the Capital Region Audubon Society chapter.

Education
Ph.D. 2003, Ecological Economics, Rensselaer Polytechnic Institute, Troy, New York.
M.S. 1998, Economics, Rensselaer Polytechnic Institute, Troy, New York.
B.A. (Econ), 1964. Dept. of Geography, University of Sheffield, England.

Ph.D. Thesis title: "Applying Multi-Criteria Decision Analysis in Participatory Planning for Sustainable Management of the New York State Forest," completed May 2003.

Relevant Employment and Professional Background
Career start as a journalist in the United Kingdom for Thompson Newspapers (1964-67) and then for Gannett Newspapers in Rochester, NY, as Gannett's first environmental reporter (1967-70.)

Trained as a natural resources planner and in this capacity prepared the first natural resources inventory and open space conservation plan for the Monroe County (NY) Environmental Management Council, published in 1976. Served as a natural resource planner (1971), then later as acting director for the Genesee/Finger Lakes Regional Planning Board (1977.)

Retired from service with New York State in 1997, after working for the State Department of Environmental Conservation, the State Department of Economic Development, and the New York State Assembly Ways and Means Committee.

Served as co-editor of the report of Governor Cuomo's Commission on the Adirondack Park in the 21st Century, published in 1990.

Served as vice president for public affairs for the National Audubon Society, 1991-94.

Member of the International Society for Ecological Economics and a charter member of the U.S. Society for Ecological Economics.

Contributed to three recent publications of the Northern Forest Alliance: "Forestry for the Future," 1999; "Shaping the Northern Forest Economy, Strategies for a Sustainable Future," 2002; and "Investing in New York's Northern Forest. An Agenda for Land Conservation in the Adirondack Park and Tug Hill Region," prepared for the New York Caucus of the Northern Forest Alliance, 2001.

Myrna H. P. HALL

Assistant Professor
SUNY College of Environmental Science and Forestry (SUNY ESF)
1 Forestry Drive
Syracuse, NY 13210
Tel: (315) 470-4741
Fax: (315) 470-6930
Email: mhhall@esf.edu

President/Owner
Geographic Modeling Services (GMS)
4090 Barker Hill Road
Jamesville, NY 13078
Tel: (315) 469-7271
Email: geomod@twcny.rr.com

EXPERTISE: Integrating simulation modeling and GIS for studying the interaction of
humans and their environment, natural resources management, issues of sustainable development, graphic information visualization, and foreign language communication.

EDUCATION: BA 1967 French, Education, University of Washington, Seattle, WA
Honors: Phi Beta Kappa, Mortar Board, Named UW Outstanding Senior Woman 1967
M.S.1995 Natural Resources Management, State University of New York College of Environmental Science and Forestry, Syracuse, NY

LANGUAGES: English, French, and Spanish

RESEARCH: SUNY Research Foundation Projects

2002-2004	Forest Fragmentation in the Northeastern United States, Joint ESF-Yale School of Forestry Project, M. Hall, ESF P.I.

RESEARCH EXPERIENCE: Geographic Modeling Services Projects

2001-2003	Spatial Modeling of the Averted Deforestation Baseline for Potential Carbon Offset Projects in the States of Chiapas, Michoacan and Campeche, Mexico. US AID funded research contract with Winrock Intl. Sandra Brown, PI.
2001-2002	Spatial Modeling of the Averted Deforestation Baseline for the Scolel Té Region of Chiapas, Mexico, 1996 – 2030, with J. D. Cornell. EPA-funded research contract with Winrock Intl. Sandra Brown, PI.
2001-2002	Spatial Modeling of the Averted Deforestation and Regeneration Baseline for the Guaraqueçaba (Itaqui) Climate Action Project, Brazil, for The Nature Conservancy, Arlington, VA.
2001-2002	Spatial Modeling of the Averted Deforestation Baseline for the Noel Kempff Mercado Climate Action Project, Bolivia. EPA-funded research contract with Winrock International. Sandra Brown, PI.

2003	Analysis of Chronic Toxicity to Benthic Organisms of Onondaga Lake Sediments. Funded by EPA Technical Assistance Grant to Atlantic States Legal Foundation, Syracuse, NY.
1999	GIS Analysis of Wetland Loss in Onondaga County to determine feasibility of creating constructed wetlands in urban Syracuse, NY. Joint ESF-Atlantic States Legal Foundation EPA-supported grant.
1998	Computer Visualization and GIS Data Base Query Program for Onondaga Lake Super Fund Site, EPA Technical Assistance Grant, for Atlantic States Legal Foundation, Syracuse, NY
1996-1997	Non-point Source Pollution Modeling, Rio Piedras Watershed, for San Juan Bay Estuary Project, San Juan, PR Computer Visualization, for Caribbean National Forest Visitors' Center, El Portal, Puerto Rico Environmental Gradient Modeling of Commercial Species Growth and Distribution, for USDA Forest Service
1995 - 1996	GIS Subcontractor, for South Florida Water Management District Contract C- 5348, linking GIS to Object-Oriented Hydrological Model.
1995	Modeling Human Carrying Capacity through Sustainable Forestry Practices, Maya Biosphere Reserve, for Project OLAFO, CATIE, Turrialba, Costa Rica
1993 - 1994	Computer Visualization of Glacier and Vegetation Change as a Function of Different Climate Scenarios, for Apgar Visitors Center, Glacier National Park, West Glacier, MT
1992	Forest cover and wildlife habitat modeling, for USDA Forest Service, Lolo National Forest, Missoula, MT
1991	Translation of GIS software commands into French and Spanish; for Resources Planning Associates, Inc., Ithaca, NY

EXPERIENCE: Teaching -- US

2001-2004	Assistant Professor, Faculty of Environmental Studies, SUNY-ESF
2000	Visiting Assistant Professor, SUNY-ESF, Faculty of Environmental Forest Biology
1994 -	Visiting Instructor, Geographical Modeling, SUNY-ESF, Faculty of

1999	Environmental Forest Biology
1993- 1994	Instructor, Geographical Modeling Workshops, SUNY-ESF, Division of Continuing Education

Teaching -- Latin America

2000, 1997	Instituto de Investigaciones de Ecología y Media Ambiente, Tarija, Bolivia
1999, 1996	Universidad Nacional de Rio Cuarto, Rio Cuarto, Argentina
1995	Instituto de Ecología, Jalapa, Mexico
1994	Universidad Nacional Autónoma Metropolitana, Xochimilco, Mexico, DF.

PEER-REVIEWED PUBLICATIONS:

Hall, Myrna H. P. and D. B. Fagre, 2003. **Modeled Climate-Induced Glacier Change in Glacier National Park, 1850- 2100**. BioScience 53: 131-140 (cover article).

Hall, C.A.S, and M.H.P. Hall, 1993. **The efficiency of land and energy use in tropical economies and agriculture,** Agriculture, Ecosystems and Environment 46(1993) 1-30.

Wang, H. Q., C. A. S. Hall, J. D. Cornell, and M. H. P. Hall. 2002. **Spatial dependence and the relationship of soil organic carbon and soil moisture in the Luquillo Experimental Forest, Puerto Rico**, Landscape Ecology, 17 (8): 671-684, December 2002.

CHAPTERS IN BOOKS:

Hall, M. H. P., A. Dushku, and S. Brown (*in press).* **Scale Issues in Prediction of Land Use Change in the Developing Tropics**, in C. Hall and G. LeClerc (eds.) Making Development Work: A New Role for Science, University of New Mexico Press, Albuquerque, NM.

Hall, M.H.P, C.A.S. Hall and M.R. Taylor, 2000. **Geographical Modeling: The Synthesis of GIS and Simulation Modeling**, pp177-202 in Hall, C. A. S. (Ed.), Quantifying Sustainable Development, The Future of Tropical Economies, Academic Press, San Diego.

Hall, C. A. S., M. Hall, and B. Aguilar, 2000. **A Brief Historical and Visual Introduction to Costa Rica**, PP 19-42 in Hall, C. A. S. (Ed.), Quantifying

Sustainable Development, The Future of Tropical Economies, Academic Press, San Diego.

Hall, M. H. P. and C. A. S. Hall, 1998. **The Use of Geographic Modeling to Analyze Agricultural Energy Return on Investment**, Proceedings: International Workshop on Advances in Energy Studies, Porto Venere, Italy, May 26-30, 1998.

OTHER PUBLICATIONS/REPORTS:

Tyrrell, M., M. H. P. Hall, and R. N. Sampson. 2003. **Dynamic Models of land Use Change in Northeastern USA**: Developing Tools, Techniques, and Talents for Effective Conservation Action, Global Institute of Sustainable Forestry Research Paper 003, Yale University, New Haven, CT.

Hall, M. H. P. and G. Guerrero, O. Masera, 2003. **Modeling Deforestation Baselines using GEOMOD for the Calakmul and Meseta Purépecha Regions in Mexico,** http://www.ine.gob.mx/dgicurg/cclimatico/download/Deforestation%20baselines-Appendix%202.pdf

Hall, M. H. P., D. Hughes, J. Mead, and P. Thompson. 2003. **Quantification of Extent and Level of Benthic Toxicity of Onondaga Lake Sediments**, Report to Atlantic States Legal Foundation, EPA Technical Assistance Grant.

Hughes, D., M. H. P. Hall, and S. Sage. 2003. **Onondaga Lake's Contaminated Sediments: Characterization and Public Policy Implications**. http://www.epa.gov/superfund/new/hughes.pdf

Hall, M. H. P. and A. Dushku. 2002. **Spatial Modeling of the Averted Deforestation Baseline for the Noel Kempff Mercado Climate Action Project, Bolivia**. Winrock International, EPA-supported Research, http://www.winrock.org/general/Publications/EcoCoop.pdf.

Hall, M. H. P. and J. D. Cornell. 2002. **Spatial Modeling of the Averted Deforestation Baseline for the Scolel Té Region of Chiapas, Mexico, 1996 – 2030**. Winrock International, EPA-supported Research, http://www.winrock.org/what/PDF/eco/Product%206%20GEOMOD%20Chiapas.pdf.

Hall, M. H. P. 2002. **Spatial Modeling of the Averted Deforestation and Regeneration Baseline for the Guaraqueçaba (Itaqui) Climate Action Project, Brazil.** Winrock International, EPA–supported Research, http://www.winrock.org/what/PDF/eco/Product%204%20Geomod%20to%20GCAP.pdf.

Brown, S. M. H. P. Hall, F. Ruiz, a. Flamenco, B. DeJong, L. Auckland, O. Masera, and D. Shoch. 2002. **Land Use and Forestry Projects that Abate Greenhouse Gas Emissions: Baselines and Additionality**. Winrock

International, US AID-supported Research. http://www.irgltd.com/irgltd/Pubs/LAC/2002-04%20Land%20Use%20and%20Forestry%20Projects%20That%20Abate%20GHG-Mexico.pdf

MARY L. TYRRELL

124 Mather Street
Hamden, CT 06511

203-287-0368
mary.tyrrell@yale.edu

Education

Master of Forest Science, Yale University School of Forestry and Environmental Studies
Master of Business Administration, Boston University
B.A., Mathematics, University of New Hampshire

Experience

Yale University School of Forestry and Environmental Studies (FES) (1997 – present)
Program Director and Researcher, Global Institute of Sustainable Forestry (2000 – present)

Responsible for promoting within the FES community an understanding and awareness of the importance, status and challenges of stewardship and long-term sustainability of private forestlands, through publications, lectures, seminars, research, internships, and collaboration with external organizations.

- Raised $150,000 in research grants to support program activities
- Directed and implemented a research project to apply statistical modeling tools to forecast the pattern and rate of increasing forest fragmentation in the Northeast, in collaboration with researchers at the State College of New York, College of Environmental Science and Forestry
- Designed and co-taught graduate course *Seminar on Invasive Species Biology and Ecology*
- Member of the executive management committee and project coordinator for the Sustaining Family Forests project, a national collaboration of NGOs, government agencies, forestry professionals, landowners, and forest products companies working to improve forestry practices on private lands
- Supervised student research project to determine the social, economic, and environmental cost of wildfires in the United States
- Organized and convened forums and workshops on institutional timberland investment, forest health, and wildfire

Associate Director, Global Institute of Sustainable Forestry (2002 – present)

- Edited and produced the Institute's publications including brochures, program materials, seminar and forum summaries, issue summaries, fact sheets, working papers, and research papers
- Launched the GISF Research Paper Series as a vehicle to broadly publicize applied scientific research on issues related to forest health and sustainable forestry
- Managed the Institute's finances, including budgeting and account management
- Supervised department coordinator and graduate student assistants

Yale University School of Forestry and Environmental Studies

Program Director, Center for Coastal and Watershed Systems (1997-2000)

Managed all Center activities and projects. Responsibilities and accomplishments included:

- Oversight of two major studies of non-point source pollution involving researchers from three institutions
- Researched and wrote synthesis reports on topics related to watershed science and ecology
- Co-chaired water quality work group of the Quinnipiac River Watershed Partnership, a community-based watershed improvement initiative
- Managed student internship program and supervised technical staff and student assistants
- Managed Center library resources and Geographic Information Systems (GIS) data bases

Appalachian Mountain Club (1997)

Researched and wrote report on sustainable forestry initiatives in the Northern Forest region (northern New England and New York). Developed a GIS database and analysis criteria for identifying areas of the Northern Forest which have high potential for wilderness preservation. Conducted alpine vegetation surveys at high elevation huts.

Digital Equipment Corporation, Maynard, MA (1980 – 1995)

Business Operations Manager, International Contract Manufacturing (1991 – 1995)

As key member of a new business start up team, built a $130 million international contract manufacturing business in just over two years. Responsibilities included development of business plans, program management for large accounts, customer relations and negotiations, sales training, staff development, and revenue and profit management. Managed collaboration process among manufacturing facilities in Asia, Canada, Europe, and the United States.

Manufacturing Engineering Manager, General International Area (1986 – 1991)

Managed an engineering group responsible for providing technical support and process development for new manufacturing plants in emerging markets. Supported the start up of manufacturing operations in Brazil, India and Australia; provided new product introduction and ongoing technical support for manufacturing operations in India, Australia and China.

Prior to 1986, held various positions in Quality Assurance and Manufacturing Engineering

Community Service

Northeast Organic Farming Association (NOFA) Organic Land Care Committee of Connecticut and Massachusetts (1999-present)

Participated in the development and implementation of a new program to extend the vision and principles of organic agriculture to the care of the landscapes where most people live, work, and play. Major committee accomplishments include publication of *Standards for Organic Land Care: Practices for Design and Maintenance of Organic Landscapes*; development of an organic land care professional accreditation program; design and delivery of a four-day course on organic land care; writing and publishing *A Citizen's Guide to Organic Land Care*.

Connecticut NOFA Board of Directors (2001 – present)

Town of Hamden Natural Resources and Open Space Commission (2000 – 2004)

Mill River Watershed Association Board of Directors and Newsletter Editor (1999 – 2003)

Publications and Research Reports

Tyrrell, Mary L., Myrna H.P. Hall, and R.Neil Sampson. 2004. *Dynamic Models of Land Use Change in Northeastern USA: Developing Tools, Techniques, and Talents for Effective Conservation Action.* GISF Research Paper 003. Yale School of Forestry & Environmental Studies, New Haven, CT.

Hobson, David A., Mary L. Tyrrell, and Ann E. Camp. 2004. *New Threats to North American Forests: A summary of a forum and workshop exploring the impact of Asian Longhorned Beetle and Emerald Ash Borer on forests and forest-based economies.* YFFReview Vol. 6, No.1. Yale School of Forestry & Environmental Studies. New Haven, Connecticut.

Tyrrell, Mary. *The True Cost of Wildfires Shouldn't Be A Mystery.* The Hartford Courant. November 7, 2003.

Morton, Douglas C., Megan E. Roessing, Ann E. Camp, and Mary L. Tyrrell. 2003. *Assessing the Environmental, Social, and Economic Impacts of Wildfire.* GISF Research Paper 001. Yale School of Forestry & Environmental Studies, New Haven, CT.

Ravenel, Ramsay M. and Mary L. Tyrrell, eds. 2002. *Institutional Timberland Investment - Balancing Ecology, Finance and the Public Interest: A summary of a forum exploring changes in forestland tenure and the implications for sustainable forest management.* YFFReview Vol. 5, No. 3. Yale School of Forestry & Environmental Studies. New Haven, Connecticut.

Tyrrell, Mary L. *Water Quality in the Quinnipiac River Watershed: An Analysis of Water Quality Data for the Period 1989-1999.* 2001. Yale School of Forestry & Environmental Studies, Center for Coastal and Watershed Systems. New Haven, Connecticut.

Tyrrell, Mary and Gary Dunning, eds. 2000. *Forestland Conversion, Fragmentation, and Parcelization: A summary of a forum exploring the loss of forestland and the future of working family forests.* YFFReview Vol. 3, No. 6. Yale School of Forestry & Environmental Studies. New Haven, Connecticut.

Tyrrell, Mary L., ed. 2000. *Quinnipiac River Point Source Pollution – Is It Still a Problem?: The Proceedings of a Symposium on the Health of the Quinnipiac River – The Role of Point Source Pollution.* Yale School of Forestry & Environmental Studies, Center for Coastal and Watershed Systems. New Haven, Connecticut.

Lawrence G. B., K.A. Vogt, D.J. Vogt, J.P. Tilley, P.M. Wargo and M. Tyrrell. 2000. Atmospheric Deposition Effects on Surface Waters, Soils and Forest Productivity. In: *Responses of Northern U.S. Forests to Environmental Change.* Springer-Verlag. New York.

Tyrrell, Mary and David Publicover. 1997. *Assessment of Recommendations and Guidelines for Sustainable Forestry in the Northern Forest Region.* A Cooperative Project of the Northern Forest Alliance, The Wilderness Society and The Appalachian Mountain Club.

Tyrrell, Mary L. 1996. Ecological resource risk assessment of the impact of the Asian longhorned beetle *Anoplophora glabripennis* on maple trees on Long Island, New York. Yale School of Forestry and Environmental Studies, New Haven, CT.

JOHN M. ELLSWORTH
Manager of Environmental Programs /SEQRA Specialist

EDUCATION/REGISTRATION

Master of Science, Marine Environmental Sciences, State University of NY at Stony Brook, 1982
Bachelor of Science, Biology-Geology, University of Rochester, 1978.

EXPERIENCE

Mr. Ellsworth specializes in projects relating to New York State Environmental Quality Review Act (SEQRA) compliance, environmental impact assessment, and resource and land use management. Mr. Ellsworth is thoroughly familiar with the requirements of SEQRA, and he has assisted numerous clients, including both public agencies and private entities, in complying with SEQRA over the past 15 years. His work has included both the preparation and review of a wide range of SEQRA documents (Environmental Assessment Forms, lead agency coordination correspondence, lead agency dispute documentation, Determinations of Significance, Scoping Documents, site-specific and Generic Environmental Impact Statements, Supplemental Environmental Impact Statements, and Findings Statements). Mr. Ellsworth's involvement on these projects has included all aspects of environmental impact analysis, so that he is knowledgeable in the full range of environmental impact issues, including, but not limited to, natural resource protection, zoning and land use policy, traffic and transportation resources, and socio-economics.

A representative summary of Mr. Ellsworth's project experience includes:

- Assistance with environmental reviews and SEQRA compliance for a large number of proposed projects on behalf of the Town of Oyster Bay, including a number of major development proposals from 1987 to present. These assignments have included: a regional mall in Syosset; a multi-use development of a hospital campus in Massapequa, consisting of senior housing, home improvement warehouse, and assisted living facility; redevelopment of an industrial site in Hicksville for senior housing; major supermarket in Farmingdale, involving the redevelopment of a federal Superfund site; single-family residential subdivision in Jericho, involving an environmentally sensitive property containing significant slopes and kettle-pond wetlands; redevelopment of a former sand mine with mixed housing in Plainview; multi-family housing developments in Massapequa and Bethpage; redevelopment of an industrial park in Woodbury for office use; and redevelopment of the Grumman Aerospace property in Bethpage.

- Assistance with municipally-sponsored planning initiatives in the Town of Oyster Bay, including: the preparation of a Generic Environmental Impact Statement for a redevelopment and revitalization plan covering the western waterfront area in Oyster Bay hamlet; preparation of redevelopment and revitalization plan for the waterfront area in Glenwood Landing, including a series of recommendations for parcel-specific zoning changes, among other proposals, and SEQRA compliance documentation; Aquifer Protection Overlay legislation covering the Town's portion of the Special Groundwater Protection Area; and completion of SEQRA process for the comprehensive revision of the Town's Zoning Code.

- Preparation of a Generic Environmental Impact Statement for adoption of the Town of Greenburgh Comprehensive Plan, including implementing legislation for the regulation of activities in areas containing steep slopes and wetlands.

- Preparation of a Generic Environmental Impact Statement for comprehensive revisions to the Town of Brookhaven Zoning Code, covering non-residential zoning districts throughout the Town.

- Preparation of a Generic Environmental Impact Statement for the implementation of a community revitalization plan for the Montauk Highway Corridor in Mastic-Shirley.

- Preparation of an Environmental Impact Statement for a municipally-sponsored affordable housing project in the Town of East Hampton.

- Preparation of an Environmental Impact Statement covering a proposal by the Town of Brookhaven to undertake a hard clam restoration project in eastern Great South Bay.

- Environmental analysis and SEQRA compliance review on behalf of the Town of North Hempstead and associated villages for the proposed widening and improvements of the Long Island Expressway in Nassau County.

- SEQRA assistance to the Village of Islandia in the review of various applications, including an Environmental Impact Statement for the expansion of Computer Associates World Headquarters, environmental review of the expansion of a regional shopping center, and SEQRA considerations relative to the update of the Village's Comprehensive Plan.

- SEQRA assistance to the Village of Kings Point in the review of various proposed development projects, including a single-family subdivision on a site with federally-designated wetlands and a religious institution on a property with slope issues.

- SEQRA assistance to the Village of Great Neck in the review of the expansion of a multi-family residential building, with slope issues.

- SEQRA assistance to the City of New Rochelle in the review of Environmental Impact Statements and preparation of Findings Statements for a dormitory construction project and campus development plan for Iona College.

- Assistance to the Town of Greenburgh, as an interested agency, in undertaking review of an EIS prepared for the Ridge Hill multi-use development in the City of Yonkers.

- SEQRA assistance to the Village of Amityville in the review of a proposed medical waste incinerator.

- SEQRA assistance to the Village of Lindenhurst for a multi-family housing development.

- SEQRA assistance to the City of Peekskill in the review of a proposed asphalt production facility.

- SEQRA assistance to Lawrence and Valley Stream School Districts with respect to facility expansion programs.

- Preparation of a series of technical studies on coastal erosion abatement, hazard mitigation, and marine/coastal resources for the New York State Department of State as part of the Governor's Coastal Erosion Task Force Program.

- Assistance in the planning and design of stormwater mitigation systems for sites in Sag Harbor, including a wetland demonstration project.

- Assistance in planning, design and permit applications for improvements to the JFK Wildlife Sanctuary and associated wetland preserves at TOBAY Beach for the Town of Oyster Bay.

John H. Alschuler

John H. Alschuler is the President of Hamilton, Rabinovitz & Alschuler, Inc., a consulting organization with offices in New York and Los Angeles. He directs a consulting practice devoted to urban development, real estate transactions, and the re-restructuring of public institutions. His work focuses on managing large-scale developments in urban areas, planning the revitalization of under-utilized areas, and strategic business planning for downtowns and regions. He has advised a wide range of clients, including the Guggenheim Foundation, Madison Square Garden, the Related Companies, the Brooklyn Bridge Park Development Corporation, the Battery Park City Authority, the New Jersey Performing Arts Center, the Brooklyn Academy of Music, and Brookfield Properties. He has also served as advisor to the Government of Kuwait, the Cities of Columbus and Cincinnati, Ohio and is a regular advisor to the City and State of New York.

He regularly works with developers supporting their transactional activities and he assists governments and no-for-profits with the full range of their real estate related requirements. This work involves intimate familiarity with real estate finance, with transactional structures and often involves the ability to communicate complex findings to senior executives, Mayors and Governors, and in a multiplicity of public forums. The core of his work involves structuring transactions that create the places and institutions that give renewed vitality to communities. This work has involved the creation of new centers for the arts, the re-use of abandoned military property, the creation of a widely acclaimed new community in Charleston, South Carolina, and the often complex redevelopment of projects in the heart of major cities. In addition, he has taken an active role in education reform and supported workforce development programs.

Among Dr. Alschuler's most significant projects has been launching the development of Daniel Island, South Carolina for the Guggenheim Foundation, gaining public support for the approval for $650 million public and private investments in Brooklyn Bridge Park, economic impact analysis of the redevelopment of the World Trade Center site, shaping the reuse plan for Governor's Island, and developing a plan for the reuse of the Washington DC Convention Center site along with the transformation of the Anacostia Riverfront. Major current engagements are the implementation of a redevelopment program for Columbus, Ohio, transactional support for the District of Columbia and development of a series of initiatives for center city Cincinnati, Ohio.

Prior to joining HR&A, Dr. Alschuler served in a number of prominent positions with local governments, including City Manager of Santa Monica, California; Associate City Manager of Hartford, Connecticut; and as a leader of the Hartford Public Schools. He has also led the Coro Foundation's program, Leadership New York. Dr. Alschuler currently teaches in the Graduate Program in Real Estate at Columbia University where he has held the title of Adjunct Assistant Professor since 1987, and he serves on the Board and Executive Committee of SLGreen Reality, a NYSE listed REIT based in New York.

CURRICULUM VITAE
For
Peter Swift

Personal Details:

Name:	Peter Swift, PE
Address:	1699 Geneva Circle
Town/City:	Longmont, CO
Country:	USA
Postal or Zip code:	80503
Phone number:	303-772-7052
Fax number:	303-651-7226
Email address:	phswi@aol.com
Web Site	www.swiftllc.com

Education:

Liberal Arts, Kendall College, Evanston, Ill.
Marine Corps Intelligence Training Program (G2), USMC, Cherry Point, NC
Egyptian Philology, UWW, Providence (Brown Univ.)
Civil Engineering, Univ. Colo./Boulder
Stochastic and Continuous Simulation Hydrology, Colorado State Univ. Cert. Program

Academic

Occasional Lecturer Univ. of Colorado, Denver

Research Fellow, 2002, Univ. of Miami School of Architecture and Design; Knight Community Fellowship. The proposed research centers around the development of a system to evaluate New Urbanist projects based on historical American urban precedent and the CNU Charter.

Expert Witness

Accepted by the 8th District Federal Court of Appeals in matters of transportation and traffic engineering.

Professional Registration

Professional Engineer; Several States, please inquire.

Military
1967-68 USMC Aviation Intelligence (G2)
- Top Secret and Crypto Clearance

Work History

1969-Staunton and Freeman Consulting Engineers, N.Y., N.Y., Civil Design/Drafting
1972-India Imports, Providence, R.I., Carpenter

1975-Independent, Carpenter, Washington and R.I.
1976-L. A. Garofalo, Inc., Providence, R.I., Civil Design Drafting
1978-Costin Engineering, Denver, Co., Civil Design and Project Manager
1980-McCarty Engineering Consultants, Longmont, Co., Senior Project Manager
1985-City of Longmont, Colorado, Civil Engineer II, Project Engineer, Chair Public Improvement Review Committee, Developer Contract Administrator
1988-Owner, Swift and Associates, Engineers and Town Planners, Longmont, Co.

Public Service

Transportation Advisory Committee, Vice Chair, Longmont, Co., 1984-1988
Planning and Zoning Commission, Vice Chair, Longmont, Co., 1990-1994
Airport Advisory Committee, Member, Longmont, Co., 1988-1991
Co-Chair, Urban Design Task Force, Congress for the New Urbanism, current

Select Publications

American Planning Association, 4 Corners Conference, 1997, "The Engineer as Generalist at the Turn of the Century"
Congress for the New Urbanism, 1997, Denver, Co., "Residential Street Typology and Injury Accident Frequency
NU Council Report V, "A Warning to Europe", April, 2003

Current Projects

Translation editor of "Handbuch Der Architektur", 1907, J. Stuben (Chapters 6 and 7 completed).

Translation editor of "Architecture Bible", 2001, Leon and Rob Krier (completed).

Co-author, "Context Directed Street Design" (in progress, completion for publication summer 2004)

Author of chapter on narrow street design in the forthcoming (2005) Planning and Urban Design Standards from the American Planning Association.

Memberships
Congress for the New Urbanism
American Planning Association
Egypt Exploration Society (UK)
Town and Country Planning Association (UK)
Institute of Transportation Planners

CARPENTER ENVIRONMENTAL ASSOCIATES, INC.
CEA ENGINEERS, P.C.

CURRICULUM VITAE

STEVEN R. GARABED, P.E., SENIOR ENGINEER

EDUCATION
B.S. Civil Engineering, New Jersey Institute of Technology, 1991
M.S. Civil Engineering, New Jersey Institute of Technology, 1995

REGISTRATION
Licensed professional engineer in New York and New Jersey
State of New Jersey UST Certification (Subsurface Evaluation and Tank Closure)

PROFESSIONAL EDUCATION
Hydrologic Modeling using GIS and the Watershed Modeling System, 2002
Capacity and Management of Operations and Maintenance, Pre-Conference Workshop, WEF, 2001
Biological Nutrient Removal Seminar, 2000
Industrial Site Recovery Act Seminar, 1998
NJDEP Regulation Amendments to the Technical Requirements for Site Remediation in New Jersey, Cook College, 1997
Advanced Industrial Wastewater Treatment: A Workshop on Activated Sludge, NYWEA, 1997
Riverware Training Workshop, University of Colorado, USBR, 1997
Analysis of Receiving Waters, New Jersey Institute of Technology, 1996
Advanced Water Pollution Control: Biological Wastewater Treatment, 5 Day Short Course, University of Texas, 1995
OSHA 8 Hour Supervisor Training, 1994
NJDEP Site Remediation, Seminar, 1992
OSHA 40 Hour Health and Safety Training, 1991

PROFESSIONAL HISTORY
Senior Engineer, Carpenter Environmental Associates, Inc. Monroe, New York, 1989 - present
Promoted to Senior Engineer in 1998.

Serves as Senior Engineer providing civil/environmental engineering expertise and project management on projects including:

Wastewater/Storm Water
- Wastewater treatment plant evaluation.
- Development of WWTP computer models to investigate ways to enhance plant performance.
- Management of Industrial Pretreatment Programs.
- Waste treatability studies for industrial wastes.
- Development of local limits for POTWs.
- Evaluation of NPDES permits and preparation of comments.
- Collection system evaluations: CSO/SSO.
- Septic system and advanced treatment subsurface disposal system evaluations.
- Development of estimates of storm water pollution loading from developed sites and highways.
- Design and evaluation of storm water BMPs

- Design of storm water conveyance and management systems.
- Evaluation of storm water impacts due to mountain top mining.
- Wastewater treatment plant upgrade cost estimates
- Wetland hydrology evaluations

Litigation Support

- Technical/expert witness support for Clean Water Act, RCRA, SEQRA, and site development litigations.
- Provides expert testimony at deposition, administrative hearings, public hearings, and planning boards.

Site Assessment/Hazardous Materials

- Development of Preliminary Assessments, Site Investigation reports, Remedial Action Work plans, Remedial Investigation Work plans, and Classification Exception Area reports.
- Phase I and Phase II site assessments in accordance with ASTM protocols.
- Environmental sampling.
- Worker health and safety oversight.
- Groundwater modeling to determine the rate of contamination migration and the estimation of the period of release.
- Level I Environmental Reviews for sites in New Jersey as part of CSO abatement requirements.
- Tank inspections.
- Development of ERAP, FRP, SPCC, and DPCC plans.

Modeling

- Determination of impacts of industrial discharges on receiving streams using HEC-2 and QUAL2E models.
- Determination of appropriate effluent limits for wastewater treatment plants using computer models.
- Completion of waste assimilative capacity studies.
- Groundwater modeling to determine the fate and transport of petroleum hydrocarbons and chlorinated solvents.
- Watershed modeling to determine storm water runoff rates and surface water impacts.

Site Development

- Development of pre and post development drainage studies, design of storm sewer utilities, dry wells, and detention basin facilities.
- Design of site grading, lot layouts, and roadways.
- Development of soil erosion and sediment control plans.
- Evaluation of environmental impact assessments on behalf of concerned and affected parties.

AFFILIATIONS

The Water Environment Federation
The Order of the Engineer
The International Association on Water Quality
New York Water Environment Association (Research Committee Member)

HONORS

Member of Tau Beta Pi National Engineering Honor Society and Chi Epsilon National Civil Engineering Honor Society.

PROFESSIONAL ACTIVITIES

Conference presentation - A Full Scale Comparison of Conventional and DAF Primary Treatment, NYWEA, 1996.

PUBLICATIONS

Garabed, S., Amuro A., Stone, J., Bell, B., and Melnyk, P., *A Full Scale Comparison of Conventional and DAF Primary Treatment*, **NYWEA Environmental Technical Conference, Lake George, NY,** 1996.

March 2004

Robert E. Pitt

Cudworth Professor of Urban Water Systems
Director of Environmental Engineering Programs

School of Engineering
Department of Civil and Environmental Engineering
University of Alabama, Box 870205
Tuscaloosa, Alabama 35487-0205

(205) 348-2684 (office and messages)
(205) 348-0783 (fax)
email address: rpitt@coe.eng.ua.edu
teaching and research web page: http://www.eng.ua.edu/~rpitt/

Rank and Department

Cudworth Professor of Urban Water Systems, Department of Civil and Environmental Engineering, University of Alabama

Director of Environmental Engineering program, University of Alabama

Education

Ph.D., Civil and Environmental Engineering, with major work in the areas of water resources, environmental chemistry and statistics, University of Wisconsin-Madison, WI, 1987

M.S.C.E., Environmental Engineering/Hydraulic Engineering, San Jose State University, CA, 1971

B.S. Engineering Science, Humboldt State University, Arcata, CA, 1970

Engineering Registration

State of Wisconsin (No. 24044)

Diplomate, American Academy of Environmental Engineers (No. 93-20037)

Teaching, Research and Industrial Experience

Cudworth Professor of Urban Water Systems, Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL, 2002 – present.

Professor, Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL, 2001 – present.

Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1997- 2001.

Director, Environmental Health Engineering Ph.D. program, University of Alabama at Birmingham, 1997–2001.

Associate Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1993-1997.

Assistant Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1987-1993.

Environmental Engineer, Wisconsin Department of Natural Resources, Madison, WI, 1984-1987.

Consulting Environmental Engineer, Blue Mounds, WI, and Birmingham, AL, 1979-present.

Senior Engineer, Woodward-Clyde Consultants, San Francisco, CA, 1974-1979.

Environmental Engineer, URS Research Company, San Mateo, CA, 1971-1974.

Memberships in Professional Societies

American Society of Civil Engineers (ASCE), Member

Executive Committee Member, Urban Water Resources Research Council

Water Environment Federation (WEF), Member

Chair, Stormwater Technical Advisory Board, Research Council

North American Lake Management Society (NALMS), Member

American Water Resources Association (AWRA), Member

American Water Works Association (AWWA), Member

Alabama Academy of Science, Member

Member, Carmichael Award Committee

Sigma Xi, Member

Society for Environmental Toxicology and Chemistry (SETAC)

Journal Reviewer

Journal of Water Resources Planning and Management (ASCE)

Water Environment Research (WEF)

Water Research (IAWQ)

Water Resources Bulletin (AWRA)

Water Science and Technology (IAWQ)

Watershed Protection Techniques (Center for Watershed Protection)

Recent Reviews for State and National Agencies

National Academy Press (National Research Council)

Department of Ecology (Washington)

Wisconsin Water Resources Institute (University of Wisconsin)

Alabama Department of Environmental Management (Montgomery)

Computational Hydraulics Institute (Guelph, Ontario)

California Sea Grant Institutional Program (Univ. of Southern California)

Urban Waste Management and Research Center (Univ. of New Orleans)

Water Resources Division (Wisconsin Department of Natural Resources)

Baldwin County Public Works Department (Alabama)

Vermont Water Resources and Lake Studies Center (Univ. of Vermont)

Center of Environmental Research Information (U.S. Environmental Protection Agency)

Division of Water Quality (Minnesota Pollution Control Agency)

Watershed Evaluation Branch (U.S. Environmental Protection Agency)

Memberships on Professional Committees and Boards

State of Washington, Office of Salmon Recovery, *Independent Science Panel*, 2003 – present.

US EPA, *Experts Panel for the 2003 Report to Congress on Combined Sewer Overflows and Sanitary Sewer Overflows, Public Health Effects*. 2002 – present.

Water Environment Research Foundation, *Stormwater Advisory Board, Chairman*. 2001 – present.

Alabama Water Resources Research Institute, *Alabama Water Resources Council*. 2000 – 2001.

National Council of Examiners for Engineering and Surveying (NCEES). Clemson, S.C. *Fundamentals of Engineering (FE) Examination Development Committee*. 1999 – 2001.

U.S. Environmental Protection Agency, Washington, D.C. and the American Society of Civil Engineers, Reston, VA. Peer review committee on *Development of Performance Measures, National Stormwater Best Management Practices (BMP) Database*. 1998 – 2003.

U.S. Environmental Protection Agency, Washington, D.C. *Urban Wet Weather Federal Advisory Subcommittee on Revision of Water Quality Standards*. 1997.

Construction Industry Research and Information Association (CIRIA), London, steering committee member, *Management of Gully Pots for Improved Runoff Quality*. 1997.

New York City, Department of Environmental Protection, member of *Technical Advisory Committee on Combined Sewer Overflow Program*. 1997 – 2000.

Center for Watershed Protection - Editorial Board Member. 1995 – present.

Watershed Management Institute, Inc., Member of Board of Directors. 1995 – present.

International Association on Water Quality (IAWQ), London, member of Scientific and Technical Report group preparing: *Solids in Sewers: Characteristics, Effects, and Controls of Sewer Solids and Associated Pollutants.* 1995 – present.
Univ. of New Orleans, *Urban Waste Management & Research Center*, affiliate member. 1994 – present.
Center for Watershed Protection, member of *Work Group on Stormwater Indicators.* 1995.
The Rensselaerville Institute, NY, committee on evaluating *Phase II U.S. EPA Stormwater Discharge Permit Requirements.* 1995.
Cleveland *CSO Value Engineering Task Force*, 1993.
U.S. EPA "SWAT" Team member for assisting states in determining Total Maximum Daily Loads (TMDL), 1992 – 1995.
U.S. EPA Task Force on Phase II of the Stormwater Permit Program, 1992 – 1994.
U.S. DOE EPSCoR Alabama State Director for Energy and the Environment, 1992 – 1994.
Resource Conservation and Development Council, Jefferson County, Soil and Water Conservation District, 1992 – 1994.
Committee on Class V Underground Injection Control-Stormwater NPDES, U.S. EPA Groundwater Protection Division, 1992.
Committee on Augmenting Natural Recharge of Groundwater with Reclaimed Wastewater, Stormwater, and Irrigation Return Flows. National Research Council, National Academy of Science, 1991 – 1994.
Alabama Erosion and Sediment Control Manual Development Committee, U.S. Department of Agriculture, Soil Conservation Service, 1991-1994.
Chairman, Cahaba River Work Group, Alabama Environmental Management Commission, 1990 – 1994.
U.S. EPA Planning Committee on Pollution Prevention Research, Risk Reduction Engineering Laboratory, 1990.

Conference Program Committees

Ecology of Cities. Russian Academy of Sciences and the General Physics Institute of the RAS, Ministry of Ecology of Greece, and the Ministry of Culture of Greece. Rhodes, Greece, June 1998.
Effects of Watershed Development and Management on Aquatic Ecosystems. Engineering Foundation and ASCE. Snowbird, Utah. August 1996.

Honors, Awards and Listings

Distinguished Service Citation, School of Engineering, University of Wisconsin, 2002.
Listed in:
- Marquis' Who's Who in the World (12th edition 1995, to current).
- Marquis' Who's Who in America (51st edition 1997, to current).
- Marquis' Who's Who in American Education (5th edition 1996 – 1997, to current).
- Marquis' Who's Who in the South and Southwest (24th edition 1995 – 1996, to current).
- Marquis' Who's Who in Science and Engineering (2nd edition 1994 – 1995, to current).
- Marquis' Who's Who in Finance and Industry (30th edition, 1998 – 1999, to current).

Guest Lecture at University of Tel Aviv, Israel, 2001.
Outstanding Student Chapter for 1997, American Water Resources Association, faculty advisor.
Board of Visitors Faculty Award for Distinguished Achievement, 1995.
Guest Lectureship, Universität Gesamthochschule Essen, Germany, 1994.
Ellen Gregg Ingals/UAB National Alumni Award for quality of teaching, finalist for 1994.
Excellence in Teaching Award, UAB School of Engineering, 1994.
Water Environment Federation, first place national award for combined sewer project (member of New York City project team), 1992.
North American Lake Management Society, professional presentation award, 1992.
Take Pride in America, first place Alabama environmental volunteer award, 1991.
Award of Recognition, U.S. Department of Agriculture, 1990.
U.S. Soil Conservation Service Earth Team, first place national award, 1989.
General Electric Engineering Education Fellowship, 1984 – 1986.
Federal Water Pollution Control Administration Fellowship, 1970 – 1971.

Representative Experience

Dr. Pitt has been the project manager and principal investigator for many water resources research projects. He has worked on lake management projects, environmental research projects, hazardous material management plans, facility location studies, and environmental assessments. His major area of interest is in stormwater management, especially the integration of drainage and water quality objectives.

Dr. Pitt has conducted research for the U.S. EPA, Environment Canada, Ontario Ministry of the Environment, states, and local governments concerning the effects, sources, and control of urban runoff for more than 30 years. He was also been involved in a number of projects that have used this research information to develop management plans, stormwater ordinances, and design manuals. As an example, he was a member of the technical advisory group for the EPA's Nationwide Urban Runoff Program (NURP). He also prepared the Source Loading and Management Model (SLAMM) and developed the watershed analysis procedures to investigate urban runoff for the priority watershed program of the Wisconsin Department of Natural Resources. These procedures are being used as the basis for state cost-sharing for major runoff control retro-fitting programs. He has also prepared manuals of practice which contain design procedures and construction specifications for stormwater and erosion control practices and has supervised their construction.

Dr. Pitt has also conducted research for the EPA to develop and test procedures to recognize and reduce inappropriate discharges of wastewaters to separate storm drainages. These procedures are being used by municipalities involved in the Clean Water Act's stormwater permit program as a field screening technique to identify and quantify discharge sources.

He has also directed a series of EPA research projects to investigate the sources and control of stormwater toxicants. As an example, he has found that combinations of sedimentation, aeration, and photo-degradation can significantly reduce stormwater toxicity. Automobile service facilities have been identified as a significant toxic pollutant source and a specialized treatment system to be located at these sources has been designed and tested at several locations. His research also examined stormwater effects on groundwater, and a book on this research was published by Ann Arbor Press. He has also evaluated the effects of separate sewage overflows on human health, especially considering toxic metal and organic pollutants and pathogens. Another EPA project directed by Dr. Pitt examined past drainage design procedures and recommends future approaches for drainage design. He has co-authored three recent books and numerous chapters based on this and related material, especially integrating stormwater modeling tools for water quality and drainage design objectives.

Current EPA – funded research includes developing a nationwide database of national stormwater permit information and conducting comprehensive evaluations of this data. He is also updating field screening procedures used for identifying inappropriate discharges to storm drainage systems. Recent research included investigating innovative heavy metal removal techniques for stormwater. He is currently investigating the sources and significance of stormwater bacteria and the transport and effects of stormwater gross solids.

He has also carried out a number of receiving water impact studies associated with stormwater. These studies have included a variety of field monitoring activities, including water and sediment quality, fish and benthos taxonomic composition, and laboratory toxicity tests. He is the co-author of a book recently completed (published by CRC/Lewis) detailing field, laboratory, and data analyses methods for use in examining stormwater effects on receiving waters.

Dr. Pitt was the project manager and principal investigator of a project with the telecommunications industry (sponsored by Bellcore, AT&T, plus many "baby Bells" from throughout the U.S.) to evaluate and develop methods that may be needed to treat stormwater that collects in telecommunication manholes. This water needs to be pumped before repair operations can be conducted and stormwater NPDES permits are typically required before its discharge to local drainage systems. He has worked with the industry and the EPA and conducted a comprehensive characterization and field evaluation program and developed protocols to examine potential treatment methods.

Dr. Pitt has helped prepare training manuals on the operation of sanitary wastewater treatment plants and on the clean-up of oil spills. He has evaluated the effects of municipal, industrial, and nonpoint water pollution discharges on receiving water quality and beneficial uses, including model development. He has also been involved in the preparation of contingency plans for spills of petroleum products and other hazardous materials, especially in the assessment of potential water and air quality problems. He has completed the noise, air and water quality assessments for a variety of projects; including nuclear and fossil fuel power facilities, oil refineries, oil fields, coal mines, uranium mines, gravel removal operations, airports, urban redevelopment projects, pipelines, and hazardous material transfer and storage facilities. Many of these studies involved field and laboratory work, as well as statistical analyses and modeling. These projects have been located throughout the United States (including Alaska and Hawaii), and in the Middle East. An experienced photographer, Dr. Pitt has used both aerial and underwater photography in conjunction with many projects. He has developed and managed water and air quality laboratories capable of monitoring a wide range of inorganic and organic pollutants.

Dr. Pitt moved to the University of Alabama campus in Tuscaloosa in 2001. Earlier, he had served on the School of Engineering faculty at the University of Alabama at Birmingham from 1987 to 2001. Prior to that, he was a senior engineer for 16 years in industry and government, and continues to consult to many municipalities and engineering firms. He has also taught workshops and was guest lecturer at several universities (including the Univ. of Wisconsin; the Univ. of Minnesota; Syracuse University, the University of Nevada, Tel Aviv University, Israel; the University of Guelph, Ontario, Canada; Singapore National University; and the Universität Gesamthochschule, Essen, Germany). He has published more than 100 chapters, books, journal articles, and major research reports. Dr. Pitt is a Diplomate of the American Academy of Environmental Engineers and is a registered engineer in the state of Wisconsin.

Research Funding Obtained as Principal Investigator

Alabama Highway Drainage Conservation Design Practices (University Transportation Center for Alabama): $120,819 (2004).

Evaluation of NPDES MS4 Stormwater Monitoring Data, with the Center for Watershed Protection (EPA Office of Wastewater Management 104(b)3 grant): $419,114 (2001-2004).

Techniques for Identifying/Correcting Inappropriate Discharges, with the Center for Watershed Protection (EPA Office of Wastewater Management 104(b)3 grant): $477,231 (2001-2004).

Erosion and Sediment Control for Highway Construction (University Transportation Center for Alabama): $119,239 (2001-2002).

Environmental Health, Public Safety, and Social Impacts Associated with Transportation Accidents Involving Hazardous Substances, with the Dept. of Government and Public Service, UAB (University Transportation Center for Alabama): $121,580 (2000-2001).

Evaluation of New Techniques for the Identification of Inappropriate Discharges into Storm Drainage Systems (University of New Orleans, Urban Waste Management Institute and EPA): $60,000 (1999).

Guidance Manual for Integrated Wet Weather Flow Collection and Treatment Systems for Newly Urbanized Areas, with the University of Alabama (U.S. Environmental Protection Agency, Cooperative Agreement): $150,000 project (1996-1998).

*Characterization of Manhole Water and Sedimen*t (NYNEX, BellSouth, Bell Atlantic, GTE, SNET, Pacific Bell, US West, Ameritech and AT&T): $400,000 (1996-1998).

Development and Testing of a Methodology to Assess the Health Risks and Environmental Impacts from Separate Sanitary Sewer Overflows, co-principal investigator, with UAB EARTH Center (U.S. Environmental Protection Agency): $199,996 (cooperative agreement) (1996-1997).

The Development of a Tunable Laser Spectrophotometric Method for the Analysis of Toxic Water Pollutants, with UAB Dept. of Physics (National Science Foundation): $580,587 (1995-1998).

Effects, Sources and Treatment of Stormwater Toxicants (U.S. Environmental Protection Agency): $942,318 cooperative agreement (1992-1997).

Evaluation and Treatment of Manhole Water (Bellcore, Inc.): $615,048 (1994-1997).

Drainage of Water from Pavement Structures (U.S. Transportation Research Board and Alabama Department of Transportation): $111,520 (1993-1994).

Demonstration of Investigation Procedures for the Control of Inappropriate Discharges into Storm Drainage Systems (University of New Orleans, Urban Waste Management Institute): $25,000 (1992).
Modifications to the Source Loading and Management Model (U.S. Environmental Protection Agency, Region V): $21,050 (1992).
Review of Existing Water Quality Data (Torchmark Development Corp.): $9,500 (1991).
Identification and Control of Inappropriate Discharges into Storm Drainage (U.S. Environmental Protection Agency, Office of Research and Development and Office of Water): $101,048 cooperative agreement (1989-1992).
Sources and Treatment of Stormwater Toxicants (U.S. Environmental Protection Agency, Office of Research and Development): $155,767 cooperative agreement (1989-1992).
Development of Model Watershed Protection Ordinance and Development Plan Reviews (Birmingham Water Works Board): $53,785 (1988-1989).

Example Consultations

ADS Environmental Services, Huntsville, AL. Verification of flow monitoring equipment performance. 1994-1995.
Brown and Caldwell, Irvine, CA. Design of MCTT installations for testing by Caltrans. Los Angeles. 1998 – 1999.
Brown and Mitchell, Inc., Gulfport, MS. Evaluation of detention pond design for shopping center development. 1995-1996.
C.M. Towers, West Caldwell, NJ. Design consultation for flow-balancing method installations for stormwater and CSO controls. 1993.
Camp Dresser & McKee, Inc., Detroit, MI. Design work for multi-chambered treatment tank (MCTT) stormwater controls for public works yard in Detroit. 1995.
CH2M-Hill, Portland, OR. Training for use of SLAMM. 1992.
City of New York, Division of Engineering, NY. Evaluation of Fresh Creek (Brooklyn) FBM installation for CSO controls, 1992-1994, and evaluation of litter and floatable debris control for New York City. 1997-present.
Environment Canada, Ottawa, Ontario, Canada. Evaluation of bacteria sources and control in Ottawa. 1985-1987.
Envirometrics Engineering, Inc., Birmingham, AL. Evaluation of stormwater filtration for the U.S. Army Corps of Engineers. 1995-1996.
Foster Wheeler/Enviresponse, Inc. Edison, NJ. Treatment of stormwater toxicants. 1991-1993.
Fresh Creek Technologies, Inc., West Caldwell, NJ. Evaluation of New York City EquaFlow CSO control system. 1993.
Havens and Emerson, Boston, MA. Value engineering evaluation of Cleveland CSO plan. 1993.
Jefferson Co., Environmental Services, AL. Examination of separate sanitary sewer overflows. 1994.
Johnson, Johnson & Roy, Inc., Madison, WI. Review of commercial development stormwater control plan. 1994.
K.B. Weygand and Assoc., Birmingham, AL. Preparation of erosion control plan for commercial development. 1995.
Kurahashi & Assoc., Tigard, OR. Development of stormwater models and particle characterizations. 1994.
Law Engineering, Birmingham, AL. Training for stormwater regulation compliance for industrial activities. 1992.
Liesch Companies, Minneapolis, MN. Evaluation of the retention pond design for the Minneapolis-St. Paul International Airport. 1999.
Loomis & Assoc., Austin, TX. Preliminary design for EquaFlow stormwater control program for Waller Creek watershed in Austin. 1995.
Los Angeles County Department of Public Works, CA. Review of stormwater monitoring activities. 1996 - present.
Metcalf and Eddy, Inc., Wakefield, MA. Review of CSO guidance manual prepared for EPA. 1992.
Moffa & Associates, Syracuse, NY. Decision criteria for CSO evaluations, and retrofitting water quality controls for wet weather flow conditions. 1997-1998.
National Surveying and Engineering. R.A. Smith, Brookfield, WI. Training in the use of the Source Loading and Management Model. 1999.
Natural Resources Defense Council, Los Angeles, CA. Evaluation of Los Angeles County stormwater plan. 1994-1996 - present.
Ontario Ministry of the Environment, Toronto and Ottawa, Ontario, Canada. Stormwater evaluations for industrial activities, and other critical source areas in the Humber River watershed, Toronto. 1985-1988.

OTAK Engineering, Inc., Lake Oswego, OR. Development of joint training program for using stormwater models. 1991.
P.E. LaMoreaux and Assoc., Tuscaloosa, AL. Evaluation of stormwater drainage design, Shelby Co. 1995-1996.
Santa Clara County Flood Control District, CA. Review of special metals control plan for South San Francisco Bay. 1996.
Southern Environmental Law Center, Charlottesville, VA. Evaluation of industrial effluent effects on the Cahaba River. 1992.
The Rensselaerville Institute, Rensselaerville, NY. Review of phase II EPA stormwater plan. 1994.
Robert Bein, William Frost & Associates, Irving, CA. Design review of multi-chambered treatment train (MCTT) stormwater installations for Caltrans. 1998 - 1999.
Urban Waste Management Center, Univ. of New Orleans, LA. Training of field personnel for screening testing of stormwater outfall. 1995-1996.
U.S. Environmental Protection Agency. Effects of compost amended soils on infiltration rates. 1997-1998.
U.S. Geological Survey, Madison, WI. Calibration of SLAMM for Wisconsin conditions. 1994-1995.
U.S. Infrastructure, Birmingham, AL. Wet weather flow consulting. 1998-2002.
Washington State Department of Ecology, Olympia, WA. Statistical guidance for the evaluation of stormwater control test protocols. 2002.
Wisconsin Dept. of Natural Resources, Madison, WI. Design of the multi-chambered treatment tank (MCTT) for Milwaukee public works area. 1995.
Woodward Clyde Consultants, Oakland, CA. Evaluation of field screening analysis methods for stormwater outfalls. 1991-1993.

Dissertation

Pitt, R. *Small Storm Urban Flow and Particulate Washoff Contributions to Outfall Discharges*, Ph.D. Dissertation, Civil and Environmental Engineering Department, University of Wisconsin, Madison, WI, November 1987.

Books

James, W., W.C. Huber, R.E. Dickinson, R.E. Pitt, R.C. James, L.A. Roesner, and J.A. Aldrich. *Water Systems Models User's Guide to SWMM.* Computational Hydraulics International. Guelph, Ontario, Canada. May 2003. 406 pages.
Durrans, S. R. with contributions from M. Ahmad, T.E. Barnard, P. Hjorth, and R. Pitt. *Stormwater Conveyance Modeling and Design*. Haestad Methods. Waterbury, CT. 2003. 686 pages.
James, W., W.C. Huber, R.E. Pitt, R.E. Dickinson, and R.C. James. *Water Systems Models [1]: Hydrology, User's guide to SWMM4 RUNOFF and supporting modules and to PCSWMM.* Version 2.4. Computational Hydraulics International. Guelph, Ontario, Canada. October 2002. 311 pages.
James, W., W.C. Huber, R.E. Pitt, R.E. Dickinson, L.A. Roesner, J.A. Aldrich, and R.C. James. *Water Systems Models [2]: Hydraulics, User's guide to SWMM4 TRANSPORT, EXTRAN and STORAGE modules and to PCSWMM.* Version 2.4. Computational Hydraulics International. Guelph, Ontario, Canada. October 2002. 359 pages.
Burton, G.A. Jr., and R. Pitt. *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers.* CRC Press, Inc., Boca Raton, FL. August 2001. 911 pages.
Heaney, J.P., R. Pitt, and R. Field. *Innovative Urban Wet-Weather Flow Management Systems.* ISBN 1-56676-914-0. Technomics, Lancaster, PA. June 2000. 535 pages.
Pitt, R., with contributions from S. Clark, R. Field, and K. Parmer. *Groundwater Contamination from Stormwater.* ISBN 1-57504-015-8. Ann Arbor Press, Inc. Chelsea, Michigan. 1996. 219 pages.
NRC (National Research Council), Groundwater Recharge Committee, National Academy of Science. *Ground Water Recharge using Waters of Impaired Quality.* ISBN 0-309-05142-8. National Academy Press, Washington, D.C. 1994. 284 pages.
Pitt, R., M. Lalor, R. Field, D. Adrian, and D. Barbe'. *Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems*, ISBN 0-7881-1359-3. Diane Press. Upland, Pennsylvania, 1994. 87 pages.
Pitt, R., S. Clark, and K. Parmer. *Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration.* ISBN 0-7881-1059-4. Diane Press. Upland, Pennsylvania. 1994. 120 pages.

Chapters in Books

Maestre, A., Pitt, R. E., and Derek Williamson. "Nonparametric statistical tests comparing first flush with composite samples from the NPDES Phase 1 municipal stormwater monitoring data." *Stormwater and Urban Water Systems Modeling.* In: *Models and Applications to Urban Water Systems*, Vol. 12 (edited by W. James). CHI. Guelph, Ontario, pp. 317 – 338. 2004.

Pitt, R. E., A. Maestre, R. Morquecho, and Derek Williamson. "Collection and examination of a municipal separate storm sewer system database." *Stormwater and Urban Water Systems Modeling.* In: *Models and Applications to Urban Water Systems*, Vol. 12 (edited by W. James). CHI. Guelph, Ontario, pp. 257 – 294. 2004.

Graettinger, A.J., T. Supriyasilp, S.R. Durrans, and R.E. Pitt. "Directing sampling based on uncertainty analysis." *Stormwater and Urban Water Systems Modeling.* In: *Models and Applications to Urban Water Systems*, Vol. 11 (edited by W. James). CHI. Guelph, Ontario, pp. 123 – 138. 2003.

Pitt, R. E. Shen-En Chen, S. Clark, J. Lantrip, and C.K. Ong. "Infiltration through compacted urban soils and effects on biofiltration design." *Stormwater and Urban Water Systems Modeling.* In: *Models and Applications to Urban Water Systems*, Vol. 11 (edited by W. James). CHI. Guelph, Ontario, pp. 217 – 252. 2003.

Pitt, R. "Receiving water impacts associated with urban runoff." In: *Handbook of Ecotoxicology*, 2nd edition (Edited by D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr. and J.Cairns, Jr.). Lewis Publishers/CRC Press, Boca Raton. pp 79 – 101. 2002.

Pitt, R. and S. Clark. "Emerging stormwater controls for critical source areas." In: *Wet-Weather Flow in the Urban Watershed* (Edited by Richard Field and Daniel Sullivan). CRC Press, Boca Raton. pp 575 – 613. 2002.

Pitt, R. and J. Voorhees. "SLAMM, the Source Loading and Management Model." In: *Wet-Weather Flow in the Urban Watershed* (Edited by Richard Field and Daniel Sullivan). CRC Press, Boca Raton. pp 103 – 139. 2002.

Pitt, R., R. Ashley, J-D Baladès, and D. Butler. "Solids control at sources and at inputs to sewerage systems." In: *Solids in Sewers: Characteristics, Effects, and Controls of Sewer Solids and Associated Pollutants.* (Edited by Richard Ashley). International Association on Water Quality (IAWQ). London. 2001.

Pitt, R. and M. Lalor. "The role of pollution prevention in stormwater management." In: *Models and Applications to Urban Water Systems*, Vol. 9 (edited by W. James). CHI. Guelph, Ontario, 2001., pp. 1-20.

Myllyoja, R., H. Baroudi, R. Pitt, and J. Paluzzi. "Use of SLAMM in evaluating best management practices." In: *Models and Applications to Urban Water Systems*, Vol. 9 (edited by W. James). CHI. Guelph, Ontario, 2001., pp. 131-141.

Pitt, R. and J. Lantrip. "Infiltration through disturbed urban soils." In: *Advances in Modeling the Management of Stormwater Impacts, Volume 8.* (Edited by W. James). Computational Hydraulics International, Guelph, Ontario. 2000. pp. 1 –22.

Pitt, R. "Small storm hydrology and why it is important for the design of stormwater control practices." In: *Advances in Modeling the Management of Stormwater Impacts, Volume 7.* (Edited by W. James). Computational Hydraulics International, Guelph, Ontario and Lewis Publishers/CRC Press. 1999.

Heaney, J.P., L. Wright, D. Sample, R. Pitt, R. Field, and C-Y. Fan. "Innovative Wet-Weather Flow Collection/Control Systems for Newly Urbanizing Areas in the 21st Century." *Stormwater Management – Creating Sustainable Urban Water Resources for the 21st Century.* (Edited by A.C. Rowney, P. Stahre, and L.A. Roesner). Engineering Foundation and ASCE. New York. 1998.

Pitt, R. "Unique Features of the Source Loading and Management Model (SLAMM)." In: *Advances in Modeling the Management of Stormwater Impacts, Volume 6.* (Edited by W. James). Computational Hydraulics International, Guelph, Ontario and Lewis Publishers/CRC Press. pp. 13 – 37. 1997.

Pitt, R. "The Control of Toxicants at Critical Source Areas." In: *Effects of Watershed Development and Management on Aquatic Ecosystems.* (Edited by L.A. Roesner). Engineering Foundation and ASCE. New York. pp. 70-92. 1997.

Ashley, R., M. Verbanck, J-L Bertrand-Krajewski, T. Hvitved-Jacobsen, C. Nalluri, G. Perrusquia, R. Pitt, E. Ristenpart, and A. Saul. "Solids in Sewers – The State of the Art." *Proceedings of the 7th International Conference on Urban Storm Drainage.* Hannover, Germany. (edited by F. Sieker and H-R. Verworn). pp. 1771 - 1776. IAHR/IAWQ. London. 1996.

Pitt, R. "Biological Effects of Urban Runoff Discharges." In: *Stormwater Runoff and Receiving Systems: Impact, Monitoring, and Assessment.* (Edited by E.E. Herricks). Engineering Foundation and ASCE. CRC/Lewis. Boca Raton, pp. 127-162. 1995.

Pitt, R. "Effects of Urban Runoff on Aquatic Biota." In: *Handbook of Ecotoxicology* (Edited by D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr. and J.Cairns, Jr.). Lewis Publishers/CRC Press, Boca Raton, pp. 609-630. 1995.

Lalor, M., R. Pitt, R. Field, and E. Thacktson. "Locating Inappropriate Discharges to Storm Drains." In: *Stormwater NPDES Related Monitoring Needs* (Edited by H.C. Torno). Engineering Foundation and ASCE. pp. 63-80. 1995.

Pitt, R. "Water Quality Trends from Stormwater Controls." In: *Stormwater NPDES Related Monitoring Needs* (Edited by H.C. Torno). Engineering Foundation and ASCE. pp. 413-434. 1995.

Parmer, K., R. Pitt, R. Field, and S. Clark. "Stormwater Infiltration Effects on Groundwater." In: *Stormwater NPDES Related Monitoring Needs* (Edited by H.C. Torno). Engineering Foundation and ASCE. pp. 617-630. 1995.

Robertson, B., R. Pitt, A. Ayyoubi, and R. Field. "A Multi-Chambered Stormwater Treatment Train." In: *Stormwater NPDES Related Monitoring Needs* (Edited by H.C. Torno). Engineering Foundation and ASCE. pp. 631-640. 1995.

Clark, S., R. Pitt, and R. Field. "Stormwater Treatment: Inlet Devices and Filtration." In: *Stormwater NPDES Related Monitoring Needs* (Edited by H.C. Torno). Engineering Foundation and ASCE. pp. 641-650. 1995.

Pitt, R. "Source Waters and their Treatment." In: *Ground Water Recharge Using Waters of Impaired Quality* (Committee on Groundwater Recharge). National Research Council, National Academy of Science, National Academy Press. Washington, D.C., pp. 35-96. 1994.

Pitt, R., A. Ayyoubi, R. Field and M. O'Shea. "The Treatability of Urban Runoff Toxicants." In: *International Perspectives on Integrated Stormwater Management* (Edited by R. Field, M. O'Shea, and K.K. Chin). Lewis Publishers, pp. 121-148. 1992.

Pitt, R., R. Field, M. Lalor, and M. O'Shea. "U.S. EPA's Manual of Practice for the Investigation and Control of Cross-connection Pollution into Storm Drainage Systems." In: *International Perspectives on Integrated Stormwater Management* (Edited by R. Field, M. O'Shea, and K.K. Chin). pp. 355-368. Lewis Publishers, 1992.

Pitt, R. and R. Field. "The Treatability of Urban Stormwater Toxicants." In: *New Technologies in Urban Drainage*, Elsevier Applied Science. London. 1991.

Pitt, R., R. Field, M. Lalor, and E. Driscoll. "Analysis of Cross-Connections and Storm Drainage." In: *Urban Stormwater Quality Enhancement - Source Control, Retrofitting and Combined Sewer Technology* (Edited by H. Torno). Engineering Foundation and ASCE, New York. pp. 297-312. 1990.

Pitt, R. "The Incorporation of Urban Runoff Controls in the Wisconsin Priority Watershed Program." In: *Advanced Topics in Urban Runoff Research*, (Edited by B. Urbonas and L.A. Roesner). Engineering Foundation and ASCE, New York. pp. 290-313. 1986.

Pitt, R. and M. Bozeman. "Biological and Water Quality Degradation in an Urban Creek." In *Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies.* (Edited by Y.Yousef, M. Wanielista, W. McLellon and J. Taylor). U.S. Environmental Protection Agency, EPA-600/9-80-056. pp. 371-405. November 1979.

Major Computer Programs

WinDETPOND. A Water Quality Detention Pond Analysis and Design Program. 1986-2002 (with J. Voorhees).

WinSLAMM. Source Loading and Management Model for Stormwater Control. 1978-2002 (with J. Voorhees).

Journal Articles and Published Proceedings

Durrans, S.R.. and R. Pitt. "Maximum likelihood estimators for coarsely resolved precipitation data." *ASCE Journal of Hydraulic Engineering*. Vol. 9, No. 1, Jan/Feb 2004, pp 13 – 29.

Pitt, R., A. Maestre and R. Morquecho. "Compilation and review of nationwide MS4 stormwater quality data." *76th Annual Water Environment Federation Technical Exposition and Conference*. Los Angeles, CA. Oct. 2003 (conference CD-ROM).

Morquecho, R. and R. Pitt. "Stormwater heavy metal particulate associations." *76th Annual Water Environment Federation Technical Exposition and Conference*. Los Angeles, CA. Oct. 2003 (conference CD-ROM).

Clark, S., R. Pitt, and S. Burian. "Urban Wet Weather Flows - 2002 Literature Review." *Water Environment Research*. Vol. 75, No. 5, Sept./Oct. 2003 (CD-ROM).

Johnson, P.D., S. Clark, R. Pitt, S.R. Durrans, M. Urrutia, S. Gill, and J. Kirby. "Metals removal technologies for stormwater." *Published proceedings of the 9th Industrial Wastes Technical Conference*. Austin, TX. Water Environment Foundation. April 2003.

Clark, S., M. Lalor, R. Pitt, and R. Field. "Investigation of wet-weather pollution contributions from building materials commonly used at industrial sites." *Published proceedings of the 9th Industrial Wastes Technical Conference*. Austin, TX. Water Environment Foundation. April 2003.

Pitt, R. A. Maestre, and R. Morquecho. "Evaluation of NPDES Phase 1 Municipal Stormwater Monitoring Data." *Published proceedings of the National Conference on Urban Storm Water: Enhancing Programs at the Local Level*. February 17-20, 2003. Sponsored by the US EPA and Chicago Botanic Garden. Chicago. 2003.

Clark, S., R. Pitt, and S. Burian. "Urban Wet Weather Flows - 2001 Literature Review." *Water Environment Research*. Vol. 74, No. 5, Sept./Oct. 2002 (CD-ROM).

Pitt, R, S. Chen, and S. Clark. "Compacted urban soils effects on infiltration and bioretention stormwater control designs." *Global Solutions for Urban Drainage; 9IUCD*. CD-ROM Proceedings of the 9th International Urban Drainage Conference, edited by E.W. Strecker and W.C. Huber., Sept 8-13, 2002, Portland, OR. Sponsored by the ASCE, Reston, VA, and the International Water Association, London. 2002.

Clark, S., R. Rovansek, L. Wright, J. Heaney, R. Field, and R. Pitt. "Urban Wet Weather Flows 2000 Literature Review." *Water Environment Research*. Vol. 73, No. 5, Sept./Oct. 2001. (CD-ROM).

Burian, S.J., S.J. Nix, S.R. Durrans, and R.E. Pitt. "Analysis of the long-term performance of storage/release systems using linked watershed-water body modeling." *Global Solutions for Urban Drainage; 9IUCD*. CD-ROM Proceedings of the 9th International Urban Drainage Conference, edited by E.W. Strecker and W.C. Huber., Sept 8-13, 2002, Portland, OR. Sponsored by the ASCE, Reston, VA, and the International Water Association, London. 2002.

Garrett, W.E., Jr., A.A. Bartolucci, R. Pitt, and M. Vermace. "Recirculating-reducing and alkalinity producing system (RERAPS) for the treatment of acidic coal pile runoff." *2002 National Meeting of the American Society of Mining and Reclamation*, Lexington, KY, June 9-13, 2002. ASMR, Lexington, 2002.

Gabriel, M.C., D.G. Williamson, and R. Pitt. "Availability of atmospherically deposited mercury to runoff and receiving waters." *National TMDL Science and Policy 2002 Specialty Conference*. Phoenix, AZ. Water Environment Federation, Alexandria, VA. July 2002.

Pitt, R. "Stormwater treatment at critical source areas using the multi-chambered treatment train (MCTT)." *The 2002 Borchardt Conference, A Seminar on Advancements in Water and Wastewater*. The University of Michigan, Ann Arbor, Feb. 2002.

Clark, S., Ronald Rovansek, Leonard Wright, James Heaney, Richard Field, and Robert Pitt. "Urban Wet Weather Flows - 2000 Literature Review." *Water Environment Research*. Vol. 73, No. 5, Sept./Oct. 2001 (CD-ROM).

Burian, S.J., Durrans, S.R., Nix, S.J., and Pitt, R.E., Training Artificial Neural Networks to Perform Rainfall Disaggregation, ASCE Journal of Hydrologic Engineering, 6(1) 43-51, 2001.

Burton, G.A., Jr., R. Pitt, and S. Clark. "The role of whole effluent toxicity test methods in assessing stormwater and sediment contamination." *CRC Critical Reviews in Environmental Science & Technology*. 30: 413-447. 2000.

Burian, S.J., S.J. Nix, R.E. Pitt, and S.D. Durrans. "Urban wastewater management in the United States: Past, present, and future." *Journal of Urban Technology*. Dec 2000.

Fan, C-Y, R. Field, J. Heaney, R. Pitt, S. Clark, L. Wright, R. Rovansek, and S. Olivera. "Urban Wet Weather Flows 1999 Literature Review." *Water Environment Research*. Vol. 72, No. 5, Sept./Oct. 2000 (CD-ROM), 199 pgs.

Clark, S., P. Brown, and R. Pitt. "Wastewater treatment using low-cost adsorbents and waste materials."*2000 WEF and Purdue University Industrial Wastes Technical Conference CD-ROM*. St. Louis, MO. May 2000.

Pitt, R., S. Clark, and R. Field. "Groundwater contamination potential from stormwater infiltration practices." *Urban Water*. Vol. 1, no. 3, pp. 217-236. September 1999.

Durrans, S.R., S.J. Burian, S.J. Nix, A. Hajji, R.E. Pitt, C-Y Fan, and R. Field. "Polynomial-based disaggregation of hourly rainfall for continuous hydrologic simulation." *Journal of the American Water Resources Association*. Vol. 35, no. 5, pp. 1213-1221. Oct 1999.

"An interview with Sergey Mirov and Bob Pitt, Univ. of Alabama; Birmingham, AL: Novel laser breakdown spectrometer provides multi-element analysis for environmental monitoring." *OE Reports: Technology and Trends for the International Optical Engineering Community*. Number 189, September 1999, pp. 3 – 12.

Mirov, S.B., R.E. Pitt, A. Dergachev, W. Lee, D.V. Martyshkin, O.D. Mirov, J.J. Randolph, L.J. DeLucas, C.G. Brouillette, T.T. Basiev, Y.V. Orlovskii, and O.K. Alimiv. "A novel laser breakdown spectrophotometer for environmental monitoring." In: *Air Monitoring and Detection of Chemical and Biological Agents* (edited by J. Leonelli and M.L. Althouse). Society of Photo-Optical Instrumentation Engineers (SPIE). Vol. 3855. pp. 34-41. September 1999.

O'Connor, R. Field, D. Fischer, R. Rovansek, R. Pitt, S. Clark, and M. Lama. "Urban Wet Weather Flows - 1998 Literature Review." *Water Environment Research*. Vol. 71, No. 4, June 1999.

Lalor, M. and R. Pitt. "Use of tracers to identify sources of contamination in dry weather flow." *Watershed Protection Techniques*. Vol. 3, No. 1, pp. 585 – 592. April 1999.

Burian, S.J. S. J. Nix, S.R. Durrans, R.E. Pitt, C-Y Fan, and R. Field. "The Historical Development of Wet Weather Flow Management." ASCE. *Journal of Water Resources Planning and Management*. pp. 3 – 13. January/February 1999.

Field, R., T. O'Connor, C-Y. Fan, R. Pitt, S. Clark, J. Ludwig, and T. Hendrix. "Urban Wet Weather Flows - 1997 Literature Review." *Water Environment Research*. Vol. 70, No. 4, June 1998.

Field, R., R. Pitt, Hsu, K., M. Borst, R. DeGuida, C-Y. Fan, J. Heaney, J. Perdek, and M. Stinson. "Urban Wet Weather Flow - 1996 Literature Review." *Water Environment Research*. Vol. 69, No. 4, pp. 426-444. June 1997.

Pitt, R., S. Mirov, K. Parmer, and A. Dergachev. "Laser Applications for Water Quality Analyses." In: *ALT'96 International Symposium on Laser Methods for Biomedical Applications.* (Edited by V. Pustovoy). SPIE – The International Society for Optical Engineering. Volume 2965, pp. 70 – 82. 1997.

Nix, S.J., S.R. Durrans, S.J. Burian, and R. Pitt. "Wet Weather Flows in Newly Urbanizing Areas: Initial Thoughts on Designs for the Future." *Proceedings of the 1997 Georgia Water Resources Conference*, March 20-22, 1997. The University of Georgia (Editor: K.J. Hatcher). Institute of Ecology. The University of Georgia, Athens, Georgia. pp. 318-321. 1997.

Field, R., R. Pitt, M. Brown, and T. O'Conner. "Combined Sewer Overflow Control Using Storage in Seawater." *Water Research*. Vol. 29, No. 6, pp. 1505-1514. 1995.

Pitt, R., R. Field, M. Lalor, and M. Brown. "Urban Stormwater Toxic Pollutants: Assessment, Sources and Treatability." *Water Environment Research*. Vol. 67, No. 3, pp. 260-275. May/June 1995. Discussion and closure in Vol. 68, No. 4, pp. 953-955. July/August 1996.

Pitt, R. and J. Voorhees. "Source loading and management model (SLAMM)." *Seminar Publication: National Conference on Urban Runoff Management: Enhancing Urban Watershed Management at the Local, County, and State Levels*. March 30 – April 2, 1993. Center for Environmental Research Information, U.S. Environmental Protection Agency. EPA/625/R-95/003. Cincinnati. Ohio. pp. 225-243. April 1995.

Pitt, R. Book Review: *Urban Stormwater Modeling and Simulation* by S.J. Nix. *Water Resources Bulletin*. American Water Resources Association. Vol. 30, No. 6, pp. 1137-1139. Dec. 1994.

Field, R., R. Pitt, D. Jaeger, and M. Brown. "Combined Sewer Overflow Control Through In-Receiving Water Storage: An Efficiency Evaluation." *Water Resources Bulletin*, the Journal of the American Water Resources Association. Vol. 30, No. 5. pp. 921-928. October 1994.

Field, R., R. Pitt, M. Lalor, M. Brown, W. Vilkelis, and E. Thacktson. "Investigation of Dry-Weather Pollutant Entries Into Storm Drainage Systems." *Journal of Environmental Engineering.* American Society of Civil Engineering. Vol. 120, No. 5, pp. 1044-1066. September/October 1994.

Pitt, R., S. Clark, and K. Parmer. "Potential Groundwater Contamination from Intentional and Nonintentional Stormwater Infiltration." *Journal of Alabama's Water Environment Association*. Vol. 15, No. 1. pp. 8-11. Summer 1994.

Pitt, R., M. Lalor, R. Field, and M. Brown. "The Investigation of Source Area Controls for the Treatment of Urban Stormwater Toxicants." International Association on Water Quality. *Water Science and Technology*. Vol. 28, no. 3-5, pp. 271-282. September/October 1993.

Barbe', D., R. Pitt, M. Lalor, D. Adrian, and R. Field. " Methodology for the Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems." *Transportation Research Board Record: Hydrology, Hydraulics, and Water Quality*. National Research Council. No. 1420, pg. 49-55.

Field, R. and R. Pitt. "U.S. Environmental Protection Agency Research Program Review: Receiving Water Effects." International Association on Water Quality. *Water Science and Technology*. Vol. 22, no. 10-11, pg. 1-7. October 1990.

Field, R. and R. Pitt. "Urban Storm-Induced Discharge Impacts." *Water Environment and Technology*, Water Environment Federation, Vol. 2, No. 8, pp. 64-67. August 1990.

Pitt, R. "Asbestos as an Urban Area Pollutant," *Journal Water Pollution Control Federation*, Vol. 60, No. 11, pp.1993-2001. November 1988.

Pitt, R. "Some Benefits of Street Cleaning as Measured in a Recent Study." *American City and County Magazine*, pp. 41-43. April 1980.

Pitt, R. "Water Quality Effects of Urban Runoff." *Journal American Water Works Association*, pp. 432-436, August 1977.

Peer-Reviewed Research Reports

Johnson, P.D., R. Pitt, S.R. Durrans, M. Urrutia, and S. Clark. *Innovative Metals Removal Technologies for Urban Stormwater*. Water Environment Research Foundation. WERF 97-IRM-2. Alexandria, VA. 2003.

Pitt, R., M. Lilburn, S. Nix, S.R. Durrans, S. Burian, J. Voorhees, and J. Martinson *Guidance Manual for Integrated Wet Weather Flow (WWF) Collection and Treatment Systems for Newly Urbanized Areas (New WWF Systems)*. U.S. Environmental Protection Agency. 612 pgs. forthcoming in 2003.

Moffa, P.E., J.J. LaGorga and R. Pitt. *Assessment of Decision Criteria Used to Determine Benefits of CSO/SSO/SW Investments*. Water Environment Federation Research Foundation. WERF project 97-Cts-6. 2001.

Becker, S., R. Pitt, and S. Clark. *Environmental Health, Public Safety, and Social Impacts Associated with Transportation Accidents Involving Hazardous Substances*. University Transportation Center of Alabama and US Dept. of Transportation. UTCA Project No. 00214. Tuscaloosa, AL. Dec. 2000.

Panwhar, S.T., R. Pitt and M.D. Anderson. *Development of a GIS-Based Hazardous Materials Transportation Management System, A Demonstration Project*. University Transportation Center of Alabama and US Dept. of Transportation. UTCA Project No. 99244. Tuscaloosa, AL. Dec. 2000.

Moffa, P.E., H.M. Goegel, D.P. Davis, J.J. LaGorga, Earth Tech, Inc., and R. Pitt. *Retrofitting Control Facilities for Wet-Weather Flow Treatment*. U.S. Environmental Protection Agency, Office of Research and Development. EPA/600/R-00/020. Washington, D.C. 198 pgs. January 2000.

Barbe', D.E., R.E. Pitt, M.M. Lalor, J.P. Harper, and C.M. Nix. *Including New Technologies into the Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems – A User's Guide*. Urban Waste Management & Research Center, University of New Orleans, and the U.S. Environmental Protection Agency. January 2000.

Heaney, J.P., R. Pitt, and R. Field. *Innovative Urban Wet-Weather Flow Management Systems*. U.S. Environmental Protection Agency. EPA/600/R-99/029. 535 pgs. 1999.

Pitt, R., J. Lantrip, R. Harrison, C. Henry, and D. Hue. *Infiltration through Disturbed Urban Soils and Compost-Amended Soil Effects on Runoff Quality and Quantity*. U.S. Environmental Protection Agency, Water Supply and Water Resources Division, National Risk Management Research Laboratory. EPA 600/R-00/016. Cincinnati, Ohio. 231 pgs. December 1999.

Clark, S. and R. Pitt. *Stormwater Treatment at Critical Areas, Vol. 3: Evaluation of Filtration Media for Stormwater Treatment*. U.S. Environmental Protection Agency, Water Supply and Water Resources Division, National Risk Management Research Laboratory. EPA/600/R-00/016, Cincinnati, Ohio. 442 pgs. October 1999.

Corsi, S.R., S.R. Greb, R.T. Bannerman, and R.E. Pitt. *Evaluation of the Multi-Chambered Treatment Train, a Retrofit Water Quality Management Practice*. U.S. Geological Survey. Open-File Report 99-270. Middleton, Wisconsin. 24 pgs. 1999.

Pitt, R., B. Robertson, P. Barron, A. Ayyoubi, and S. Clark. *Stormwater Treatment at Critical Areas: The Multi-Chambered Treatment Train (MCTT)*. U.S. Environmental Protection Agency, Wet Weather Flow Management Program, National Risk Management Research Laboratory. EPA/600/R-99/017. Cincinnati, Ohio. 505 pgs. March 1999.

Pitt. R. S. Clark, J. Lantrip, and J. Day. *Telecommunication Manhole Water and Sediment Study;*

Vol. 1: Evaluation of Field Test Kits (483 pgs);
Vol. 2: Water and Sediment Characteristics (1290 pgs);
Vol. 3: Discharge Evaluation Report (218 pgs);
Vol. 4: Treatment of Pumped Water (104 pgs).

Bellcore, Inc., Special Report SR-3841. Morriston, NJ. With further support from NYNEX, BellSouth, Bell Atlantic, GTE, SNET, Pacific Bell, US West, Ameritech and AT&T. December 1998.

Pitt, R. and S.R. Durrans. *Drainage of Water from Pavement Structures.* Alabama Dept. of Transportation. 253 pgs. September 1995.

Pitt, R., S. Clark, and K. Parmer. *Protection of Groundwater from Intentional and Nonintentional Stormwater Infiltration.* U.S. Environmental Protection Agency, EPA/600/SR-94/051. PB94-165354AS, Storm and Combined Sewer Program, Cincinnati, Ohio. 187 pgs. May 1994.

Pitt, R., M. Lalor, R. Field, D.D. Adrian, and D. Barbe'. *A User's Guide for the Assessment of Non-Stormwater Discharges into Separate Storm Drainage Systems.* U.S. Environmental Protection Agency, Storm and Combined Sewer Program, Risk Reduction Engineering Laboratory. EPA/600/R-92/238. PB93-131472. Cincinnati, Ohio. 87 pgs. January 1993.

Pitt, R. and J. McLean. *Humber River Pilot Watershed Project,* Ontario Ministry of the Environment, Toronto, Canada. 483 pgs. June 1986.

Pitt, R. *Characterizing and Controlling Urban Runoff through Street and Sewerage Cleaning.* U.S. Environmental Protection Agency, Storm and Combined Sewer Program, Risk Reduction Engineering Laboratory. EPA/600/S2-85/038. PB 85-186500. Cincinnati, Ohio. 467 pgs. June 1985.

Pitt, R. and P. Bissonnette. *Bellevue Urban Runoff Program Summary Report,* U.S. Environmental Protection Agency, Water Planning Division. PB84 237213. Washington, D.C. 173 pgs. 1984.

Pitt, R. *Urban Bacteria Sources and Control in the Lower Rideau River Watershed, Ottawa, Ontario,* Ontario Ministry of the Environment, ISBN 0-7743-8487-5. 165 pgs. 1983.

Pitt, R. and M. Bozeman. *Sources of Urban Runoff Pollution and Its Effects on an Urban Creek,* EPA-600/S2-82-090, PB 83-111-021. U.S. Environmental Protection Agency, Cincinnati, Ohio. 142 pgs. 1982.

Pitt, R. and G. Shawley. *A Demonstration of Non-Point Source Pollution Management on Castro Valley Creek.* Alameda County Flood Control and Water Conservation District and the U.S. Environmental Protection Agency Water Planning Division (Nationwide Urban Runoff Program). Washington, D.C. June 1982.

Pitt, R. *Demonstration of Nonpoint Pollution Abatement Through Improved Street Cleaning Practices,* EPA-600/2-79-161, U.S. Environmental Protection Agency, Cincinnati, Ohio. 270 pgs. 1979.

Hinkle, G., S. Cordes, J. Brown, E. Kaufmann, M. Manning, and R. Pitt. *Research on Equipment Technology Utilized by Local Government: Street Cleaning.* National Science Foundation. Grant No. APR 74-20419 A01. 340 pgs. April 1977.

URS Research Co. (co-author) *Procedural Manual for Evaluating the Performance of Wastewater Treatment Plants,* U.S. Environmental Protection Agency, Contract No. 68-01-0107. 193 pgs. 1972.

Amy, G., R. Pitt, R. Singh, W. Bradford, and M. LaGraff. *Water Quality Management Planning for Urban Runoff,* EPA-440/9-75-004, U.S. Environmental Protection Agency, Washington, D.C. 413 pgs. 1974.

Pitt, R. and G. Amy. *Toxic Materials Analyses of Street Surface Contaminants,* EPA-R2-73-283, U.S. Environmental Protection Agency, Washington, D.C. 134 pgs. 1973.

Conference Presentations

Pitt, R., A. Maestre, and R. Morquecho. "Stormwater characteristics as contained in the nationwide MS4 stormwater phase 1 database." *Water World and Environmental Resources Conference 2004,* Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.

Pitt, R., S. Clark, P.D. Johnson, R. Morquecho, S. Gill, and M. Pratap. "High level treatment of stormwater heavy metals." *Water World and Environmental Resources Conference 2004,* Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.

Pitt, R. and R. Field. "Catchbasins and inserts for the control of gross solids and conventional stormwater pollutants." *Water World and Environmental Resources Conference 2004,* Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.

Pitt, R.. R. Bannerman, and R. Sutherland. "The role of street cleaning in stormwater management." *Water World and Environmental Resources Conference 2004,* Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.

Pitt, R., S. Clark, P.D. Johnson, R. Morquecho, and D. Williamson. "Treatability of stormwater heavy metals; or breaking the irreducible concentration barrier." Watershed 2004, Water Environment Foundation. Dearborn, MI. July 11 – 14, 2004.

Pitt, R., A. Maestre, and R. Morquecho. "Nationwide MS4 stormwater phase 1 database." Watershed 2004, Water Environment Foundation. Dearborn, MI. July 11 – 14, 2004.

Pitt, R. "Modeling stormwater controls in complex drainages." Invited Feature Speaker. *Designing Sites for Water Quality: Active Construction & Post-Construction BMPs.* Michigan Water Environment Association. Battle Creek, MI. Dec 2 – 3, 2003.

Pitt, R., A. Maestre and R. Morquecho. "Compilation and review of nationwide MS4 stormwater quality data." *76th Annual Water Environment Federation Technical Exposition and Conference.* Los Angeles, CA. Oct 11 – 15, 2003.

Pitt. R. and S. Clark. "Stormwater treatment at critical source areas: The Multi-Chambered Treatment Train (MCTT) and new upflow filters." *76th Annual Water Environment Federation Technical Exposition and Conference.* Los Angeles, CA. Oct 11 – 15, 2003.

Morquecho, R. and R. Pitt. "Stormwater heavy metal particulate associations." *76th Annual Water Environment Federation Technical Exposition and Conference.* Los Angeles, CA. Oct 11 – 15, 2003.

Pitt, R. "Urban sprawl: What we know and don't think about." Invited Keynote Address. *Society of Woman Engineers 2003 National Conference*, Birmingham, AL. Oct 9 – 11, 2003.

Pitt, R. "Stormwater quality database representing long-term U.S. regulatory monitoring: Do we know enough yet and can get on with it?" Invited Keynote Address. *3rd South Pacific Conference on Stormwater.* Auckland Regional Council, New Zealand. May 14-16, 2003.

Pitt, R. "Innovative metal control using grass swales and stormwater filters." *3rd South Pacific Conference on Stormwater.* Auckland Regional Council, New Zealand. May 14-16, 2003.

Pitt, R. "Overview of national stormwater needs and priorities." Invited Keynote Address. *A National Stormwater Laboratory: Needs, Priorities and Funding.* University of Minnesota, Minneapolis, MN. May 1 – 2, 2003.

Johnson, P.D., S. Clark, R. Pitt, S.R. Durrans, M. Urrutia, S. Gill, and J. Kirby. "Metals removal technologies for stormwater." *9th Industrial Wastes Technical Conference.* Austin, TX. Water Environment Foundation. April 16, 2003.

Clark, S., M. Lalor, R. Pitt, and R. Field. "Investigation of wet-weather pollution contributions from building materials commonly used at industrial sites." *9th Industrial Wastes Technical Conference.* Austin, TX. Water Environment Foundation. April 16, 2003.

Maestre, A., Pitt, R. E., and R. Morquecho. "Nonparametric statistical tests comparing first flush with composite samples from the NPDES Phase 1 municipal stormwater monitoring data." *Stormwater and Urban Water Systems Modeling Conference.* Computational Hydraulics, Inc. Toronto, Canada, Feb. 2003.

Pitt, R. E., A. Maestre, and R. Morquecho. "Collection and examination of a municipal separate storm sewer system database." *Stormwater and Urban Water Systems Modeling. Stormwater and Urban Water Systems Modeling Conference.* Computational Hydraulics, Inc. Toronto, Canada, Feb. 2003.

Pitt, R., A. Maestre, and R. Morquecho. *Evaluation of NPDES Phase 1 Municipal Stormwater Monitoring Data.* Urban Stormwater: Enhancing Programs at the Local Level. Chicago Botanic Garden and the U.S. Environmental Protection Agency. Chicago, Illinois. February 17-20, 2003.

Gabriel, M., D. Williamson, and R. Pitt. *Availability of Atmospherically Deposited Mercury to Runoff and Receiving Waters.* TMDL Science and Policy Conference. Water Environmental Federation. Phoenix, AZ. November 13-16, 2002.

Pitt, R. "Land use features benefiting stormwater management." *ACS Regional Conference: Campus as a Laboratory for Sustainability.* Birmingham Southern College. October 25-27, 2002.

Pitt, R., S. Chen, and S. Clark. "Compacted urban soils effects on infiltration and bioretention stormwater control designs." *9th International Conference on Urban Drainage.* IAHR, IWA, EWRI, and ASCE. Portland, Oregon, September 8-13, 2002.

Burian, S.J., S.J. Nix, S.R. Durrans, and R.E. Pitt. "Analysis of the long-term performance of storage/release systems using linked watershed-water body modeling." *9th International Conference on Urban Drainage.* IAHR, IWA, EWRI, and ASCE. Portland, Oregon, September 8-13, 2002.

Clark, S.E., M. Lalor, R. Pitt, and R. Field. "Wet-weather pollution prevention through materials substitution as part of industrial construction." *8th Annual Industrial Wastes Technical and Regulatory Conference*, Water Environment Federation. Atlantic City, New Jersey, August 11 - 14, 2002.

Pitt, R., S. Chen, S. Clark, and C.K. Ong. "Urbanization factors affecting infiltration." *American Water Resources Association Summer Specialty Conference: Ground Water/Surface Water Interactions.* Keystone, Colorado, July 1-3, 2002.

Pitt, R., S. Clark, and R. Field. "Groundwater contamination potential from stormwater infiltration." *American Water Resources Association Summer Specialty Conference: Ground Water/Surface Water Interactions.* Keystone, Colorado, July 1-3, 2002.

Pitt, R. "Water quality and hydrology interactions." *California Stormwater Quality Task Force*, Sacramento, CA. June 2002.

Pitt, R. "Stormwater treatment at critical source areas using the multi-chambered treatment train (MCTT)." *The 2002 Borchardt Conference, A Seminar on Advancements in Water and Wastewater.* The University of Michigan, Ann Arbor, Feb. 2002.

Pitt, R. C. Shen-En Chen, S. Clark, J. Lantrip, and C.K. Ong. "Infiltration through compacted urban soils and effects on biofiltration design." *Stormwater and Urban Water Systems Modeling.* Computational Hydraulics, Inc. Toronto, Canada, Feb. 2002.

Pitt, R. "Stormwater control practices in cold climates." *Stormwater Runoff in Vermont: An Educational Workshop.* Vermont Water Resources and Lake Studies Center, UVM and the Vermont Law School. Burlington, VT, Jan. 2002.

Pitt, R. "Source tracking." NWRI, *The National Urban Watershed Conference.* Costa Mesa, CA, Oct. 2001.

Pitt, R., S. Clark, and P. Brown. "Modeling of particulate removal in mixed media filters using power equation." Water Environmental Federation, *WEFTEC'01.* Atlanta, GA, Oct. 2001.

Clark, S., R. Pitt, and P. Brown. "Stormwater filter performance under aerobic and anaerobic conditions." (poster). Water Environmental Federation, *WEFTEC'01.* Atlanta, GA, Oct. 2001.

Pitt, R. "Source water protection." *AL/MS AWWA Conference.* Biloxi. MS. Oct. 2001.

Pitt, R. and G.A. Burton. "Methods for the assessment of urban wet-weather flow impacts. Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs.* Snowmass, CO, August 2001.

Clark, S., R. Pitt, and R. Field. "Wet-weather pollution prevention by product substitution." (poster). Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs.* Snowmass, CO, August 2001.

Clark, S., R. Pitt, and A. Balakrishnan. "Stormwater filters: Upflow vs. downflow." (poster). Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs.* Snowmass, CO, August 2001.

Clark, S., R. Pitt, and P. Brown. "Effect of anaerobiosis on filter media pollutant retention." (poster). Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs.* Snowmass, CO, August 2001.

Pitt, R. "Illicit discharge detection and elimination." *National Storm Water Coordinators Conference.* U.S. Environmental Protection Agency. Orlando, FL. May 2001.

Easton, J., M.M. Lalor, J.J. Gauthier, and R. Pitt. "Pathogen decay in urban streams." *AWRA Specialty Conference.* San Antonio, TX. May 2001.

Pitt, R. "Stormwater management for highway projects." *Symposium on the Pollution of Water Sources from Road Run-Off.* Tel Aviv University, Israel, Sponsored by The Committee for Public Transportation, the Faculty of Life Sciences, The Institute for Nature Conservation Research, and the Porter School of Environmental Studies at Tel Aviv University. March 19, 2001.

Pitt, R., and J. Lantrip. "The effects of urbanization on soil infiltration characteristics." *AIH's Conference on Atmospheric, Surface and Subsurface Hydrology Interactions.* Research Triangle Park, NC, November 2000.

Pitt, R., S. Clark, and R. Field. "Potential groundwater contamination associated with stormwater infiltration." *AIH's Conference on Atmospheric, Surface and Subsurface Hydrology Interactions.* Research Triangle Park, NC, November 2000.

Pitt, R. "Predicting changes in water quality resulting from changing land use." *AWRA Alabama Section Symposium*, Gulf Shores, AL. September 2000.

Pitt, R., J. Lantrip, and T.P. O'Connor. "Infiltration through disturbed urban soils." *ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning & Management.* Minneapolis, MN. July 2000.

Pitt, R., M. Lalor, J. Harper, and C. Nix. "Potential new tools for indicating inappropriate dry weather discharges to storm drainage systems." *Tools for Urban Water Resource Management & Protection.* Chicago Botanic Garden, U.S. EPA, and Northeastern Illinois Planning Commission. Feb. 7-10, 2000.

Pitt, R. and M. Lalor. "The role of pollution prevention in stormwater management." *Conference on stormwater and urban water systems modeling*. Computational Hydraulics Institute. Toronto, Ontario. February 2000.

Easton, J.H., M. Lalor, J.J. Gauthier, and R. Pitt. "*In-situ* die-off of indicator bacteria and pathogens." *AWRA's Annual Water Resources Conference: Watershed Management to Protect Declining Species*. Seattle, WA. December 1999.

Pitt, R., R. Harrison, C.L. Henry, D. Xue, and T. O'Connor. "Enhanced infiltration performance of disturbed urban soils using compost amendments." *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999.

Harper, J., C. Nix, J. Day, III, M. Lalor, R. Pitt, S. Clark, D. Barbe, D. Adrian, R. Field. "Detection of inappropriate sewage entries in stormwater drainage systems." *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999.

Easton, J., M. Lalor, J.J. Gauthier, R. Pitt, D.E. Newman, S. Meyland. "Determination of survival rates for selected bacterial and protozoan pathogens from wet weather discharges." *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999.

Mirov, S.B., R.E. Pitt, A. Dergachev, W. Lee, D.V. Martyshkin, O.D. Mirov, J.J. Randolph, L.J. DeLucas, C.G. Brouillette, T.T. Basiev, Y.V. Orlovskii, and O.K. Alimiv. "A novel laser breakdown spectrophotometer for environmental monitoring." Society of Photo-Optical Instrumentation Engineers (SPIE) *Photonics East*, Boston, MA, September 1999.

Pitt, R. "Small storm hydrology: Its importance for the design of stormwater control." *5th New York Stormwater Management Conference and Trade Exposition*. Rochester, NY. Feb., 1999.

Pitt, R., S. Nix, R. Durrans, R. Field, , M. Lilburn and S. Burian. "Current and Future Drainage Design, Results of EPA-Funded Research." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Pitt, R., S. Clark, and R. Field. "Groundwater Contamination Risk due to Stormwater Infiltration." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Pitt, R. "Small Storm Hydrology's Impact on the Design of Stormwater Control Practices." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Newman, D., J. Easton, R. Pitt, M. Lalor, and J. Gauthier. "Development of an *in-situ* method to determine the fate of bacterial pathogens discharged into urban receiving waters." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Meyland, S., M. Lalor, and R. Pitt. "Environmental and public health impacts on sanitary sewer overflows." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Easton, J., R. Pitt, M. Lalor, and D. Newman. "The use of a multi-parameter water quality monitoring instrument to continuously monitor and evaluate runoff events." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Harper, J., Clark, S., R. Pitt., J. Day, T. Roberts, and C. Nix. "Evaluating field test kits for citizen water quality monitoring." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Ellis, A., D. Newman, and R. Pitt. "The use of peepers to measure nutrient and bacteria stratification in urban sediments." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Lantrip, J. and R. Pitt. "Infiltration of stormwater through disturbed urban soils." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Easton, J., R. Pitt, and M. Lalor. "The effects of separate sanitary sewer discharges (SSOs) upon photosynthesis and respiration using a continuous monitoring instrument *in-situ*." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Clark, S., R. Pitt, P. Brown, and R. Field. "Stormwater runoff filtration prior to groundwater recharge." *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Pitt. R. and R. Field. "An Evaluation of Storm Drainage Inlet Devices for Stormwater Quality Treatment." *Water Environment Federation 71st Annual Conference & Exposition, WEFTEC Technology Forum*. Orlando, FL. October 1998.

Clark, S., R. Pitt, P. Brown, and R. Field. "Treatment by filtration of stormwater runoff prior to groundwater recharge." *Water Environment Federation 71st Annual Conference & Exposition*. Orlando. October 1998.

Easton, J., M. Lalor, and R. Pitt. "The use of a multi-parameter sonde for in-situ photosynthesis/respiration analyses in sewage contaminated waters. *Water Environment Federation 71st Annual Conference & Exposition*. Orlando. October 1998.

Easton, J., M. Lalor, and R. Pitt. "The use of a multi-parameter water quality monitoring instrument to detect and quantify the frequency, duration, and magnitude of wet weather events and their associated receiving water impacts." (poster) *Water Environment Federation 71st Annual Conference & Exposition*. Orlando. October 1998.

Pitt, R., S. Nix, R. Durrans, R. Field, S. Burian. "Current Storm Drainage Design Practices." *UDM'98: Developments in Urban Drainage Modelling*. London. Sept. 21-24, 1998.

Pitt, R., S. Clark, and R. Field. "Risk of Groundwater Contamination." (poster presentation). *UDM'98: Developments in Urban Drainage Modelling*. London. Sept. 21-24, 1998.

Pitt, R., B. Robertson, and R. Field. "Innovative Multi-Chambered Stormwater Control Device for Critical Source Areas." *WEF Advances in Urban Wet Weather Wet Weather Pollution Reduction Specialty Conference*. Cleveland, OH. June 1998.

Pitt, R. and S. Mirov. "Development of a Super-Sensitive Laser Fluorescence Heavy Metal Instrument for Environmental Analyses." *9th Conference on Laser Optics*. St. Petersburg, Russia, June 22 – 26, 1998.

Pitt, R. and S. Mirov. "The development of extremely sensitive laser-based instrumentation for the analysis of heavy metals in the environment." *Ecology of Cities*. Russian Academy of Sciences and the General Physics Institute of the RAS, Ministry of Ecology of Greece, and the Ministry of Culture of Greece. Rhodes, Greece. June 1998.

Clark, S., R. Pitt, R. Field, P. Brown, and R. Schulze. "Urban Runoff Filtration for Critical Source Areas." *WEF Advances in Urban Wet Weather Wet Weather Pollution Reduction Specialty Conference*. Cleveland, OH. June 1998.

Pitt, R., R. Field, S. Burian, M. Lilburn, C-Y Fan, S.J. Nix, and S.R. Durrans. "Wet Weather Flow Designs for the Future." *ASCE Water Resources Conference*. Chicago, IL June 1998 (invited).

Pitt, R. "Drainage Design for the Future." *CHI's Stormwater & Water Quality Management Modeling Conference*. Toronto, Ontario. Feb. 1998.

Pitt, R. "Sediment Control in Alabama." *41st Annual Transportation Conference*. Montgomery, AL. February 1998 (invited).

Day, J., R. Pitt, and K. Parmer. "Evaluating Field Test Kits for Citizen Water Quality Monitoring." *Water Environment Federation 70th Annual Conference & Exposition*. Chicago. October 1997.

Clark, S., R. Pitt, J. Easton, O. Mirov, K. Parmer, and R. Field. "Pollutant Removal Capacity of Stormwater Filtration Media – Break through Tests." (poster) *Water Environment Federation 70th Annual Conference & Exposition*. Chicago. October 1997.

Heaney, J.P., L. Wright, D. Sample, R. Pitt, R. Field, and C-Y. Fan. "Innovative Stormwater Management as a Subsystem of Total Urban Water Management." *Stormwater Management – Creating Sustainable Urban Water Resources for the 21st Century*. Engineering Foundation Conference. Malmo, Sweden. Sept. 1997.

Pitt, R., M. Lilburn, and S. Burian. "Storm Drainage Design for the Future – Summary of Current U.S EPA Research." *ASCE Technical Conference*. Gulf Shores, AL. July 1997.

Pitt, R., M. Lilburn, and S. Burian. "Stormwater Design Practices." *1997 Alabama's Water Environment Association and Air & Waste Management Association Alabama Chapter Joint Conference*. Orange Beach, Alabama, April 1997.

Pitt, R. "SLAMM Stormwater Quality Model." *1997 Alabama's Water Environment Association and Air & Waste Management Association Alabama Chapter Joint Conference*. Orange Beach, Alabama, April 1997.

Clark, S., J. Easton, R. Pitt. "Breakthrough Tests of Stormwater Filtration Media." *1997 Alabama's Water Environment Association and Air & Waste Management Association Alabama Chapter Joint Conference*. Orange Beach, Alabama, April 1997.

Nix, S., R. Durrans, R. Pitt, and S. Burian. "Wet Weather Flows in Newly Urbanizing Areas: Initial Thoughts on Designs for the Future." *1997 Georgia Water Resources Conference*, The University of Georgia, Institute of Ecology. Athens, Georgia, March 1997.

Pitt, R. "Unique Features of the Source Loading and Management Model (SLAMM)." *CHI's Stormwater & Water Quality Management Modeling Conference*. Toronto, Ontario. Feb. 1997.

Mirov, S. and R. Pitt "A Novel Laser Atomic Fluorescence Spectrometer for Environmental and Biomedical Analyses of Heavy Metals." *Photonics* West, San Jose, CA, Feb. 1997.

Ashley, R., M. Verbanck, J-L Bertrand-Krajewski, T. Hvitved-Jacobsen, C. Nalluri, G. Perrusquia, R. Pitt, E. Ristenpart, and A. Saul. "Solids in Sewers - the State of the Art." (poster). *Seventh International Conference on Urban Storm Drainage. Hannover*, Germany. Sept. 1996.

Pitt, R. "Managing Critical Source Areas of Toxicants at the Watershed Level." *Effects of Watershed Development and Management on Aquatic Ecosystems*. Engineering Foundation and ASCE. Snowbird, Utah. August 1996 (invited).

Pitt, R., S. Mirov, K. Parmer, and A. Dergachev. "Laser Applications for Water Quality Analyses," *Advanced Laser Technology'96 Conference: Laser Methods for Biological and Environmental Applications*. Heraklion, Crete, May 1996 (invited).

Pitt, R. "Stormwater Control through the use of In-Receiving Water Systems." *Alabama's Water Environment Association and Air and Waste Management Association Joint Conference*. Orange Beach, Alabama, April 1996.

Pitt, R. and J. Voorhees. "Critical Source Area Controls in the SLAMM Water Quality Model." *A National Symposium: Assessing the Cumulative Impacts of Watershed Developments on Aquatic Ecosystems and Water Quality*. U.S. EPA and Northeastern Illinois Planning Commission. Chicago, Illinois, March 1996 (invited).

Pitt, R., S. Clark, K. Parmer, and R. Field. "Potential Groundwater Contamination from Stormwater Infiltration." *ASCE Joint Conferences: First International Conference on Water Resources Engineering, International Groundwater Management Symposium, Watershed Management Symposium, and Texas Water '95*. San Antonio. Texas. August 1995.

Pitt, R. and B. Robertson. "A Multi-Chambered Stormwater Treatment Train for the Treatment of Stormwater." *21st Annual RREL Research Symposium*. U. S. Environmental Protection Agency. EPA/600/R-95/012. Cincinnati, Ohio. pp. 217-221. April 1995.

Pitt, R., S. Clark, K. Parmer, and R. Field. "Groundwater Contamination from Stormwater Infiltration." *21st Annual RREL Research Symposium*. U. S. Environmental Protection Agency. EPA/600/R-95/012. Cincinnati, Ohio. pp. 222-230. April 1995.

Pitt, R. and B. Robertson. "Treatment of Stormwater from Critical Source Areas Using a Multi-Chambered Treatment Train (MCTT)." *67th Annual Water Environment Federation Conference*. Chicago, IL. October 1994.

Pitt, R., S. Clark, K. Parmer, and R. Field. "Potential Groundwater Contamination from Stormwater Infiltration." *67th Annual Water Environment Federation Conference*. Chicago, IL. October 1994.

Lalor, M., R. Pitt, and R. Field. "Locating Inappropriate Discharges to Storm Drains." Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994 (invited).

Parmer, K., R. Pitt, R. Field, and S. Clark. "Groundwater Impacts from Stormwater Infiltration." (poster) Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994.

Robertson, B., R. Pitt, A. Ayyoubi, and R. Field. "Stormwater Treatment Using a Multi-Chambered Treatment Train." (poster) Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994.

Clark, S., R. Pitt, and R. Field. "Stormwater Treatment Using Inlet Devices, Filter Media, and Filter Fabrics." (poster) Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994.

Pitt, R. "Detecting Water Quality Trends from Stormwater Discharge Reductions." Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994 (invited).

Pitt, R. "General Urban Runoff Model for Water Quality Investigations." *ASCE 1994 Conference on Hydraulic Engineering*. Buffalo, New York, August 1994.

Pitt, R., R. Field and K. Dunkers "Combined Sewer Overflow Control through In-Receiving Water Storage: An Efficiency Evaluation." *Water Environment Federation Specialty Conference on A Global Perspective for Reducing CSOs: Balancing Technologies, Costs, and Water Quality*. Louisville, KT. July 1994.

Field, R., M. Brown, and R. Pitt. "Optimization of CSO Storage and Treatment Systems." *Water Environment Federation Specialty Conference on A Global Perspective for Reducing CSOs: Balancing Technologies, Costs, and Water Quality.* Louisville, KT. July 1994.

Pitt, R. "Biological Impacts Associated with Stormwater Discharges." *Society for Environmental Toxicology and Chemistry.* Houston, Texas, November 1993 (invited).

Pitt, R. and K. Dunkers. "Lake Water Quality Improvements from Treatment of Stormwater Using the Flow Balancing Method." *66th Annual Water Environment Federation Conference.* Anaheim, California. October 1993.

Pitt, R. and J. Voorhees. "The Stormwater Quality Detention Pond Model (DETPOND)." *26th Annual Water Resources Conference.* University of Minnesota. October 1993.

Pitt, R. "Small Storm Hydrology - The Key in Identifying Sources of Stormwater Pollutants." *26th Annual Water Resources Conference.* University of Minnesota. October 1993 (invited).

Pitt, R., A. Ayyoubi, and R. Field. "The Treatability of Urban Stormwater Toxicants." *First International Conference on Diffuse (Nonpoint) Pollution.* International Association on Water Quality. Chicago. Ill. September 1993 (invited).

Pitt, R. "Detention Pond Design for Water Quality Improvement." *National ASCE Hydraulic Conference.* San Francisco, California. July 1993.

Pitt, R. and J. Voohees. "The Source Loading and Management Model (SLAMM)." *National Conference on Urban Runoff Management.* U.S. EPA, Chicago, Ill. March 1993 (invited).

Pitt, R. "Monitoring the Effects of Urban Runoff: The Coyote Creek Project." *National Conference on Urban Runoff Management.* U.S. EPA, Chicago, Ill. March 1993 (invited).

Pitt, R. and K. Dunkers. "Combined Treatment of Stormwater and Lakewater in Lake Rönningesjön, Sweden." *12th Annual International Symposium, North American Lake Management Society*, Cincinnati, Ohio, November 1992.

Lalor, M. and R. Pitt. "Cross-Connection Investigations for Stormwater Permit Applications." *64th Annual Conference of the Water Pollution Control Federation*, Toronto, Ontario, October 1991.

Pitt, R. and J. McLean. "Stormwater, Baseflow, and Snowmelt Pollutant Contributions from an Industrial Area." *65th Annual Conference of the Water Pollution Control Federation*, New Orleans, Louisiana, September 1992.

Pitt, R. and R. Field. "The Treatability of Urban Runoff Toxicants." *International Conference on Integrated Stormwater Management*, Singapore, July 1991 (invited).

Pitt, R., R. Field, M. Lalor, and M. O'Shea. "U.S. EPA's Manual of Practice for the Investigation and Control of Cross-connection Pollution into Storm Drainage Systems." *International Conference on Integrated Stormwater Management*, Singapore, July 1991 (invited).

Pitt, R. and R. Field. "The Treatability of Urban Stormwater Toxicants." *International Conference on Urban Drainage and New Technologies*, Dubrovnik, Yugoslavia, June 1991 (invited).

Pitt, R., A. Ayyoubi, and R. Field. "The Treatability of Urban Stormwater Toxicants." *17th Annual Hazardous Waste Research Symposium: Remedial Action, Treatment, and Disposal of Hazardous Waste.* U.S. EPA, Cincinnati, Ohio, April 1991.

Barron, P. and R. Pitt. "Characterization of PAHs in Urban Runoff Source Area Sheetflows." *63rd Annual Conference of the Water Pollution Control Federation*, Washington, D.C., October 1990.

Field, R., R. Pitt, and M. Lalor "U.S. EPA's Manual of Practice for the Investigation and Control of Cross-Connections into Storm Drainage Systems." *Fifth International Conference on Urban Storm Drainage*, Osaka, Japan, July 1990 (invited).

Pitt, R., P. Barron, and R. Field. "Sources and Reduction of Toxicants in Storm Induced Discharges." *International Symposium - Urban Planning and Stormwater Management*, Kuala Lumpur, Malaysia, June 1990 (invited).

Pitt, R. and M. Lalor. "Non-Stormwater Discharges into Storm Drainage Systems." *CSO Specialty Conference, Water Pollution Control Federation*, Boston, Massachusetts, April 1990.

Pitt, R., P. Barron, and R, Field. "Hazardous and Toxic Wastes Associated with Urban Stormwater and Combined Sewer Overflows." *16th Annual Hazardous Waste Research Symposium: Remedial Action, Treatment, and Disposal of Hazardous Waste.* U.S. EPA, Cincinnati, Ohio, April 1990.

Pitt, R. "Urban and Industrial Stormwater Runoff Toxicity." *Ninth International Symposium on Lake and Reservoir Management, North American Lake Management Society*, Austin, Texas, November 1989.

Pitt, R. and M. Lalor. "Identification of Cross-Connections Affecting Storm Drainage Systems." *Ninth International Symposium on Lake and Reservoir Management, North American Lake Management Society*, Austin, Texas, November 1989.

Pitt, R., R. Field, M. Lalor, and E. Driscoll. "Analysis of Cross-Connections and Storm Drainage." *Engineering Foundation Conference on Urban Stormwater Quality Enhancement - Source Control, Retrofitting and Combined Sewer Technology Conference*, Davos, Switzerland, October 1989 (invited).

Barron, P. and R. Pitt. "Sources and Reduction of Toxicants in Urban Runoff." *62nd Annual Conference of the Water Pollution Control Federation*, San Francisco, CA, October 1989.

Field, R. and R. Pitt. "Urban Storm-Induced Discharge Impacts: U.S. Environmental Protection Agency Research Program Review." *International Association on Water Pollution Research and Control*, Wageningen, The Netherlands, September 1989 (invited).

Pitt, R. "Management Alternatives for Urban Stormwater," *Marquette University Nonpoint Pollution Symposium*, Milwaukee, WI, Proceedings published by the U.S. Environmental Protection Agency, April 1985 (invited).

Pitt, R. "Effects of Urbanization on Receiving Waters," *Urban Effects on Water Quality and Quantity Conference*, Urbana, IL. Proceedings published by the Illinois Department of Energy and Natural Resources, October 1983 (invited).

Pitt, R. and M. Bozeman. "Biological and Water Quality Degradation in an Urban Creek," *Urban Stormwater and Combined Sewer Overflow Impact on Receiving Water Bodies National Conference*, Orlando, FL. Proceedings published by the U.S. Environmental Protection Agency, November 1979 (invited).

Pitt, R. "The Potential of Street Cleaning in Reducing Nonpoint Pollution," *Urban Stormwater Management Workshop Proceedings*, U.S. Environmental Protection Agency, August 1978, and *Proceedings of the International Symposium on Urban Storm Water Management*, University of KY, July 1978.

Pitt, R. and R. Field. "Water Quality Effects of Urban Runoff," *94th Annual AWWA Conference*, Boston, MA, 1975.

Selected Research Reports

DETPOND 4: A Water Quality Detention Pond Design Program; Model Documentation and Users Manual. Wisconsin Department of Natural Resources, May 1989.

Construction Site Erosion Control Manual, Water Works Board for the City of Birmingham, April 1989.

Characterization and Control of Storm Water Pollution; Source Loading and Management Model (SLAMM): Volume I: Model Development and Summary. Wisconsin Department of Natural Resources, March 1989.

SLAMM: Volume II: Model Documentation; Wisconsin Department of Natural Resources, March 1989.

Birmingham Watershed Protection Ordinance, Water Works Board for the City of Birmingham (AL), December 1988.

State Plan for the Control of Construction Site Erosion and Stormwater Runoff, Wisconsin Department of Natural Resources, July 1987.

Manual of Practice for Stormwater Controls, Wisconsin Department of Natural Resources, 1987.

Model Ordinance for the Control of Construction Site and Stormwater Runoff, Wisconsin Department of Natural Resources, October 1986.

Snowmelt as a Pollutant Source, Ontario Ministry of the Environment, Toronto, Canada, January 1986.

Particulate Accumulation and Washoff Relationships - Modifications to the HSPF Model, Ontario Ministry of the Environment, Toronto, Canada, June 1984.

Washoe County Urban Stormwater Management Program, Washoe Council of Governments, Reno, NV, August 1982.

Lake Merritt Management Plan, City of Oakland, CA, Department of Public Works, May 1979.

Water Quality Study for Pittsburgh Power Plant Units 8 and 9, for the Pacific Gas and Electric Company (West Pittsburgh, California), 1978.

Oil Spill Movement Study, for the Port of Long Beach (San Pedro Bay, California), 1978.

Red Desert Uranium Mine and Mill, for Minerals Exploration Company (Sweetwater County, Wyoming), 1978.

Recommended Measures for the Control of Surface Runoff, Alameda County Flood Control and Water Conservation District, September 1977.

Water Quality and Biological Consulting Services Concerning Sewage Treatment Discharge Effects on Alaskan Tundra Ponds, Atlantic Richfield Company (Prudhoe Bay, Alaska), 1977.

Hazardous Material Contingency Plan for a Chemical Facility, for Allied Chemical Corporation (Pittsburg, California), 1977.
Ute Mountain Uranium Exploration Activities, for Mobil Oil Corporation (Montezuma County, Colorado), 1977.
Geothermal Resources Studies, for the Phillips Petroleum Company (Roosevelt Hot Springs, Utah), 1977.
Review of the Sun Desert Nuclear Power Plant Environmental Report, for the San Diego Gas and Electric Company, 1976.
Water Quality Investigations for Nuclear Notices of Intent, for the Pacific Gas and Electric Company (Stanislaus, Merced, and Madera Counties, California), 1976.
Crow Indian Reservation Coal Mining Lease, for Shell Oil Company (Big Horn County, Montana), 1976.
Water Quality and Biological Survey of the Zeyandeh Rud near Isfahan, Iran, for E. I. duPont de Nemours Company, 1976.
The Effects of Sand and Gravel Removal on Arctic and Subarctic Streams, for the U. S. Fish and Wildlife Service (Alaska), 1976.
Engineering Report for Air Quality Mitigation Measures, for the Southern California Gas Company, 1975.
Air Quality Effects of Oil Spills, Standard Oil Company of California (Santa Barbara), 1975.
Contingency Plan for a Proposed Ammonia and Urea Transfer and Storage Facility, for Collier Carbon and Chemical Corporation (Sacramento, California), 1975.
Environmental Effects of a Possible Oil Spill at Morro Bay, for the Pacific Gas and Electric Company (Morro Bay, California), 1974.
Twin Creek Coal Mine, for the Rocky Mountain Energy Company (Lincoln County, Wyoming), 1974.
Monitoring of Oil Spill Waste Disposal Areas, for Standard Oil Company of California (San Francisco), 1973.
Oakland Airport Maintenance Facility Expansion, for the Port of Oakland (California), 1973.
Environmental, Social, and Economic Impact of the Proposed 1972-1977 Capital Improvement Program for the San Jose Municipal Airport, for the City of San Jose (California), 1972.
Industrial Waste Survey of the Northwest Fruit and Vegetable Canning Industry, for the Environmental Protection Agency (Washington, Oregon, and Idaho), 1972.
Oil Spill/Sorbent Harvesting Systems on Vessels of Opportunity, A motion picture, U.S. Environmental Agency, 1972.

Department of Civil and Environmental Engineering Courses Taught:

CE 333 - Water Supply and Drainage Design
CE 335 - Water and Wastewater Treatment
CE 401 – Senior Design Project
CE 435 - Environmental Engineering
CE 478 – Water Resources Engineering
CE 484 - Hydraulic Engineering Systems
CE 485 - Engineering Hydrology
CE 499 - Senior Design
CE 544 - Engineering Statistical Analyses
CE 636 - Stormwater Management
http://www.eng.ua.edu/~rpitt/Class/StormWaterManagement/MainSWM.html
CE 637 - Experimental Design and Field Sampling
http://www.eng.ua.edu/~rpitt/Class/ExperimentalDesignFieldSampling/MainEDFS.html
CE 638 - Chemical Processes and Pollutant Impacts in Water
CE 639 – Construction Site Erosion Control
http://www.eng.ua.edu/~rpitt/Class/Erosioncontrol/MainEC.html
CE 641 - Environmental Engineering and Water Resources Seminar
CE 685 - Research Methods in Civil and Environmental Engineering
CE 687 - Stormwater Detention Pond Design
http://www.eng.ua.edu/~rpitt/Class/Detentionponddesign/MainDPD.html
CE 690 – Effects and Fates of Hazardous Materials
http://www.eng.ua.edu/~rpitt/Class/EffectsandFates/MainEffectsandFates.html

CE 690 - International Internet based courses on Stormwater Modeling and Stormwater Management
http://www.eos.uoguelph.ca/webfiles/james/homepage/Teaching/661/wj661HomePage.html
HON 101-406 - Honors course: The Environment: The Earth in Our Shadow
HON 107/407 - Honors course: The Environment: Earth, Air, Fire, and Water

Major Advisor for the Following Graduate Students:

Agnew, Frank. MSCE. *Performance of Inlet Treatment Devices.* 1996.
Ayyoubi, Ali. MSCE. *Physical Treatment of Urban Storm Water Runoff Toxicants* (published thesis). 1993.
Baker, Martin, R. III. MSCE. *Constructed Wetlands for the Treatment of Paper Mill Wastes.* 2001.
Balakrishnan, Anitha C. MSCE. *Comparison of Upflow and Downflow Filtration on Clogging and Pollutant Removal Capabilities of Stormwater Filters.* 2001.
Barron, Patricia. MSCE. *Characterization of Polynuclear Aromatic Hydrocarbons n Urban Runoff* (published thesis). 1990.
Buford, Mark. MSCE. *Land Use Characteristics Affecting Baseflow Quality.* 1995.
Burnett, David. MSCE. *Snowmelt Water Quality.* 1997.
Clark, Shirley. MSCE. *Evaluation of Filtration Media for Stormwater Runoff Treatment* (published thesis). 1996.
Clark, Shirley. Ph.D. *Urban Stormwater Filtration/Sorption: Optimization of Design Parameters and a Pilot-Scale Evaluation* (published dissertation). 2000.
Creel, Robert. MSCE. *Evaluating Detention Pond Performance with Computer Modeling Verification* (published thesis). 1994.
Day, James. MSCE. *Selection of Appropriate Analytical Procedures for Volunteer Field Monitoring of Water Quality* (published thesis). 1996.
Delawadia, Naran. MSCE. *Validation of the DETPOND Model.* 1996.
Dykes, William C. MSCE. *Water Pipeline Networks.* 1989.
Echols, W.C. MSCE. *Calibration and Performance of Micro-Scale Peepers for High-Resolution Interstitial Water Sampling.* 1997.
El-Husari, Ayman. MSCE. *Rain Monitoring Options.* 1996.
Ellis, April. MSCE. *The use of Peepers to Measure Bacteria and Nutrient Gradients in Urban Pond Sediments,* 1998.
Farmer, Joseph. MSCE. *Oil and Grease Separators for Stormwater Control.* 1997.
Garrett, William. MSCE. *Control of Zebra Mussels in Power Plant Cooling Water Systems.* 1995.
Garrett, William. Ph.D. *Recirculating – Reducing and Alkalinity Producing System (RERAPS) for the Treatment of Acidic Coal Pile Runoff.* (published dissertation). 2002.
Goertz, Susan. MSCE. *Runoff Quality from a Xeroscaped Area.* 1996.
Hamrick, James. MSCE. *Drainage of Water from Pavement Structures* (published thesis). 1995.
Howser, John. MSCE. *Performance of Stormwater Detention Practices.* 1995.
Karri, Verra. MSCE. *Monte Carlo Mixing Model to Identify Inappropriate Discharges to Storm Drainage Systems* (published thesis). 2004.
Khan, Mustaque. MSCE. *Organic Compound Automated Extraction Methods for Sediments,* 1999.
Kemp, Randall. MSCE. *Demonstration of Erosion Control Practices.* 1995.
Hosmer, Carla. MSCE. *Behavior of Stormwater Filtration Media under Aerobic and Anaerobic Conditions,* 2000.
Lalor, Melinda. Ph.D. (Vanderbilt Univ.) *Assessment of Non-Stormwater Discharges to Storm Drainage Systems in Residential and Commercial Land Use Areas* (published dissertation). 1993.
Lantrip, Janice. MSCE. *Infiltration through Disturbed Urban Soils.* 1999.
Lilburn, Melissa. MSCE. *Storm Drainage Design Practices* (published thesis). 1997.
Morquecho, Renee. MSCE. *Sequential Extraction and Particle Size Associations for Stormwater Pollutants.* 2001.
McConnel, Vic. MSCE. *Design of Detention Ponds for Commercial Development.* 1997.
McGill, Milan. MSCE. *Rainfall Distribution Analysis Options.* 1996.
McKell, Mitch. MSCE. *New Concepts in Wastewater Effluent Diffuser Design.* 1994.
Nelson, John. MSCE. *Characterizing Erosion Processes and Sediment Yields on Construction Sites* (published thesis). 1996.
Nix, Christy, M. MSCE. *Evaluation and Calibration of the Pastel UV for Detecting Sewage in Storm Water Drainage Systems.* 1999.

Nolen, Bobby. MSCE. *Hydraulic Models of the Transition Section of Laurel Lake Spillway*. 1989.
Panwhar, Samina. MSCE. *An Application of a GIS System for Risk Analysis and Routing of Hazardous Materials* (published thesis). 2001.
Peeples, Alan. MSCE. *Comparison of Rainfall Depth Calculation Procedures*. 1995.
Ponstein, Jonathan. MSCE. *Sources and Control of Tastes and Odors in a Public Water Supply*. 2001
Ray, Holly. MSCE. *Street Dirt as a Phosphorus Source in Urban Stormwater* (published thesis). 1997.
Revell, Edwin. MSCE. *Rainfall Measurements using Radar Systems*. 1995.
Richards, Michael. MSCE. *Arsenic Remediation Practices*. 1995.
Roberts, Timothy. MSCE. *Organochlorine Pesticide Detection Using a Compositing Scheme*. 1999.
Robertson, Brian. MSCE. *Evaluation of a Multi-Chambered Treatment Train (MCTT) for Treatment of Stormwater Runoff from Critical Pollutant Source Areas* (published thesis). 1995.
Shergill, Sumandeep. MSCE. *Quantification of Escherichia Coli and Enterococci Levels Wet Weather and Dry Weather Flows* (published thesis). 2004.
Summers, Harry. MSCE. *Upgrading of a Small Municipal Wastewater Treatment System*. 1991.
Weygand, Kenneth. MSCE. *Current Practices in Hydraulic Modeling*. 1996.
Wilson, Robert. MSCE. *Effluent Nitrate Reduction in Onsite Systems through Effluent Recycle* (published thesis). 1992.

Engineering Professional Development Courses and Workshops Taught:

Stormwater Management:	Albany, NY, 2000
and Conservation Design	Birmingham, AL, 1989 - 1998
	Boston, MA, 1993
	Chicago, IL, 1992, 1993, 1998
	Edison, NJ, 2001, 2003
	Essen, Germany, 1994
	Fair Hope, AL, 1995, 1997
	Fishkill, NY, 2002 - 2004
	Guelph, Ontario, 1995
	Huntsville, AL, 1999
	Las Vegas, NV, 2001, 2003
	Madison, WI, 1991 - 2004
	Milwaukee, WI, 1990, 1999
	Montgomery, AL, 1999, 2000
	Portland, OR, 1989, 1992
	Portland, ME, 1994
	Seattle and Olympia, WA, 2003
	Singapore, 1991
	Syracuse, NY, 2002, 2003
	St. Paul, MN, 1993
	Vancouver, BC, 2003
Bioretention Control Practices:	Birmingham, AL, 1993 – 1995
Construction Site Erosion Control:	Birmingham, AL, 1989 – 2003
	Guntersville, AL, 2003
	Mobile, AL 2003
Detention Pond Design:	Birmingham, AL, 1989 - 1997
	Boston, MA, 1993
	Chicago, IL, 1998
	Edison, NJ, 2001, 2003
	Fishkill, NY, 2002, 2004
	Guelph, Ontario, 1995

	Las Vegas, NV, 2001, 2003
	Madison, WI, 1991 – 2004
	New York City, 2001
	Portland, OR, 1993
	Portland, ME, 1994
	Rochester, NY, 2001
	Syracuse, NY, 2001
	St. Paul, MN, 1993 - 1998
PE Exam Review:	Birmingham, AL, 1988 - 1993
FE Exam Review:	Tuscaloosa, AL, 2002

University Committee Assignments and other Intramural Activities:

School of Engineering Service:

- Computer Network Committee
- Strategic Planning Committee
- Faculty Affairs Committee
- Academic Misconduct Advisory Panel
- Nonacademic Discipline Committee
- Selected speaker for 1999 UAB Day for perspective engineering students
- EGR100 Pre-College Summer Program keynote speaker, 1990
- Selection committee for Presidential Award for Excellence in Teaching
- Faculty advisor to student chapter of the American Water Resources Association (joint with Univ. of Alabama, Tuscaloosa and UAB campuses) (first place national chapter for 1997)
- Faculty advisor to student chapter of the Water Environment Federation (joint with Univ. of Alabama, Tuscaloosa and UAB campuses)
- Graduate Program Committee Chair

University Service:

- Developed new Departmental Honors Program, UAB, approved February 1999.
- Developed new Ph.D. program in Environmental Health Engineering, UAB, approved December 1996.
- Honors Council, 1997 – 2002.
- UAB Faculty Senate, 1996 - 1997.
- 9 and 12 Month Conversion Committee, 1996.
- Graduate Student Research Day Committee, 1996.
- EARTH Center Executive Board, 1994 - 1995.
- Center for Telecommunications, Director of Environmental Factors, UAB, 1994 - 2001.
- Southern Association of Colleges and Schools Self-Study accreditation committee for professional and graduate schools, 1993.
- Minority Initiative for High School Students Program mentor, 1992 – 1997.
- UAB Summer Research Program mentor, 1995 – 2001.
- Howard University/NIOSH/MOTTEP Program mentor, 2000.
- National Institute of Health Summer Program mentor, 1996, 2000, 2001.
- Coca-Cola Summer Scholars program mentor, 1993 – 1995.
- Chemical Safety Committee, 1993 – 1996.
- EPSCoR statewide Energy and the Environment Director, 1992 - 1994.
- Teacher Education Council (School of Education), 1990 - 2001.
- Task Force on Quality of Teaching, School of Arts and Humanities, 1994.
- Environmental Education Committee, 1990 - 2001.
- Summer Scholar Program mentor, 1990.

VITAE

NAME: **Walter G. Knisel**
TITLE: GLEAMS Model Consultant
ADDRESS: 1606 Rutland Road
Tifton, Georgia 31793

Telephone: +1 (912) 382-1332
Telefax: +1 (912) 382-2192

Education:
B.S. 1954 Agricultural Engineering, Oklahoma State University, Stillwater, OK
M.S. 1955 Agricultural Engineering, Oklahoma State University, Stillwater, OK
Ph.D. 1971 Civil Engineering, Colorado State University, Fort Collins, CO

Professional Society Membership:
American Geophysical Union
American Society of Civil Engineers
Sigma Xi
Soil & Water Conservation Society of America

Awards:
USDA Superior Service Group Award for leadership in model coordination and development, 1980.
USDA Superior Service Unit Award for model development, 1989.
USDA-ARS Technology Transfer Award for model implementation, 1989.
USDA-ARS-SAA Technology Transfer Award for model application, 1989.

Employment:

1995-Present	Retired, Consultant
1989-1995	Biological & Agricultural Engineering Department, University of Georgia, Coastal Plain Expt. Sta.
1957-1989	USDA-Agricultural Research Service, Texas, Arizona, and Georgia
1955-1957	New Mexico State University, Las Cruces, New Mexico

Significant Related Findings:
After successful completion of development and publication of the CREAMS model by the USDA-ARS in 1980, model modifications, validations, applications, and technology transfer continued until 1984. Work began on development of the hydrology, erosion, and pesticide components of the GLEAMS model. The pesticide fate model was completed, validated, and published by 1989, and technology transfer workshops were conducted on GLEAMS applications. Following retirement from USDA-ARS in 1989, work at the University of Georgia-Coastal Plain Experiment Station concentrated on development of a plant nutrient component of GLEAMS for simulating nitrogen and phosphorus transformations and loadings at the edge-of-field and bottom-of-root-zone. The component documentation, results of validation, and user manual were prepared and published. GLEAMS was modified to consider up to 366 pesticides simultaneously in order to evaluate losses during application windows. The modifications were successful, and recommendations of herbicide application practices were made to the U.S. Forest Service. Consulting on applications and training on the CREAMS and GLEAMS models has been provided to several state universities and to state and federal agencies as well as 10 foreign countries. Research conducted in irrigation, hydrology, erosion, water quality, and mathematical modeling in a 50-year career has resulted in publication of 125 technical papers as author or co-author.

PAUL S. MANKIEWICZ, PH.D.

The Gaia Institute
440 City Island Avenue, Bronx, NY 10464
Phone: (718) 885-1906 Fax: (718) 885-0882
gaiainst@aol.com www.gaia-inst.org

New York City Soil & Water Conservation District
121 Sixth Avenue, New York, NY 10013

Dr. Paul S. Mankiewicz received his doctoral degree from the City University of New York/New York Botanical Garden Joint Program in Plant Sciences. He is the founding Executive Director of the Gaia Institute and has served in this role since 1987. Under his direction, the Gaia Institute has taken on many challenging problems in applied and theoretical biogeochemistry and biophysics, from urban watershed restoration to landfill and mine remediation. The solutions to these problems have, in all cases, been laid out in the context of ecological engineering, turning elements of the waste stream into functional, ecological resources.

Dr. Mankiewicz's research interests have focused on the interaction of plants, water, nutrients, metals and pollutant uptake in microcosms and mesocosms. Dr. Mankiewicz has had substantial experience with enhancing, restoring and constructing wetland and terrestrial ecosystems. The goal of these efforts has been to utilize the functional capacities of plants, fungi, bacteria and burrowing organisms in soils and sediments to ecologically engineer natural systems to increase biodiversity, ecological productivity, and environmental quality.

Wastes into resources technology development has been a primary focus of Dr. Mankiewicz's career. He represented the Gaia Institute in Scotland as one of three finalists in the international St. Andrews Prize competition in 2000 for work demonstrating how urban soil systems can be restored using composted organics diverted from the waste stream and native plant communities to create stormwater catchment parks. This example of sustainable development demonstrated how natural systems can capture and biogeochemically filter large inputs of stormwater runoff from adjacent urban infrastructure. The ecological development program initiated by the Gaia Institute for restoration in the Bronx River and Jamaica Bay watersheds has been supported by contracts with the National Oceanic Atmospheric Administration (NOAA), the National Urban Community Forestry Advisory Council, and the Urban Resources Partnership (a collaborative of NRCS/US Department of Agriculture, US EPA, National Forestry Service, Cornell Cooperative Extension, and NYS Department of Environmental Conservation).

Dr. Mankiewicz has also initiated the development of numerous full-scale restoration programs. The Gaia Institute and CityGreen, Inc. have constructed a stormwater capture park in East New York in the Jamaica Bay watershed. This project was carried out in partnership with the New York City Department of Parks and Recreation, NYC Department of Sanitation, and in cooperation with the NYC Department of Transportation, together with community groups and active Community Board participation. This facility was designed and the construction directed by Dr. Mankiewicz. A similar ecological restoration and stormwater capture plan was developed for Chapel Farm, an undeveloped, forested sixteen-acre site on the highest point in the Bronx. This integrated hydrological and ecological plan was produced in collaboration with the Riverdale Nature Preservancy and the Bronx Council for Environmental Quality.

A stormwater capture and ecological restoration plan for the eleven-mile length of the Henry Hudson Parkway was created by Dr. Mankiewicz, and documented in a pamphlet produced by the Gaia Institute through Kaplan Foundation funding to the Riverdale Nature Preservancy. These efforts have helped unite community groups along the northwest side of the City to provide input and to join in the creation of the Henry Hudson Parkway Scenic Byway Task Force. In addition, documentation and design work on the Croton Watershed have indicated how terraced natural systems can produce carbon sinks to manage the watershed for the water quality protection In the Kensico Watershed, Dr. Mankiewicz has provided an important link with engineering designs to biogeochemical work with soils and plants through his contribution to the New York State Department of Transportation I-684, Routes 22 and 120 expansion plan. This NYS DOT Region 8 program, in collaboration with National Resources Defense Council (NRDC) and Riverkeeper, has produced highway construction plans which, when constructed, will improve water quality in the Rye Lake portion of the Kensico Reservoir.

During more than twenty years of teaching and research experience at the City University, Columbia University, the New School University and Pratt Institute, Dr. Mankiewicz has developed a number of fluid purification and measurement technologies. These technologies include inexpensive tensiometers for field and laboratory measurement of low pressure hydrostatic forces in soils, peats, and communities of small plants, a proprietary light weight soil for green roof development, and a stormwater treatment buffer for urban applications. Dr. Mankiewicz has served as a consultant on issues of heavy metal and hydrocarbon contaminants in urban soils, streams and estuaries, and on the remediation and restoration of landfills, mines, brownfields, and other impacted ecological systems. A past president of the Torrey Botanical Society, the oldest such organization in the New World Dr. Mankiewicz has been a member and chair of the Solid Waste Advisory Board of the Bronx, and Treasurer of the Soil and Water Conservation District Board of New York City.

EDUCATION

CITY UNIVERSITY OF NEW YORK, Ph.D. in Biology, 1987. Thesis: "Hydrostatic and fluid dynamic constraints on external capillary water conduction in the diversification of land plants."

CITY UNIVERSITY OF NEW YORK, M. Phil in Biology, 1979.

LEHMAN COLLEGE OF CUNY, M.A. in Biology, 1976.

NEW SCHOOL UNIVERSITY, New York, NY. B.A. in Philosophy, 1970.

EMPLOYMENT

THE GAIA INSTITUTE, Bronx, NY
1987-Present
Executive Director. The Gaia Institute is a 501(c)(3) not-for-profit corporation, whose work is focused on environmental research and development, education and design. The Gaia's work is centered on the restoration and ecological re-engineering of natural systems to protect and enhance environmental quality, by coupling ecological engineering and restoration with the integration of human communities in natural systems. The purpose of the Gaia Institute is to test, through demonstration, the means by which the ecological

components of backyards, communities, towns and cities, as well as watersheds and estuaries, can be enhanced through integrated wastes-into-resources technologies.

ECOTERRA, INC., Chadds Ford, PA 1995-1996
Director of Ecological and Biogeochemical Engineering. This start-up company carried out toxic site bioremediation, wastewater treatment, risk assessment, and human health protection through the installation and enhancement of natural systems and processes.

THE URBAN ROOFTOP GREENHOUSE PROJECT, New York, NY 1982-1999
Director. Cathedral of St. John the Divine. Development of lightweight rooftop agricultural systems for urban roof space.

THE CENTER FOR THE RESTORATION OF WATERS, Providence, RI 1992-1993
Director of Scientific Research. Research focused on sludge, bacterial films, and heavy metals uptake by plants at Ocean Arks International's ecologically engineered 20,000 gallons-per-day wastewater treatment facility.

PRATT INSTITUTE SCHOOL OF ARCHITECTURE, New York, NY 1984-1988
Assistant Professor in Ecology. Lecture, lab and fieldwork course.

NEW SCHOOL UNIVERSITY, New York, NY 1975-1988
Instructor/Assistant Professor. Development of a fourteen-course curriculum in the natural sciences centered on concepts of ecology and organismic biology, grounded in laboratory and field experience.

NEW YORK BOTANICAL GARDEN 1973-1976
Field Guide/Tour Leader.

CUNY RESEARCH FOUNDATION, LEHMAN COLLEGE OF CUNY 1973-1975
Technician/Teaching Assistant. Plant development/morphogenesis in the laboratory of Professor Dominick V. Basile.

CUNY RESEARCH FOUNDATION, LEHMAN COLLEGE OF CUNY 1972-1975
Technician/Research Assistant. Research in the laboratory of Professor Thomas E. Jensen involving phycology, cell biology, electron microscopy, Hudson River water quality, and biodiversity.

COLUMBIA UNIVERSITY, New York, NY 1972-1973
Teaching Assistant/Laboratory Instructor. General Biology.

GRANTS AND CONTRACTS

ECOLOGICAL ENGINEERING AND STORMWATER CAPTURE DESIGN DEVELOPMENT FOR THE HENRY HUDSON PARKWAY

Funded by the Riverdale Nature Preservency. Henry Hudson Parkway Scenic Byway Task Force. Utilized National and State transportation initiatives to redesign stormwater capture on upland vegetated landscapes. Produced a report to further this program, "The Gaia Institute Reports on the Henry Hudson Parkway – Stormwater Capture Parks along the Henry Hudson Parkway" (http://www.gaiainst.org/pdfs/Stormwater_Capture_Parks_HH.pdf). The purpose of this program is to describe a model framework for the Henry Hudson Parkway Scenic Byway, which couples parkland creation with roadway, bridge, and overpass infrastructure along the Henry Hudson Right-of-Way in the Bronx. This program was developed by the Gaia Institute in partnership with the Riverdale Nature Preservancy. 2003-Present

CLEAN-UP OF OPERABLE UNIT #5 ON PECONIC RIVER, BROOKHAVEN NATIONAL LABORATORY/DEPARTMENT OF ENERGY
Contracted through the Suffolk County Department of Health. Reviewed remediation and restoration technologies for the headwaters of the Peconic River. 2003-Present

RESTORING NATURAL CYCLES IN A COMMUNITY PARK: EL JARDIN DEL PARAISO, LOWER EAST SIDE, MANHATTAN, NY
Funded by Green Acres Foundation. Coupled plantings, soil enrichment, water features and walkways at this community garden, included stormwater, groundwater and greywater treatment. November 2003-Present

STORMWATER CATCHMENT MODIFICATIONS ON LAFAYETTE AVENUE/EDGEWATER ROAD, BRONX RIVER WATERSHED, BRONX, NY
Funded by NOAA/Wildlife Conservation Society. Increased biodiversity and ecological productivity in the Bronx River Corridor through roadway and shoreline ecological engineering and restoration. Included support for Gaia Institute personnel, undergraduate interns and graduate student support. April 2003-Present

FOREST RESTORATION IN CUNNINGHAM PARK, QUEENS, NY
Funded by the New York City Environment Fund. Incorporated community groups and students into a long-term forest restoration project. Included support for Gaia Institute personnel, undergraduate research interns and graduate student support. October 2002-Present

MOBILE VAN LABORATORY FOR EDUCATION AND RESEARCH ON THE BRONX RIVER
Funded by NOAA/Wildlife Conservation Society. Included support for Gaia Institute personnel, undergraduate interns and graduate student support. August 2002-Present

HYDROLOGICAL BEHAVIOR AND LANDSCAPE PROPERTIES, BRONX RIVER WATERSHED
Funded by NOAA/City Parks Foundation. Mapped upland landscape and water features in the sewersheds in the lower Bronx River watershed and Bronx River estuary. March 2002-Present

ECOLOGICAL ENGINEERING & RESTORATION STUDY, FLUSHING MEADOWS LAKES & WATERSHED
Consultant to NYC 2012. This not-for-profit corporation developed the successful submission for New York City to represent the United States in the bid for the 2012 Olympics. Advised on how the venue for the 2000m rowing course could be utilized to capture and treat stormwater from the Van Wyck and Grand Central Parkways and other roadways from the entire watershed in order to

increase biodiversity and enhance environmental quality in and around Flushing Meadow. 2001-Present

DRAFT STORMWATER POLLUTION PREVENTION PLAN
Funded by the New York State Department of Transportation. Consultant for the expansion and development work on Routes I-684, 120, and 22 in the town of Armonk, NY. Analyzed and designed ecological and biogeochemical effects of stormwater detention and treatment systems. June 1999-Present

ECOLOGICAL ENGINEERING AND DESIGN DEVELOPMENT, OAKLAND RAVINE, QUEENS
Funded by NYC Department of Environmental Protection. Developed designed schematics of stormwater catchment and treatment using hydrological modifications, biological remediation, and ecological restoration at Oakland Ravine. 1992, 1996-Present

ECOLOGICAL INFRASTRUCTURE EXHIBIT, NEW YORK, NY
In collaboration with the Metropolitan Waterfront Alliance, the Gaia Institute and other members of the design team created a map of sustainable approaches to couple ecology and infrastructure throughout the city, March-September, 2002. The exhibit thus produced "Revealing the Edges: Communities and Infrastructure," was on view at the Municipal Art Society Urban Center, July 1-August 31, 2002.

CREATING NATIVE WETLAND GARDENS FOR STORMWATER CAPTURE AT THE EDGE OF THE HUTCHINSON RIVER: CO-OP CITY, NY
Funded by the New York City Environment Fund. Investigated design feasibility. February 2001-2002

UPLAND SOIL BUFFER AND WETLANDS CREATION FOR STORMWATER TREATMENT, EAST NEW YORK, BROOKLYN
Funded by the Urban Resources Partnership. Transformed an abandoned construction staging zone in East New York into an urban stormwater buffer through soil enrichment with composted NYC organic waste for the creation of aquatic and upland habitat for stormwater recharge and community greenspace. Fall 1999-Fall 2002

CLEANING THE WATERS OF JAMAICA BAY
Funded by the National Urban & Community Forestry Advisory Council 2000. (In conjunction with the URP grant, directly above). Challenge Cost-Share Grant Program. Created holding water sites and forested parks in East New York. May 2000-April 2001

BRONX RIVER RESTORATION WATER QUALITY MONITORING
Funded by NOAA/City Parks Foundation. Monitored cement plant site water quality and developed a restoration plan. November 2000-December 2001

FEASIBILITY STUDY FOR BIOGEOCHEMICAL ACID MINE DRAINAGE MITIGATION SOUTH STAFFORD, VERMONT
Funded by Elizabeth Mine Study Group/Citizens for a Sensible Solution. Developed a native plant wetland and soil restoration system to reverse negative impacts from one of the oldest copper and

copperas mines in America which drains into a trout stream in western Vermont. October 2000-June 2001

GREAT SWAMP ECOLOGICAL ENGINEERING, DUTCHESS COUNTY, NY
Funded by the US Environmental Protection Agency. Conducted site survey and developed a design for ecological engineering and mitigation of erosion sites in the Great Swamp which contribute to pollution in the Croton Reservoir System. Fall 1998-Summer 2000

FIELD EVALUATIONS, LABORATORY ANALYSIS AND EXPERT TESTIMONY, PINE TREE LAKE, MONROE, NY
Funded by the Pine Tree Lake Association. Conducted field evaluations and laboratory analysis of erosion and sedimentation in Pine Tree Lake and Watershed. Provided expert testimony in legal proceedings regarding erosion from golf course and housing development construction in the Pine Tree Lake Watershed. January 1998-May 2000

BRONX RIVER RESTORATION: PRODUCTION OF ANNUAL REPORTS ON WATER QUALITY MONITORING
Performed data analysis, integration, and testing on hydrology and water quality. 1990-1999

EXPERT TESTIMONY: ORANGE COUNTY LANDFILL, GOSHEN, NY
Provided expert testimony in a lawsuit involving Clean Water Act violations, wetland destruction, and discharges from the Orange County Landfill. Developed testimony, mitigation, and restoration plans, which contributed to a settlement including the establishment of a $750,000 Wallkill River Restoration Fund. 1992-1999

CROSSING BORDERS: ART AND ECOLOGY, POLAND
Funded by the Trust for Mutual Understanding. A travel and investigative grant to go to Krakow Silesia, and other areas in Poland to establish collaborative projects with Polish scientists and artists for water quality improvement, incorporating public art. Summer 1998, Fall 1999

CONSULTANT/EXPERT TESTIMONY FOR THE CITY OF NEW YORK, CANARSIE BEACH/PAERDEGAT BASIN, BROOKLYN
Supported by the Corporation Counsel, City of New York. Developed testimony to support the City's case documenting illegal fill. Proposed the removal of fill and restoration of natural systems. July-November 1999

COST-EFFECTIVE STORMWATER TREATMENT UTILIZING RESTORED WETLANDS
Funded by the NYC Department of Environmental Protection. Used physiological ecology and wetland biogeochemistry as tools to understand and restore an urban watershed for stormwater treatment and habitat reconstruction in Oakland Ravine, an urban watershed in Queens, New York. The Gaia Institute worked under a subcontract with URS Consultants. July 1996-September 1998

OAKLAND RAVINE: DEVELOPMENT OF THE FIRST INFILTRATION-BASED FLOOD AND POLLUTION CONTROL STORMWATER CAPTURE SYSTEM IN NEW YORK CITY
Funded by NYC Department of Environmental Conservation. Assessed floatable and nonpoint source pollutants in the Bronx River to develop plans for wetland restoration and community

participation for mitigation. Facilitated the development of educational steps towards prevention and restoration September 1995-February 1996

BRONX RIVER FLOATABLES REMOVAL EDUCATION
Funded by the US EPA and NYC Department of Sanitation. Developed on-site composting of source-separated organic wastes with small scale, in-vessel technologies. Contract renewed to develop material handling technologies for composting system developed in 1992. A joint project of the Gaia Institute and the Bureau of Reuse, Recycling and Waste Prevention of the NYC DOS. March 1994-February 1996

ON-SITE FOOD WASTE COMPOSTING OF SOURCE-SEPARATED ORGANIC WASTES, NYC
Grant renewal funded by the US EPA and the Recycling Bureau of the NYC DOS. Developed and implemented the design of an on-site food waste composting system. March-August 1993

PELHAM BAY LANDFILL ECOLOGICALLY BASED REMEDIATION PLAN, BRONX, NY
Funded by the NYC Department of Environmental Protection. Developed an on-site bioremediation, pilot leachate treatment system around the Pelham Bay Landfill to improve water quality by constructing salt marshes and restoring creek beds on beneficially used dredged sediments from local marinas. March 1993-February 1994

METALS REMOVAL FROM THE WASTEWATER STREAM OF AN INDUSTRIAL CITY
Funded by the Stewart Mott Foundation. Grant awarded to the Center for the Restoration of Waters at Ocean Arks International for implementation in Providence, RI. September 1992-August 1993

ON-SITE COMPOSTING OF SOURCE-SEPARATED ORGANIC WASTES, NYC
Funded by the US EPA. Composted on-site, source-separated organic wastes with small scale in-vessel technologies. A joint project of the Gaia Institute and the Recycling Bureau of the NYC DOS. October 1991-October 1992

SALT MARSH RESTORATION AND DEVELOPMENT OF ON-SITE BIOREMEDIATION
Funded by the NYC Department of Environmental Protection. Developed designs for salt marsh restoration and an on-site bioremediation, pilot leachate treatment system to redress water quality issues in and around the Pelham Bay Landfill, Bronx, NY. Evaluated past, present and future potential of salt marsh contribution to local water quality in Eastchester Bay. 1991

SALT MARSH RESTORATION PROJECT, HUDSON RIVER
Consultant in the River Project's attempts to create intertidal habitat north of Pier 26 by redistributing fill and sediments within the river. 1991

PALMER INLET, BRONX NY
Funded by New York State Senator Valella. Directed a salt marsh restoration project, in conjunction with the New York Coastal Fishermen's Association, and Bronx Council for Environmental Quality. 1990-1991

INTEGRATING ARCHITECTURE AND ECOLOGY

Funded by the Dubos Foundation. Designed plant and soil configurations for air and water purification in cities. November 1990

NATURE'S ECONOMY AND HUMAN ECOLOGY
Funded by the Society for the Plastics Industries and the James River Corporation. Created an exhibit on recycling and environmental quality in New York City that was displayed in the Earth Bay of the Cathedral of St. John the Divine. April 1990

BRONX RIVER PARK RESTORATION PROPOSAL
Ecological Consultant. Collaborated with the Landscape Architecture Firm of Signe Nielsen and King & Gavaris Engineering on an ecology/landscape architecture/engineering proposal for the New York City Department of Parks and Recreation, which was awarded 1st place by the NYC Department of Parks and Recreation. 1987

HOLT RHINEHARDT AND WINSTON, HOLT GENERAL SCIENCE, New York, NY
Ecology and Biology Consultant. Textbook review. 1985

CUNNINGHAM PARK RENOVATION COMPETITION, Queens, NY
Ecological Consultant. Collaborated with the Landscape Architecture Firm of Signe Nielsen on a proposal for the NYC Department of Parks and Recreation. Awarded 2nd place. 1984

NEW YORK CITY COUNCIL ON THE ENVIRONMENT
Ecology and Biology Consultant. Worked on the problems of urban gardens, fill, organic, and heavy metal pollution and the established native and horticultural plants in urban environments. 1982, 1984

RECENT AWARDS AND HONORS

INTERNATIONAL ST. ANDREWS PRIZE, one of three finalists for the submission, "Putting Waste to Work, Compost Utilization in the Reconstruction of Wetland Habitat for Storm Water Treatment in Urban Areas," 2000.

GOOD EARTH EARTHLING AWARD, City Club of New York, April 1995.

ENVIRONMENTAL QUALITY Award (to the Gaia Institute), US EPA Region 2, April, 1994.

TASKFORCE, COMMITTEE, AND BOARD APPOINTMENTS AND NOMINATIONS

Jamaica Bay Task Force, 1999-Present.
University Outreach and Research Committee, Chair, New York City Soil & Water Conservation District, October 1999-Present.
NY/NJ Harbor Estuary Program, Habitat Restoration Working Group, 1996-Present.
New York City Soil and Water Conservation Board, January 1993-present. Treasurer, October 1996-Present.
Bronx Council for Environmental Quality, Vice President, 1995-present. Board Member, 1988-Present.
Penn and Fountain Avenue Landfills Technical Advisory Committee, 1996-Present.
The Lindisfarne Association, Fellow, 1990-Present.

The River Project, Hudson River Restoration, Board Member, 1989-Present.
Citywide Recycling Advisory Board Steering Committee (Bronx SWAB representative), May 2000-May 2001.
Solid Waste Advisory Board, Bronx, NY 1992-2000 (elected Chair, October 1994-April 1997).
Citywide Recycling Advisory Board, Steering Committee, 1994-2000.
Bronx River Working Group, NYC Department of Parks and Recreation: initiation and facilitation of US Army Corps of Engineers feasibility study for stormwater capture and ecological restoration of the Bronx River watershed, May 1999.
SoundWatch, Advisory Panel, 1990-1999.
New York City Brownfields Initiative, Mayoral Task Force, September, 1996-June, 1998.
SUSNET, Network for a Sustainable New York City, Board Member, 1995-1998.
National Peer Review Panel, Exxon Arthur Kill Oil Spill Mitigation and Remediation Program, evaluating the work product of NYC Department of Parks & Recreation, Natural Resources Group in remediating and mitigating the petroleum products in the sediments in marshes of the eastern Arthur Kill, 1996, 1997.
Bronx Solid Waste Working Group, appointed Co-Chair, January-June, 1997.
NYS Department of Environmental Conservation Bronx River Working Group on non-point pollution and storm water treatment: Environmental Focus (newsletter of the Bronx Council for Environmental Quality): Special 1996 issue devoted to Floatables and Non Point Source Pollution: Innovative Solutions, April, 1996.
Memoirs of the Torrey Botanical Society, Editor, 1989-1995.
The Torrey Botanical Society, President, 1990-1991.

Professional Societies

American Bryological and Lichenological Society
American Institute of Biological Sciences
American Association for the Advancement of Science
Botanical Society of America
New York Academy of Sciences
New York Water Environment Association
Society for Ecological Restoration
Torrey Botanical Society
Water Environment Federation

References

Professor Dominick V. Basile, Professor, Lehman College, CUNY.
Dr. Elizabeth Coleman, President, Bennington College, Vermont.
Professor Lynn Margulis, Professor, University of Massachusetts, Amherst, Massachusetts.

Recent Papers, Publications, Presentations and Patents

Mankiewicz, P.S., 2004. "Criteria for evaluating the behavior and directing the manufacture of green roofs soils." Invited paper to be given at the 2004 New Roofs for a New Century Conference, sponsored by the NYS Environmental Business Association. March 29, 2004.

Mankiewicz, P.S., 2003. "How soils and plantings can be used to meet and surpass stormwater regulation requirements: A zero discharge strategy." Invited seminar, 3rd Annual Southeast NY Stormwater Conference and Trade Show, Poughkeepsie, NY. November 6, 2003.

Mankiewicz, P.S., 2003. "Lightweight artificial soil for green roof ecological enhancement " US Patent Application. Submitted July 2003.

Mankiewicz, P.S., Julie A. Mankiewicz and Gwen Sanchirico, 2000. Case studies for addressing New York City's legacy of coastal landfill: Beneficial use of dredged material to ensure the growth and development of intertidal communities around the Pelham Bay and Penn and Fountain Avenue Landfills. American Museum of Natural History Conference: Conserving Biodiversity in Hudson River Habitats: New York Harbor to Troy. Sponsored by NYS DEC, Hudson River Estuary Program, Hudson River Environmental Society and Center for Biodiversity and Conservation, American Museum of Natural Hisotry. November 16, 2000.

Mankiewicz, P.S. & J.A. Mankiewicz, 1998. "Can we drink the water we live with?" Invited article in *Whole Earth*, special issue on Modern Landscape Ecology, 93:56-59.

Mankiewicz, P.S., J.A. Mankiewicz, F.H. Griffis, A.C. Bagtzoglou, A. van Geen, & R.J. Versteeg, 1998. "Should salt marshes be constructed with dredged material?" Joint project of the Earth Engineering Center of Columbia University and the Gaia Institute. Poster presented at Concepts & Controversies in Tidal Marsh Ecology, A Special International Conference, Cumberland County College, Vineland, NJ. April 5-9, 1998.

Contributor, USDA Natural Resources Conservation Service, 1997. "Soil survey of South LaTourette Park, Staten Island, New York City, NY."

Mankiewicz, P.S., 1996. "A theoretical exploration of biological surfaces and metabolic capacitance: Thermodynamic, economic, and material efficiencies in fluid purification systems." *Ecological Engineering for Wastewater Treatment*, 2nd ed., Trosa, Sweden, March 25-28, 1991. Lewis Publishers, 1996.

Mankiewicz, P.S., 1996. "Organic Waste Composting System," US Patent, Serial Number 08/585,990. April 1996.

Mankiewicz, P.S., 1992. "The macromolecular matrix of plant cell walls as a major Gaian interfacial regulator in terrestrial environments." Presented at the American Geophysical Union Chapman Conference on the Gaia Hypothesis, March 1988. Published in *Scientists on Gaia*, ed. by S. H. Schneider & P. J. Boston, MIT Press. January 1992.

Mankiewicz, P.S., 1992. "Marine and estuarine systems: Patterns of pollution-potentials for Restoration." Presented in the series, "Science for Environmentalists, Environmental Lawyers, and Other Environmental Professionals," the Association of the Bar of the City of New York. February, 25 1992.

Tanner, Marietta J., Diana Hernandez, Julie A. & Paul S. Mankiewicz, 1992. "The Big Apple:

Restoration based education on the Bronx River." *Restoration & Management Notes*, 10 (1):14-17.

Kinsinger, W., P.S. Mankiewicz & J.A. Mankiewicz, 1991. "Wastewater, groundwater, and air purification schematics for the René Dubos Bioshelter, planned south transept of the Cathedral of St. John the Divine in New York City." *Ecological Engineering for Wastewater Treatment*, ed. by Proceedings of the International Conference. March 24-28, 1991. Stensund Folk College, Trosa, Sweden.

Mankiewicz, P.S. & W. Kinsinger, 1990. "Strategies for the future of Long Island Sound." Presentation sponsored by SoundWatch and Greenwich Audubon. September 18, 1990.

Mankiewicz, P.S., J.A. Downey, L. Margulis, & R.E. Ulanowicz, 1990. "The emergence of regulation in biological and abiotic systems." A four-part symposium organized by Dr. Mankiewicz for the Eighth International Congress of Cybernetics and Systems. June 1990. Published in *Handbook of Systems and Cybernetics*.

Klinger, Lee F., 1989. "Global patterns in community succession: 1. Bryophytes and forest Decline." *Memoirs of the Torrey Botanical Club*, 24(1). First in the series "The Role of Plants in Landscape Transformation" initiated by Paul S. Mankiewicz, editor.

Mankiewicz, P.S., 1989. "The Gaia Hypothesis: Coherent investigation of regulation at organismic, community, & global scale," Rockefeller University, New York City. November 6, 1989.

Mankiewicz, P.S., 1989. "Macroscopic boundary layer shape of open soil surfaces and colonies of bryophytes." Presented at the Joint American Institute for Biological Sciences/Botanical Society of America meetings, Toronto, Canada. August 8, 1989. Abstract published in the *American Journal of Botany*. June 1989.

Bronx Council for Environmental Quality and the Gaia Institute, 1988. "Environmental progress: Developing urban communities according to ecological principles," a six-part symposium on strategies for restoring the functional capacity of ecological systems in cities, cosponsored by the Bronx Council for Environmental Quality and the Gaia Institute, held at Lehman College, CUNY. March 1988.

Mankiewicz, P.S., 1987. "The low pressure field porometer: A new, low cost technique for characterizing external capillary water conduction in whole colonies of bryophytes and other small plants." *The Bryologist*, 90(3): 253-262.